



# **GUIDEBOOK**

#SonS2019



SKILLS FOR THE FUTURE

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# WELCOME

Dear students, teachers and scientists,

Welcome to Cascais.

This festival comes at a good time.

For two reasons.

First, as we like to say, we are a laboratory territory. We love to experiment and innovate. To test. To confront each mistake with new attempts and new solutions. This is how we approach the problems. Cascais being home to this great science festival is more than a happy coincidence: it is a right alignment. Secondly, we are investing a lot in education. In the coming years we will devote 39 million euros from the municipal budget to the requalification of our primary and secondary schools. An amount that adds up to the 75 million already invested in the last decade in kindergartens and elementary schools. More than quality of physical facilities, we want our schools to be the best in the country to learn. This also implies setting the stage for science. We want to sharpen the curious spirit of our students and give our teachers more tools to teach.

This is extraordinarily important as we are going through a true industrial revolution, with impressive levels of technological progress.

In short: more than good students, we need to stimulate the spirit of curiosity of young people. We want them to be curious about the world and curious about managing the technology that will invariably mark their lives.

This will prepare better students and, above all, better citizens for the future.



Carlos Carreiras Mayor of Cascais

# **WELCOME**

Welcome to our 11th Science on Stage festival 2019 in Cascais, Portugal! I am very pleased to meet so many excellent STEM teachers from primary and secondary schools. Our festival shows the abundance of high-quality teaching ideas from all over Europe and I would like to thank all participants for their input, their commitment – and for their daily work in their classrooms!

'Skills for the future' is the motto of this year's festival. And you, as teachers, play a key role in equipping young people with the competences they need to tackle global challenges, such as climate change, shaping the digital future or social cohabitation. Sciences and IT are particularly important in finding solutions to the challenges we are facing today. Teachers with appropriate ideas make a difference! I hope that you will gain inspiration, new ideas and friends at our festival. We invite you to stay in touch with the enthusiastic colleagues you meet here-through our international activities, such as workshops, teachers exchange programmes or via the development of teaching materials.

And finally, we would like to sincerely thank the Portuguese organisers for their great cooperation and especially the City of Cascais for being such a wonderful festival host!



Stefanie Schlunk, Chair Science on Stage Europe, on behalf of the whole board

# WELCOME



Science was always part of my life since I was little child, in particular astronomy. I always wanted to learn more, to understand how our knowledge about the universe evolved, how scientists make their discoveries. I always had questions: Where did we come from? Is there more life like ours in the universe? Are there other planets we can visit? Well, most of the answers still inhabit my heart and many more were added to them. I was lucky enough to have inspiring teachers who showed me the way to knowledge, creativity and the excitement to be the best I can.

This Festival is, for you teachers, the best travel companion of everyone's lives. Thank you for your dedication, creativity and resilience. It is for us a privilege to have you with us. We hope that during these few days you find interesting new ideas, share your great work, make new friends and find new adventures to bring to your students. We hope that Portugal will become a point for many returns.

Cheers to all teachers, the most important profession in the world!

fra Deron

Rosa Doran, President of the Executive Council of NUCLIO, Chair Science on Stage Portugal, on behalf of NUCLIO team

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# CATEGORIES & GUIDING THEMES

### CATEGORIES OF ACTIVITY

#### **FAIR**

The fair is the main element of the festival, where all participants present their projects.

#### **ON STAGE PERFORMANCES**

Teachers present scientific and technical subjects in the form of a performance on stage (duration of 20 minutes) in the Auditorium. Special performances and talks also belong to this category.

#### WORKSHOPS

In several workshops (50 minutes each) teachers introduce their teaching methods to a group of pedagogues.

## HIGHLIGHTS SESSION

A selection of projects is presented in the Auditorium on Friday and Saturday. In this category will also take place special performances and talks.

#### SOCIAL EVENTS

Carry on your conversations in a fun and relaxed environment.

### **GUIDING THEMES**

#### **SCIENCE IN EARLY YEARS**

Projects for pre-school and primary school children.

#### DIGITAL LITERACY AND SCIENCE EDUCATION

Projects on subjects like coding, digital media or the Internet of Things.

### SUSTAINABLE DEVELOPMENT IN SCIENCE EDUCATION

Projects using science to explore environmental, health and sustainability issues.

#### ASTRONOMY AND SPACE EXPLORATION IN SCIENCE EDUCATION

Projects with focus on e.g. astronomy, aerospace, life on other planets or spaceflight inventions in everyday life.

#### **LOW-COST AND RECYCLED SCIENCE**

Projects with inexpensive or reused materials; easily adapted by evervone.

#### **INCLUSIVE SCIENCE**

Projects for all students – welcoming diversity.

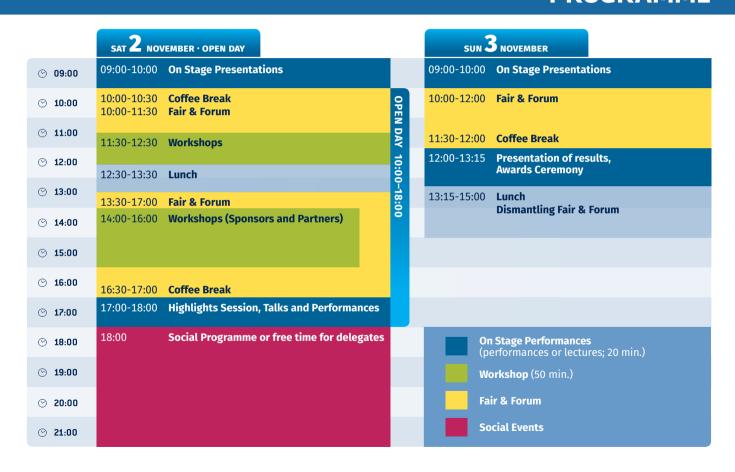
### **JOINT PROJECTS**

Projects developed in an international cooperation with a former festival participant.

# **PROGRAMME**

|                                   | тни 3       | остовек                                     | FRI         | NOVEMBER                                    |
|-----------------------------------|-------------|---|-------------|---|
| ⊙ 09:00                           |             |   | 09:00-10:00 | On Stage presentations                      |
| <b>⊙ 10:00</b>                    | 10:30-15:00 | Arrivals and registration                   |             | Coffee Break<br>Fair & Forum                |
| <b>○ 11:00</b>                    |             | Set-up Fair                                 | 11:30-12:30 | Workshops                                   |
| <ul><li></li></ul>                |             |   | 12:30-13:30 | Lunch                                       |
| <ul><li> 13.00</li><li></li></ul> |             |   | 13:30-16:00 | Fair & Forum                                |
| <b>⊘</b> 15:00                    | 15:00-16:30 | Fair and Forum ready to open Final clear up | 15:30-16:00 | Coffee Break                                |
| ⊙ 16:00                           | 16:30-17:00 | Coffee Break - Welcome to the Festival      | 16:00-17:00 | Workshops                                   |
| <b>⊘</b> 17:00                    | 17:00-18:30 | Opening Ceremony                            | 17:00-18:00 | Highlights Session and Special Performances |
| ⊙ 18:00                           | 18:30-20:00 | Fair and Forum opens – VIP Tour             | 18:00-20:00 | Free time                                   |
| ⊙ 19:00                           |             | ·   |             |   |
| <b>⊘</b> 20:00                    | 20:00       | Welcome Cocktail                            | 20:00       | Dinner                                      |
| <b>⊘</b> 21:00                    |             |   |             |   |

# **PROGRAMME**



# **TIMETABLE - WORSHOPS AND PERFORMANCES**

## **FRIDAY, 1 NOVEMBER**

| TRIDAT, TROVENDER  |                                     |                     |            |           |
|--|-------------------------------------|---------------------|------------|-----------|
| 9:00-10:00 On Stage Performances                             |                                     |                     |            |           |
| TITLE  | PRESENTER                           | COUNTRY/INSTITUTION | ROOM       | STAND NO. |
| Let's build a sustainable future - together!                 | Gerald Decelles III, Ulrike Englert | Norway - Germany    | Auditorium | 105       |
| Kalevala goes science  | Johanna Eskelinen, Päivi Mustalampi | Finland             | Auditorium | C09       |
| Exploring Mars: An Adventure of a Lifetime                   | Gernot Groemer                      | OeWF                | Auditorium |           |
| 11:30-12:30 <b>Workshops</b>                                 |                                     |                     |            |           |
| TITLE  | PRESENTER                           | COUNTRY/INSTITUTION | ROOM       | STAND NO. |
| Be a magician! Using magic illusions to teach science        | Adrian Allan                        | United Kingdom      | WS1        | 001       |
| Biocube Project-Biodiversity-"Slow down and look at closely" | Sinem Mankir Öztan                  | Turkey              | WS2        | P11       |
| CoALA - Code A Little Animal                                 | Imma Abad, Mirek Hancl              | Spain - Germany     | WS3        | J02       |
| Crater and summit – two faces of a candle                    | Tobias Mahnke, Tanja Schapat        | Germany             | WS4        | N02       |
| GimLit Fortress  | Branko Koprivnikar                  | Slovenia            | WS5        | R02       |
| History of Maths in Classroom: an educational challenge      | Paulo Gil                           | Portugal            | WS6        | N07       |
| Oranges and Lemons   | Francesca Butturini, Gordon Kennedy | Italy               | WS7        | R10       |
| Go-Lab, Inquiry Scenarios Using Online Labs                  | Maria Luísa Almeida                 | NUCLIO              | WS8        |           |
| How to build a spacesuit                                     | Gernot Groemer                      | OeWF                | Auditorium |           |
|  |                                     |                     |            |           |

# **TIMETABLE- WORSHOPS AND PERFORMANCES**

# **FRIDAY, 1 NOVEMBER**

| 16:00-17:00 <b>Workshops</b>  |   |                          |            |           |
|---|---|--------------------------|------------|-----------|
| TITLE   | PRESENTER   | COUNTRY/INSTITUTION      | ROOM       | STAND NO. |
| Affordable experiment for every pupil   | Nasko Stamenov                                      | Bulgaria                 | WS1        | M08       |
| Braga through a technological "lens"  | Liliana Fernandes, Jorge Reis                       | Portugal                 | WS2        | D05       |
| Can you see the light? To see, feel and understand the properties of light                    | Astrid Pösl, Sonja Vochezer                         | Germany                  | WS3        | I10       |
| ESCAPING with SCIENCE   | Christina Aristodimou, Georgios Villias             | Cyprus - Greece          | WS7        | 103       |
| It's all in our hands   | Sacha Glardon, Thomas Scheuber                      | Switzerland              | WS4        | M05       |
| The hiLyte battery  | Patricia Descombes, Annick Vidonne                  | Switzerland              | WS5        | G07       |
| The physics of a DIY sand pendulum: a project about physics, mathematics, engineering and art | Nicole Fux  | Belgium                  | WS6        | Q01       |
| IDiverSE – Art and Design Thinking for<br>Science Education                                   | Priscila Doran                                      | NUCLIO                   | WS8        |           |
| Google Geo for Good Workshop  | Liza Goldberg, Rohan Uttamsingh, Emily<br>Henderson | Google Earth<br>Outreach | Auditorium |           |

| 17:00-18:00 Highlights Session and Performances |                 |                     |            |           |  |
|---|-----------------|---------------------|------------|-----------|--|
| TITLE   | PRESENTER       | COUNTRY/INSTITUTION | ROOM       | STAND NO. |  |
| Inspiring Life                                  | EPTOLIVA School | Portugal            | Auditorium |           |  |
| Piano Performance                               | Philippe Kobel  | Switzerland         | Auditorium |           |  |

# **TIMETABLE - WORSHOPS AND PERFORMANCES**

# SATURDAY 2 NOVEMBER

| SATURDAY, 2 NOVEMBER  |  |                          |            |           |
|---|--|--------------------------|------------|-----------|
| 9:00-10:00 On Stage Performances  |  |                          |            |           |
| TITLE   | PRESENTER  | COUNTRY/INSTITUTION      | ROOM       | STAND NO. |
| Brain of Olching - The Scientific Castingshow                                 | Thomas Drexler, Florian Gärtner, Martin<br>Hölzel, Carola Müller, Tanja Neufeld, Miriam<br>Plank, Oliver Schuppach | Germany                  | Auditorium | E09       |
| European Physical Society Presentation  | Enrique Sánchez  | EPS                      | Auditorium |           |
| Mighty Valentina and the Power of Books                                       | Andreia Nunes  | Portugal                 | Auditorium |           |
| Listening to Einstein's Universe: the Dawn of<br>Gravitational-Wave Astronomy | Professor Martin Hendry  | University of<br>Glasgow | Auditorium |           |
| 11:30-12:30 <b>Workshops</b>  |  |                          |            |           |
| TITLE   | PRESENTER  | COUNTRY                  | ROOM       | STAND NO. |
| High and low pressure   | Zdeněk Hubáček   | Czech Republic           | WS1        | N08       |
| Live, not survive!  | Iveta Labunska, Inese Pickaine   | Latvia                   | WS3        | Q09       |
| Magnifying Curiosity Through the Mail – origami microscopes                   | Paul Stinson   | Canada                   | WS4        | O06       |
| MathsMagic  | Dieter Kadan   | Austria                  | WS5        | P05       |
| Superficial Changes, New Properties!  | Carme Artigas, Fina Guitart  | Spain                    | WS6        | P01       |
| Walking along the Chromosomes   | Cinzia Grazioli, Livia Pirovano  | Italy                    | WS2        | D04       |
| You're Fired! A Dramatic Approach to Primary Science                          | Kathryn Horan  | United Kingdom           | WS7        | U05       |

# **TIMETABLE- WORSHOPS AND PERFORMANCES**

# SATURDAY 2 NOVEMBER

| SATURDAY, 2 NOVEMBER   |                                 |                     |            |           |
|--|---------------------------------|---------------------|------------|-----------|
| TITLE  | PRESENTER                       | COUNTRY/INSTITUTION | ROOM       | STAND NO. |
| Frontiers Bringing Nobel Prize Physics to the Classroom              | Maria Luísa Almeida             | NUCLIO              | WS8        |           |
| Learning by design with the Airbus<br>Foundation Discovery Space     | Didier Laval                    | Airbus Foundation   | Auditorium |           |
| 14:00-15:00 <b>Workshops</b>   |                                 |                     |            |           |
| TITLE  | PRESENTER                       | COUNTRY/INSTITUTION | ROOM       | STAND NO. |
| Finding Possible Earth Killer Objects – A Citizen<br>Science Program | Leonor Cabral, Slavador Bruschy | NUCLIO              | WS2        |           |
| Frontiers Bringing Nobel Prize Physics to the Classroom              | Maria Luísa Almeida             | NUCLIO              | WS5        |           |
| IIDiverSE – Art and Design Thinking for<br>Science Education         | Priscila Doran                  | NUCLIO              | WS3        |           |
| How Important is Physics to the Economies of Europe?                 | Enrique Sánchez                 | EPS                 | WS6        |           |
| Learning by design with the Airbus<br>Foundation Discovery Space     | Didier Laval                    | Airbus Foundation   | Auditorium |           |
| 15:00-16:00 <b>Workshops</b>   |                                 |                     |            |           |
| TITLE  | PRESENTER                       | COUNTRY/INSTITUTION | ROOM       | STAND NO. |
| Our Space Our Future   | Rosa Doran                      | NUCLIO              | Auditorium |           |

# **TIMETABLE - WORSHOPS AND PERFORMANCES**

# **SATURDAY, 2 NOVEMBER**

| 17:00-18:00 Highlights Session and Performances                               |                 |   |            |           |  |
|---|-----------------|---|------------|-----------|--|
| TITLE   | PRESENTER       | COUNTRY/INSTITUTION                       | ROOM       | STAND NO. |  |
| Google Earth Outreach Presentation  | Emily Henderson | Google Earth<br>Outreach                  | Auditorium |           |  |
| Airbus Foundation Discovery Space: a global approach for aerospace engagement | Didier Laval    | Airbus Foundation                         | Auditorium |           |  |
| What Can Neuroscience And Education Learn From Each Other                     | André Mendonça  | Champalimaud<br>Center for the<br>Unknown | Auditorium |           |  |
| Youth Performance   | Art Lab         | Cascais Jovem                             | Auditorium |           |  |

# **SUNDAY, 3 NOVEMBER**

| 9:00-10:00 On Stage Performances |                              |                     |            |           |
|----------------------------------|------------------------------|---------------------|------------|-----------|
| TITLE                            | PRESENTER                    | COUNTRY/INSTITUTION | ROOM       | STAND NO. |
| SoS - Sounds of Science          | Mário Correia, Álvaro Folhas | Portugal            | Auditorium | D08       |



### LET'S BUILD A SUSTAINABLE FUTURE - TOGETHER!

Friday, 1 November, 9:00-10:00 | Auditorium

Gerald Decelles III - Skagerak International School Ulrike Englert - Willibald-Gluck-Gymnasium

Climate change and conservation are topics that must move us, and especially our youth, to action. In our joint teaching project, students from two countries. Norway and Germany, deal with the subject of energy-efficient construction and jointly developed and implemented a model of a modern school building. Why a school? Every student knows their school and has opinions about the ways to make it better. Students learn about energy efficiency and apply this knowledge to their concept of a school. From their familiar learning environment, students were given benchmarks for an energyefficient school building and were tasked to come up with a model. The Norwegian students used software for modelling energy efficient buildings. The German students simulated building controls with Arduino. Collaboration between the students was through file storage for the sharing of resources. We would like to introduce you to our project and describe our experiences. Our project is about changing

students' attitudes toward the challenges that come with climate change and what is possible working together. Let's build an energy-efficient school building - together across borders!



#### KALEVALA GOES SCIENCE

Friday, 1 November, 9:00-10:00 | Auditorium

Johanna Eskelinen - Joutsan yhtenäiskoulu Päivi Mustalampi - Joutsan yhtenäiskoulu

Since the students always read and write at school, mother tongue and literature play a secondary role in interdisciplinary learning modules studies. We decided to do this the other way: literature comes first and we look at it with a scientific viewpoint. We chose Kalevala, Finland's national epic, because all the pupils study it during their final school year anyway.

We studied the main parts of the story and chose 13 subjects for the projects. Every group made up a scientific question based on the plot. They continued the work by finding theoretic information and doing practical research. The work was put on the website with some extras.

Can you get pregnant by eating a lingonberry? Why is the golden cold? Students woman were researching these and many other questions. We'll present our project, working phases, planning and methods, which we used. We'll also show the students' results, like the chemistry of lingonberries. On this stage performance you'll see how to do scientific research in secondary school using stories from a fictive novel.



#### INSPIRING LIFF

Friday, 1 November, 17:00-18:00 | Auditorium

Responsible teacher: Honorata Pereira - EPTOLIVA School Performance teachers: Ana Morais and Liliana Rodrigues - EPTOLIVA School

On the 15th October 2017, EPTOLIVA School lived the worst tragedy in its 30 years of history, with many of its students being caught by the vast fires that happened in Portugal, either as victims, firefighters or both.

This stage performance tells the story of the students' feelings and actions after the fires and shows how school projects highlighted their resilience and their ability to endure the greatest adversity turning what hurt them into a tool that strengthened their character. The project process led students to clearly identify the problem, to face its main issues, to understand and overcome real problems against all odds, improving them as individuals and as members of a community.

### Students on stage:

José F. Cardoso Ana Campos Rafaela Simões Diana Ferreira Diogo Peres Tatiana Ferreira Ângela Nogueira



# THE BRAIN OF OLCHING - THE SCIENTIFIC **CASTINGSHOW**

Saturday, 2 November, 9:00-10:00 | Auditorium

Thomas Drexler, Florian Gärtner, Martin Hölzel, Carola Müller, Tanja Neufeld, Miriam Plank, Oliver Schuppach - Gymnasium Olching

"The Brain of Olching" is a scientific castingshow and is literally taking science to the stage. Based on the TV show "The Voice of Germany" the best scientific idea for a sustainable world of tomorrow is wanted. During a school year, students present their ideas in front of a great audience and work with their coach to bring their ideas to life.

Passion for science, a new teacher role, appreciative interaction with the participants, entertainment and high scientific demands are the principles on which the show is based.

This lecture will give a taste of what can happen if we redefine traditional teacher and student roles: It's the science event of the vear!



### SOS - SOUNDS OF SCIENCE

Sunday, 3 November, 9:00-10:00 | Auditorium

Mário Correia - Escola Secundária Adolfo Portela Álvaro Folhas - Escola Secundária Marques Castilho

Music will always be a powerful vehicle for knowledge and one for which youth is most sensitive. It is therefore important to use music to open the doors of thought and add joy to learning.

Our work has two parts: In the first part, sound is explored as a physical entity, exploring the propagation and characteristics of its waves, using both physics and mathematics approaches, adding waves and perceiving the physical manifestations aligned with the mathematical process involved. For this, we will use musical instruments, tuning forks, sensors and simulators, in order to allow to experience mathematics and physics in an interdisciplinary way.

A second part consists of taking the instruments and, on stage, presenting unpublished songs about subjects, curricular about the importance of learning science and also to present our work on it.



# SPECIAL PERFORMANCES AND TALKS

#### **EXPLORING MARS: AN ADVENTURE OF A LIFETIME**

Friday, 1 November, 9:00-10:00 | Auditorium

Gernot Groemer - Analog Astronaut, (OeWF) Austrian Space Forum. Masters degree in astronomy, PhD in exploration astrobiology (Leopold-Franzens University, Innsbruck), International Space University summer school (Houston/Texas), lecturer at the International Space University and the University of Innsbruck. Member of the Space Generation Advisory Council (Board of Mentors). Flight Crew 37th ESA Parabolic Flight Campaign. Programme **Management Group AustroMars and PolAres.** 

Planet Mars is one of the most promising candidates for the search for life in the Solar System: European, US, Indian and Japanese spacecrafts investigate its surface and atmosphere and a crewed mission is in reach within the next 2-2-3 decades. In an extraordinary expedition, researchers of the Austrian Space Forum - in partnership

with teams from 25 nations - simulated aspects of such a human Mars mission in the Sultanate of Oman

Dr. Gernot Groemer led this expedition and provides a first-hand account of the science and expedition challenges of such an endeavour.



#### **3 PIANO PIECES**

Friday, 1 November, 17:00-18:00 | Auditorium

Philippe Kobel - Pianist, astrophysicist and teacher

- Andante Spianato and Grande Polonaise brillante Op. 22 (F. Chopin)
- Bajo un mismo cielo (P. Kobel)
- · Open Up (P. Kobel)

Philippe Kobel is a pianist and astrophysicist who loves to share. He studied at the Geneva conservatory under the guidance of the Argentinian maestro Luis Ascot. After completing a PhD in solar physics, he launched in 2009 GalileoMobile, an itinerant education programme for which he shared astronomy with kids in South America, India and Ouganda; GalileoMobile has now 10 years and still running. Today, Philippe passionately teaches physics in a high school in Switzerland.



### **FUROPEAN PHYSICAL SOCIETY PRESENTATION**

Saturday, 2 November, 9:00-10:00 | Auditorium

Enrique Sánchez - coordinator of the office of the European Physical Society (EPS) in Brussels

The next generation of physicists is important to the EPS. High quality physics education is essential in training scientists that will allow Europe to become the leading knowledge based society. An education in physics for all citizens is also necessary to allow them to be actively involved in the democratic debate of the interaction between science and society. Physics education is a necessary tool in societal, economic, and democratic development. We are involved in the reflection on the attitudes of students towards physics, teaching methods, curricula development and the demonstration that physics has a role in addressing issues such as energy and sustainable development. The EPS Young Minds Programme provides physics

students at the university level to develop outreach, communication and leadership skills.

Enrique Sánchez, from Madrid, is a physicist and a PhD in Photonics. In 2014, he became Young Ambassador of the European Physical Society in the Young Minds Programme. In April 2019, he became the coordinator of the office of the European Physical Society in Brussels.



#### MIGHTY VALENTINA AND THE POWER OF BOOKS

Saturday, 2 November, 9:00-10:00 | Auditorium

Andreia Nunes - Writer

Mighty Valentina is a fictional story, inspired by the first woman astronaut to go to Space: Valentina Tereshkova, Andreia Nunes wrote the text and Rachel Caiano conceived the illustrations. The fictional story of Mighty Valentina allows us to enter the child's imagination and create an identification with the character. The story hopes to inspire many more children and girls that the sky is not the limit!



Andreia Nunes holds a Bachelor's Degree in Education Sciences and a Post-Graduate Degree in Prevention Gender Violence in Schools and Family. She recently completed her Master's Degree in Entrepreneurship and Studies in Culture at ISCTE-IUL (Lisbon), conducting research on Gender Stereotypes in Award-Winning Children's Books. Since 2009, she collaborates with various NGO as a Higher Education Technician, acting in schools, promoting Gender Equality and Preventing Gender Violence among children, young people, teachers and other strategic publics. She currently collaborates with UMAR - União Mulheres Alternativa e Resposta, in the ART'THEMIS + Project, conducting sessions in Lisbon schools and participating as a researcher in the National Study of Dating Violence that this NGO carries out every year.

# LISTENING TO FINSTEIN'S UNIVERSE: THE DAWN OF GRAVITATIONAL-WAVE ASTRONOMY

Saturday, 2 November, 9:00-10:00 | Auditorium

Martin Hendry - University of Glasgow - Head of the School of Physics and Astronomy: member of the LIGO Scientific Collaboration: co-chair of the global Advocacy and Outreach Group of the LISA Consortium; Fellow of the Institute of Physics, the Royal Astronomical Society and the Royal Society of Edinburgh

Gravitational waves are the ripples in space-time predicted more than a century ago by Albert Einstein and produced by the most violent events in the cosmos: exploding stars, colliding black holes, even the Big Bang itself. Their discovery has opened a whole new window on the Universe and is bringing fresh insights on some of the biggest scientific questions of our time: from measuring the expansion of the Universe to understanding how precious metals like gold and silver were formed. Join University of Glasgow astronomer Professor Martin Hendry as he tells the inside story of how gravitational waves were

detected for the very first time, by the most sensitive scientific instruments ever built, and what they are telling us about our place in the cosmos. Learn about the amazing technology behind these discoveries and very bright future that lies ahead for this exciting new field.



# AIRBUS FOUNDATION DISCOVERY SPACE: A GLOBAL APPROACH FOR AEROSPACE ENGAGEMENT

Saturday, 2 November, 17:00-18:00 | Auditorium

Didier Laval - Leader of the global aerospace engagement campaign for the Airbus Foundation

What are the new approaches to engage children with aerospace? Linking 3D-design and hands-on activities, the Airbus Foundation Discovery Space offers an innovative way to explore the current aerospace challenges, fostering creativity along with knowledge building and collaborative practices.

Didier Laval is leading a global aerospace engagement campaign for the Airbus Foundation. Initially trained as an engineer and theatre director, he has been working in the field of non-formal education for

15 years, with science centres (Palais de la Découverte, Cap Sciences), science engagement networks (Ecsite), and Universities (University of Bristol, IAE Bordeaux). Director of the UK-based company Culture Instable, he creates engagement experience and builds international collaborations in science. heritage and culture at large.



### GOOGLE FARTH OUTREACH PRESENTATION

Saturday, 2 November, 17:00-18:00 | Auditorium

#### **Emily Henderson - Program Manager of Google Earth Outreach**

Emily has worked at Google since 2010, for the entire time on georelated programs. For the past 5 years, she has worked as a Program Manager on the Google Earth Outreach team focused on sharing Google's mapping tools with teachers and students around the world. Many of the world's toughest challenges will only be resolved through applied geospatial knowledge. By focusing on the children of today, she hopes to leverage Google Geo technology to drive geoliteracy and compassion as a fundamental learning and life skills in global education, building future generations of Earth advocates.



# WHAT CAN NEUROSCIENCE AND EDUCATION LEARN FROM EACH OTHER

Saturday, 2 November, 17:00-18:00 | Auditorium

André Mendonça - Researcher, Champalimaud Center for the Unknown

Our culture is based almost entirely on the sharing of acquired knowledge. In modern societies we first learn in direct contact with our family and friends and are later taught by mentors. in schools, alongside a group



of peers. What dictates the value of such shared information? Are we trying to convey the knowledge accumulated through centuries of civilization? Or are we teaching the ability to explore new ideas, to think creatively and independently, and thus generating functional members of a society? Ultimately, what is the goal of education? Learning is the mechanism through which we gain an education. But what are the biological basis behind such learning? How do we learn and acquire new knowledge, new skills? How can one constantly juggle between new actions with old habits? How flexible/plastic is our brain?

What can Neuroscience and Education learn from each other? These, and other, questions will be explored in light of a collection of neuroscience studies, conducted by neuroscientists all over the world, including work being developed at the Champalimaud Centre for the Unknown, in Lisbon, Portugal.



# BE A MAGICIAN! USING MAGIC ILLUSIONS TO **TEACH SCIENCE**

Friday, 1 November, 11:30-12:30 | Room WS1

Adrian Allan - Dornoch Academy

Physics, chemistry

Spectacular science demonstrations and magic illusions have many things in common. They involve practice, showmanship, audience interaction and suspense followed by a moment of astonishment

This workshop will demonstrate how science principles can be used to create magical illusions to enhance lessons and teach concepts. During the workshop you will learn how to shrink your own head, bend metal using your mind and make a coin pass



through another solid object. A true story of a how a French magician quelled a revolt in North Africa by removing a man's strength will be discussed. A practical method of making ghosts appear and disappear will be demonstrated as well as a flying carpet illusion. You will also learn how to cut and restore newspaper, vanish water and make objects invisible using new and old science technology. These demonstrations can be used by teachers but have also been taught to pupils who have in turn demonstrated these illusions to other pupils and parents.

# BIOCUBE PROIECT-BIODIVERSITY - "SLOW DOWN AND LOOK AT CLOSELY"

Friday, 1 November, 11:30-12:30 | Room WS2

Sinem Mankir Öztan - Açi Okullari

Biology, citizen science, natural science

How much life can a student discover in a small area in a short time with low cost material? In this workshop, you will explore how I organized a field trip and implemented this inquiry-based learning project in order to experience how biological systems function and interact each other out of class. Teachers can use this method with low cost materials everywhere when they are doing camp, class, club or after-school activities.

I will explain the all preparation steps process of before/during/after

the trip. You will experience building up the cubes with different materials, placing your own cubes in a model of "a sample Cascais ecosystem" and working as like a citizen scientist. In addition, you will learn how you can extend your won project with online tools.

I am inspired by Smithsonian Citizen Science research.



# COALA - CODE A LITTLE ANIMAL Friday, 1 November, 11:30-12:30 | Room WS3

Imma Ahad - Cor de Maria Mirek Hancl - Lessing-Gymnasium Uelzen Biology, citizen science, natural science

In this workshop you will learn how to create an interactive "pet" by using a microcontroller, cardboard and copper tape. The single-board controller is programmed with a graphical programming language to capture sensor readings (i.e. moisture, multi-touch, NFC) and to react to them with corresponding image and sound signals. This way the needs of a real pet (food, water, exercise etc.) are simulated using external sensors and algorithms. The pet simulator is based on Calliope mini and is 1:1 transferable to the BBC micro:bit. The project is appropriate both for primary and secondary school students, the workshop materials can also be mixed. Two additional materials are presented during the workshop as an outcome of the joint project: students can create a

pet feeder app for Android devices, and the CoALA workshop is ported to the Arduino platform to build 3D pets with low-cost hardware.



# CRATER AND SUMMIT - TWO FACES OF A CANDLE Friday, 1 November, 11:30-12:30 | Room WS4

Tobias Mahnke - Carl-Strehl-Schule blista Tanja Schapat - Carl-Strehl-Schule blista Chemistry, science, general studies

Fire is a fascinating phenomenon for humans. When it comes to teaching this concept, there are limitations. This is why teachers often rely on graphics showing the different areas of a flame with corresponding temperatures. This method is purely academic and can be boring while



posing additional problems for visually impaired students.

After a short general introduction to the challenges of teaching blind and visually impaired students, several different experiments can be observed and tried out that cover the concept of a flame for different classes and ages. They provide short pedagogical and methodical reflections but mainly focus on self-experience. Participants will try out the experiments while blindfolded to be able to experience it with their remaining senses.

Furthermore, methods of teaching theoretical concepts to blind and visually impaired students will be shown and discussed. Notable examples are the depiction of structural formula using magnetic symbols, the collection and fixation of findings and the structure of tests.

#### **GIMLIT FORTRESS**

Friday, 1 November, 11:30-12:30 | Room WS5

Branko Koprivnikar - Gimnazija Litija

Physics, computer science/ICT

The prince wants to save the princess from the frightening dragon. In order to achieve this, the prince must:

- create a microscope to read the code from a microfilm. The microscope has to be made by placing a droplet of water on a flat piece of glass. Gravity and combination of more droplets can be used to achieve greater magnification.
- find out how to create a program by which the microprocessor recognizes the code and runs the servomotor to open the door towards the accessories (neodymium magnet, battery, copper wire).
- make a tunnel made of copper wire and send a train made of a permanent magnet and a battery through this tunnel. The copper wire has to be wrapped around a rod to obtain a hollow coil. By

proper fitting of permanent magnets to the ends of the battery, a magnetic train is made that creates an electromagnetic tunnel and the train with Prince can travel through it.

The prince can now chase the frightening dragon away and hug his beloved princess.



# HISTORY OF MATHS IN CLASSROOM: AN **EDUCATIONAL CHALLENGE**

Friday, 1 November, 11:30-12:30 | Room WS6

Paulo Gil - Escola Sec. de Pinheiro Mathematics, history

This workshop intends to show the role that the history of mathematics can play when integrated into the classroom context.

In this sense, tasks based on historical sources will be proposed, so that the teachers participating in the workshop can not only reflect on the pertinence of this topic, but also solve some problems and discuss possible uses of these



tasks with their students in the classroom.

#### ORANGES AND LEMONS

Friday, 1 November, 11:30-12:30 | Room WS7

Francesca Butturini - Educandato Agli Angeli, Verona Gordon Kennedy, Liceo Agli Angeli, Verona

Chemistry, organic chemistry, physical chemistry, optical physics

This workshop will briefly introduce the didactic approach behind the "Oranges and Lemons" project introducing the three main pillars of the project: the extraction, analysis and optical characteristics of limonene, before focusing on the practicalities of building a working polarimeter using available easilv materials • while illustrating some of the



problems which may be encountered during its construction.

Participants working in small groups will construct a polarimeter to take away with them and are encouraged to bring two (empty!) 1kg plastic voghurt pots with their lids.

A series of laboratory experiences using the polarimeter will be presented including the measurement of the optical rotation of limonene.

# AFFORDABLE EXPERIMENT FOR EVERY PUPIL Friday, 1 November, 16:00-17:00 | Room WS1

Nasko Stamenov - National High School of Science and Mathematics Biology, chemistry

This workshop shows a set purposely made for low-cost chemistry classes.

Participants will be able to experience a lesson from the pupils' point of view. The set is optimized work environment - glassware is omitted, the workplace is reduced in size, the reagents are in smaller quantities all without hurdling the learning process.

The workshop itself takes place in a classroom environment participants will work in groups of two and we will experiment according to the Bulgarian 7th grade chemistry curriculum. The experiments include, but are not limited to signs of a chemical reaction - participants will mix compounds, which will yield a result in gas production, change in color etc., or using a pH indicator to check the acidity of household compounds.

The workplace is minimal and takes up the space of an A4 sheet of paper. All experiments are carried out by the means of pipetting and are done with great care for safety.



# BRAGA THROUGH A TECHNOLOGICAL "LENS" Friday, 1 November, 16:00-17:00 | Room WS2

# Liliana Fernandes - Ag. Escolas de Alberto Sampaio Jorge Reis - Ag. Escolas de Alberto Sampaio

Mathematics, computer science/ICT, history, robotics, language. social studies

This project leads us through a journey along local history and architectonic treasures and we will begin with an overview of its development and products developed by the students, and their impact on sharing local culture.



Participants will receive advice on how to adapt and apply this project in their own reality and have the opportunity to get familiar with Tynkercad, creating students' accounts and experiment with the tools used by students to model pictures and transform them into 3D printings of the monuments. We will give an overview of the apps that can be used to build virtual visits and expeditions, and thus creating accessible information both to the community and tourists. In the end participants will also experiment with a 3D printer aimed at primary school students, and check printed models as well as try our QR codes with the available virtual tours.

Teachers are invited to bring their own devices to use the suggested educational apps. We strongly advise participants do download in advance the following app onto their smartphone or tablet: Mentimeter.

# CAN YOU SEE THE LIGHT? TO SEE, FEEL AND UNDERSTAND THE PROPERTIES OF LIGHT

Friday, 1 November, 16:00-17:00 | Room WS3

Astrid Pösl - SFZ Bad Saulgau Sonia Vochezer - SFZ Bad Saulgau Science, art, language

In this project, primary students work on, experience, prove and understand the properties of light through a wide variety of experiments with simple materials. Is light visible and where do the colours of the rainbow hide? Can light colours be mixed like watercolours?

In the beginning of the workshop, a couple of demonstration experiments (catching light, making light visible, straightforward spreading of light) are introduced. A pinhole camera is now built from everyday materials and the function is explained based on a drawing. Subsequently, various stations will be offered: creation of shadows; mixture of light colours; production of spinning tops - new colours emerge; tile game - change

of colour perception; reading secret writings and designing new ones.



#### **ESCAPING WITH SCIENCE**

Saturday, 1 November, 16:00-17:00 | Room WS7

Christina Aristodimou - St. Paul & St. Peter High School, Limassol Georgios Villias - 2nd High School of Agioi Anargiroi, Athens Physics, biology

Escaping boring lectures. Escaping exam stress. Escaping daily school routine. Escaping working alone. ESCAPING with SCIENCE! For 50 minutes, fellow science educators will actively engage themselves in an exciting educational escape room activity (EER). EERs are innovative game-based didactic approaches that offer an immersive learning experience, promote active participation and facilitate students to practice problem-solving and other 21st century skills (critical thinking, creativity, collaboration, communication).

Participants will experience first-hand the same problems. difficulties, surprises and feelings that students have during such an alternative educational approach to science learning. By

showcasing one of the EER activities that we developed during our joint project, our ultimate goal is to get teachers inspired on how they could actually create and implement their own EER activities, using their personal educational interests, scientific expertise and artistic touch.



### IT'S ALL IN OUR HANDS

Friday, 1 November, 16:00-17:00 | Room WS4

Sacha Glardon - Gymnasium Bäumlihof Thomas Scheuber - Gymnasium Kirschgarten Physics, biology, chemistry

Our hands are fascinating precision tools. We grasp, indicate, touch, write, communicate and work with our hands. The upright walk freed our hands and they developed into fine motor and multifunctional gripping organs. And the brain's evolutive development has progressed in parallel to ensure the sensory and motor performance of the hand.

Hands-on: With a broad variety of simple but also complex experiments, we will demonstrate different aspects and basic concepts of biology. The hand



serves us as a model organ and allows us to investigate problems of anatomy, physiology, neural and behavioural biology, genetics and evolution. You will learn about phenomena such as the rightand left-handedness, the gripping force or the fact, that real hand washing is not that easy.

#### THE HILYTE BATTERY

Friday, 1 November, 16:00-17:00 | Room WS5

Patricia Descombes - Gymnase de Renens Annick Vidonne - Gymnase de Renens Physics, chemistry

How can chemistry enable production of clean energy? In this workshop you will build an ecological and efficient battery with cheap, non-toxic and renewable materials. A simple reaction is used to convert chemical energy into electrical energy in order to power devices such as motors



or lamps. It can even be used to charge your mobile phone.

In addition to being environmentally friendly, the advantage of this battery is that all its components can be assembled separately ensuring a full understanding of the set-up.

The battery is made of a biodegradable plastic case in which an iron sheet, a coffee filter, and a carbon felt soaked in an iron solution are inserted one after the other. The participants will have to mount this battery, test its functionalities and will be asked to work together to take part in a thrilling car race!

This workshop is intended for all sciences teachers from elementary to high school.

# THE PHYSICS OF A DIY SAND PENDULUM: A PROJECT ABOUT PHYSICS, MATHEMATICS, **ENGINEERING AND ART**

Friday, 1 November, 16:00-17:00 | Room WS6

Nicole Fux - Busleyden Atheneum campus Pitzemburg Physics, mathematics, STEM

The multi-dimensional pendulum is a fascinating hands-on device which is excellent for integrating physics, mathematics, art and engineering into one project. Designing and constructing the pendulum will lead the students to further investigation on the physics of the simple harmonic motion, the mathematics of Lissajous curves and the various applications in astronomy, electromagnetism and art

In the workshop, we'll start by a short overview of this project done by 17-year old students last year. For the practical part you will work in small groups. Each group will build a DIY sandpendulum (we provide

all the necessary materials) and investigate the mathematics of the movement of the pendulum trough a simulation (one laptop per group is needed for this part). At the end we'll exchange ideas about how to integrate this project in your curriculum.

Participants should bring their own laptop to the workshop (min. 1 laptop per 2 participants).



# HIGH AND LOW PRESSURE Saturday, 2 November, 11:30-12:30 | Room WS1

Zdeněk Hubáček - Gymnázium Uherské Hradiště Physics, biology

My project will show the DIY construction of a simple vacuum chamber (for education purposes and for everyday use in the kitchen), a U-pipe manometer (which will measure your blood pressure and the pressure in your lungs), a pneumatic lifter (to lift yourself up) and a multifunctional pressure chamber. I also will show a set of experiments enabled by this equipment. All devices are light, portable and clearly show the principles behind them.

# LIVE, NOT SURVIVE!

Saturday, 2 November, 11:30-12:30 | Room WS3

Iveta Labunska - Skrunda Secondary school Inese Pickaine - Skrunda Secondary school

Physics, biology, chemistry, STEM, health education, geography

You will learn about the practical ways in which children, young people, and adults can make sense of various natural processes with secondary raw materials, natural materials, foods and very little everyday chemicals. To answer your questions, the little thumbling from Latvia will take you on a journey through moss, water reservoirs. layers of earth and up to the sea, getting to know them and exploring, modelling, studying and making conclusions. We are looking for a group of 24 "tourists" for the trip!



# MAGNIFYING CURIOSITY THROUGH THE MAIL -**ORIGAMI MICROSCOPES**

**Saturday, 2 November, 11:30-12:30 | Room WS4** 

**Paul Stinson - Sun West Distance Learning Centre** Biology, STEM

A glass sphere is an example of an object that can magnify and bring us closer to viewing and understanding the microscopic world first-hand. So is a water droplet. Foldscopes are inexpensive, cardboard origami microscopes that use a glass bead as a magnifier, and can magnify over 100x. The simple yet effective technology allows for connections to biology/life sciences, physics/optics, as well as an exemplar of engineering/design.



Low-cost "frugal" technologies like Foldscopes can allow students to access and explore the otherwise hidden world around them, whether in a classroom, home school environment, or on a field trip. This experience can be further enhanced by interacting with digital technologies and social media to collaborate with others through an online community.

Workshop participants will be given a brief overview of this technology, followed by a short discussion of ideas and applications. We will then use pre-assembled Foldscopes to view prepared slides, followed by the opportunity to assemble individual Foldscope kits to make and view (and share) their own slides.

#### **MATHSMAGIC**

Saturday, 2 November, 11:30-12:30 | Room WS5

Dieter Kadan - Austrian St. Georgs Kolleg, Istanbul Mathematics, magic

Is it possible to locate a secretly chosen playing card simply by calculating the sum of digits of a spectator's favourite number? Who knows how to make a piece of a puzzle vanish with the help of a trigonometric function?

Magic tricks like these attract our pupils' attention and raise their curiosity about mathematics. The workshop "MathsMagic" is designed for secondary - and higher level teachers interested in teaching with

the help of magic even if they have never tried/performed a magic trick before. In no case mathematics is presented as a kind of "mysterious magic". The slogan says "Mathematics is the key to the magic secret".

Please take a deck of playing cards (Poker, Canasta, Uno etc.) with you if possible.



# SUPERFICIAL CHANGES, NEW PROPERTIES! **Saturday, 2 November, 11:30-12:30 | Room WS6**

Carme Artigas - La Salle Montcadav **Fina Guitart - CESIRE Department of Education** Chemistry, digital technology

During the workshop participants will explore properties of magic sand and kinetic sand. They will try to explain this properties and the difference between them, and with the common sand. We will show examples using some animatons and



3D printed molecules and structures. Participants will investigate some methods to prepare magic sand and kinetic sand homemade. We will present a proposal of how to use experiments performed in classroom to engage students in a teaching-learning sequence with curricular content and competencies. We will present some posters produced by students and discuss about learning outcomes.

# WALKING ALONG THE CHROMOSOMES Friday, 2 November, 11:30-12:30 | Room WS2

Cinzia Grazioli - CusMiBio, Milano Livia Pirovano - ITIS Marconi di Gorgonzola/Cusmibio Biology, genetics, bioinformatics

Introduction: we will show how to prepare information sheets about genes ("gene card") using scientifically valid websites and how to create posters with the chromosomes and QR code that allow to access the gene cards.

The game: The participants will be divided into groups and will have at their disposal:

- tablets (or their smartphones) with QR code reader, poster of chromosomes with QR codes of genes, each QR code allowing to access to all the information collected in the gene card, (gene, protein, mutations, relevant aspects of the associated disease, curiosities. links to videos. etc.).
- some plastic coated cards describing diseases with phenotype images and/or information on the gene responsible for the pathology.

They will have to find (hunting) the gene responsible for pathology described in the card.

The team that captures more genes and respond correctly to question regarding genes will win.



# YOU'RE FIRED! A DRAMATIC APPROACH TO **PRIMARY SCIENCE**

Saturday, 2 November, 11:30-12:30 | Room WS7

Kathryn Horan - Pudsey Waterloo Primary, Leeds

Science, drama, speaking & listening skills

This workshop session begins with an active warm-up activity, before taking a look at the rationale behind our dramatic approach to science teaching and the many reasons to utilise drama activities in science lessons, including a consideration of existing research in this area. We'll then take a brief look at existing resources from other teachers and professionals that inspired our project. The session then moves on to detail the different strategies we used, how they can be used for formative assessment and how they could be enhanced using ICT.

Participants will then have the opportunity to unleash their inner actors and trial the activities themselves, while considering how these could be applied in their own settings. We finish with an opportunity to share ideas and a look at how other educators have used these activities.



# WORKSHOPS BY NUCLIO

### **GOLAR**

Friday, 1 November, 11:30-12:30 | Room WS8

#### Maria Luísa Almeida - NUCLIO

Physics, chemistry, natural sciences, biology, geology, geography, mathematics, ICT

Looking for online labs? And lessons with online labs? And inquiry learning online lessons?

In the Go-Lab Ecosystem you can: find the largest collection of online labs, try-out interactive inquiry apps, combine labs and apps into Inquiry Learning Spaces (ILSs) and share these with your students and colleagues. You can create your own ILSs, or copy and adapt ILSs from the database.

This workshop will give you an overview of the Go-Lab Ecosystem sharing and authoring platform - and show how it can help you bring inquiry based learning to your classroom.



# IDIVERSE - ART AND DESIGN THINKING FOR SCIENCE EDUCATION

Friday, 1 November, 16:00-17:00 | Room WS8 Saturday, 2 November, 14:00-15:00 | Room WS3

Priscila Doran - NUCLIO

All subject domains

IDiverSE is a project that proposes an innovative learning methodology where students develop interdisciplinary projects related to reallife contemporary problems (bees, plastics, natural disasters, etc.). producing an important and relevant outcome for their community. while at the same time learning several scientific concepts.

By following a Design Thinking approach, students Feel the problem, Imagine solutions, Create an outcome to share the solution and raise awareness and then Share with their community.

In this workshop, teachers receive a playful introduction to Inquiry-

Based Learning and learn about the Design Thinking method, applied to Education.

https://idiverse.eu/



# FRONTIERS - BRINGING NOBEL PRIZE PHYSICS IN THE CLASSROOM

Saturday, 2 November, 11:30-12:30 | Room WS8 Saturday, 2 November, 14:00-15:00 | Room WS5

Maria Luísa Almeida - NUCLIO

Astrophysics, particle physics

Have you ever wondered how we can integrate Modern Physics in the school curriculum? Do you believe that exciting discoveries such as the Discovery of Gravitational Waves or the Discovery of the Higgs Boson can be brought in the classroom in a consistent and understandable fashion?

The FRONTIERS project brings together expertise from frontier scientific research and educational research in formal and informal science learning, along with user communities across Europe, in order to demonstrate how Nobel Prize winning science can be systematically integrated in the school curriculum.

This workshop invites secondary school teachers to learn about the project and how to be a FRONTIER teacher.



http://www.frontiers-project.eu/

# FINDING POSSIBLE EARTH KILLER OBIECTS – A CITIZEN SCIENCE PROGRAM

Saturday, 2 November, 14:00-15:00 | Room WS2

**Leonor Cabral, Salvador Bruschy - NUCLIO** 

Physics, astronomy and citizen science

Scientists monitor the sky to find new objects in the solar system, not only for their research but also to identify dangerous near-Earth objects.

With the International Astronomical Search Collaboration (IASC). a worldwide citizen science and educational program, schools can have access to real data and make real discoveries.

This workshop will introduce the IASC campaigns and demonstrate how to use the specific software for image analysis, Astrometrica, that helps find moving objects against a field of stars.

It is an exceptional opportunity for students of all levels and teachers to participate in real science investigation - join us!



http://iasc.cosmosearch.org/

#### **OUR SPACE OUR FUTURE**

Saturday, 2 November, 15:00-16:00 | Auditorium

Rosa Doran - NUCLIO

Space careers, science careers

Space is closer than we think, and we do not need a rocket to reach it. OUR SPACE OUR FUTURE aims to engage students, families and community and show them how space impacts their daily life, even though they might not be aware of it. We want to inspire our students, guiding them towards new paths they didn't know were available and unveiling careers they thought were inaccessible. OUR SPACE OUR FUTURE is developing a set of activities, methodologies and tools to help teachers and their students reach the stars together.

In this workshop, we will present, discuss and gather ideas on how to make Space inclusive for all our students.



https://www.ourspaceourfuture.eu/

# WORKSHOPS BY SPONSORS AND PARTNERS

# HOW TO BUILD A SPACESUIT Friday, 1 November, 11:30-12:30 | Auditorium

# Gernot Groemer - Analog Astronaut, (OeWF) Austrian Space Forum

Spacesuits are "personal spacecrafts" and are probably the most complex wearable ever conceived. In this workshop, the respective subsystems and technical solutions are presented - including a discussion of current requirements for lunar and Mars spacesuits. Participants will learn about planetary surface environments and how to keep astronauts healthy when performing Extra-Vehicular Activities (EVA, aka "spacewalk").



# GOOGLE GEO FOR GOOD WORKSHOP Friday, 1 November, 16:00-17:00 | Auditorium

#### Liza Goldberg, Rohan Uttamsingh, Emily Henderson - Google Earth Outreach

Many of the world's toughest challenges will only be resolved through applied geospatial knowledge and universal awareness of our environment: long term environmental sustainability and success depends on the children of today, and future generations, comprehending their place and impact upon the world.

Google Earth Outreach and US High School students Liza Goldberg and Rohan Uttamsingh will be offering a hands on workshop introducing Earth Engine Apps created for High School Science curriculum around the topics of deforestation, urbanization, human influence, and more. Over the course of the workshop we will kick off a buildathon to help participants develop ideas for how they can incorporate these tools into their classrooms and potentially build their own (and submit your ideas for prizes!)



# LEARNING BY DESIGN WITH THE AIRBUS FOUNDATION DISCOVERY SPACE

Saturday, 2 November, 11:30-12:30 | Auditorium Saturday, 2 November, 14:00-15:00 | Auditorium

#### **Didier Laval - Airbus Foundation**

The workshop will offer participants an opportunity to discover and test the Airbus Foundation Discovery Space approach for aerospace engagement, grounded on project-based learning and learning by design.

Different ways to use the resources of the platform will be explored, linking hands-on activities with digital tools and collaborative practices.



# HOW IMPORTANT IS PHYSICS TO THE ECONOMIES OF EUROPE?

Saturday, 2 November, 14:00-15:00 | Room WS6

#### Enrique Sánchez - European Physical Society

Enrique Sánchez, coordinator of the office of the European Physical Society (EPS) in Brussels, will present a recent EPS study that explains how important Physics is to the European Economies.





#### IF IT IS A LEGEND IT MIGHT BE SCIENCE

Stand number 106 Country Canada Teacher Diane Campeau

Institution Commission Scolaire Francophone de Colombie-Britannique

Subject Physics, biology, chemistry, environment

The new curriculum in British Columbia, Canada, is asking teachers at every level to integrate Indigenous perspectives and knowledge into every aspect of sciences. During the fair, we will present different ways we had experienced to integrate the local Indigenous knowledge about science in classrooms. Examples will range from kindergarten to high school level and will challenge the traditional Western way to envision science using local legends.

#### LIFE OF PLANTS

Stand number 111

Country Czech Republic

Monika Hojdanová, Šárka Látalová Teachers

Institution VIDA! Science Centrum Subjects Physics, biology, botany

How do plants work? Why are they green? Do you know how to light up wood? Together we can try to explore the kingdom of plants through different kinds of playful experiments. We can learn what the plant's body looks like and learn how capillary action and photosynthesis work. We can also try to extract chlorophyll and feel the "magic" of the chestnut fluorescence.



#### VISIT FAMOUS SCIENTISTS AND DISCOVERERS WITH US

Stand number L01

Country Czech Republic

Teachers Kateřina Osmiková, litka Soukupová

Institution Gvmnázium Stříbro

Subjects Mathematics, science, geography, history

Project for kids at age 6-18, a leisure time activity:

Interesting facts from the life and work of selected scientists

Information about the countries where they lived

- ·Simple models and experiments related to discoveries, inventions, experiments, and observations by individual scientists
- Instructions for experiments and models preparation
- A 12-month calendar with 12 scientists and discoverers and 24 experiments

An important part of the project is inter-subject interconnection of information and realization of models and experiments of individual scientist.

#### THE TRAVEL TO THE MOON 2019

Stand number K06 Denmark

Country

Teacher Allan Ullits Sørensen Institution Sct. Mariæ School

Subjects Rocketlaunching, exrcise in moonlanding, cleaning and recycling of

water

In a video constructed as a storyline, two children discuss the aspects and challenges of spaceflight. The storyline is made of short video sequences, in which the children talk about various subjects. The children will be working on different exercises like it is intended in the class room. The purpose is that the pupils, when they see the video, will begin to think about what's important in space travel. In the video there will be a conversation about the need for food and water. They will discover the challenges in bringing water on a space journey and recycling water will be an issue. The last subject will be landing a space rocket safely.

#### PLAY A ROLE AND LEARN

Stand number K04 Finland Country

Teachers Kaisu Pövskö. Anniina Vimpari

Institution Päiväkoti Piilometsä

Subjects Mathematics, science, literature, history, exercise, art, music

In the Piilometsä project, children use their imagination, take on different roles and learn at the same time. They design, implement, document and evaluate the project together with the teacher. The projects cover various topics such as space exploration and prehistoric times. Outside teaching encourages children to work and their activity is enhanced by research in small groups. An interesting topic makes children understand the study matter and they want to solve the problems themselves. The project is versatile and has included mathematics, literature, art, expression, ecology, nature and physical exercise. The teacher proceeds without haste and encourages the children to try and explore.

#### **GAMING LAB**

Stand number 109 Country Georgia

Teacher/Institution Nino Abesadze/American International School Progress

Teacher/Institution Lali Mgeladze/State School N51, Tbilisi

Subjects Science

The playing laboratory is intended for kids ages 5-6 in kindergarten.

We have tried to make every single model in a way that takes into account what kids are interested in at this age. Kids are not only observing physical changes but also participating in the process of creating the models. They have coloured planets, toys for a dolls' theatre and cut out trees. But this isn't a complete list of the activities the kids can get involved in. It is an important fact that they do not only observe, explore or find out but also play at our "funny laboratory". Because kids study better with playing at this age!

# CAN YOU SEE THE LIGHT? TO SEE. FEEL AND UNDERSTAND THE PROPERTIES OF LIGHT

Stand number 110 Country Germany

Teachers Astrid Pösl, Sonja Vochezer Institution SFZ Bad Saulgau Subjects Science, art, language

With this project, the children will work towards. grasp, experience, prove and understand the properties of light through different experiments with simple materials. Is light visible and where are the colours of the rainbow hiding? Can you mix the colours of the light like watercolours? Can it happen to me that my shadow is in front of me when I am looking towards the sun? Through observation, listening, putting concepts into words and reduction to the basics this project is also beneficial for the development of speech and the expansion of vocabulary.



#### WE BECOME INSULATION EXPERTS!

Stand number K01 Country Germany

Silke Puda, Ricarda Rustige Teachers Institution Grundschule Birth Subjects Science, German, art

The project is an action-oriented teaching series on the subject of "thermal insulation" and resource protection. The students get to know technical ways of thinking and they work with the aim of promoting sustainable thinking. They implement their own ideas, observe concrete conditions and experience the effect of simple physical forces.

#### OH THAT GRAVITY!

Stand number 106 Country Greece

Teacher Evangelia Samanta

Institution 1st Gymnasium Agiou Athanasiou Thessalonikis

Subjects Computer science/ICT, science

The "Oh that gravity" project took place with the cooperation of three teachers and their schools, where we attempted to make students comprehend the concept of gravity and overcome the respective alternative ideas of students. The project includes inquiry based activities like online research (e.g. videos), analogue and digital tool design, board game design and poster design where the project results are presented.

#### FIRST KISS WITH SCIENCE

Stand number J07 Country Hungary Teacher Fanni Flach

Institution Szent-Györgyi Albert Agora

Subjects Physics, biology, chemistry, natural science

I would like to present our self-developed experiments and projects that have been a part of the "Let's Play Science" classes. These classes are for children at the age 6-10. The thematic experiments promote the interest in science in the early years and help the development of thinking skills. The special learning environment frequently provides opportunity for inquiry-based learning. The main goal of our stand is to show an example of scientific experiments that are suitable for children in kindergarten and primary school.

# STEM EXPLORATION THROUGH ROCKET/PROJECTILE LAUNCHING

Stand number 108 Country Ireland Teacher Jane Shimizu

Institution Scoil Chaitríona Iunior Subjects Mathematics, technology,

engineering, science

We use both home-made rockets/projectiles and small commercial rockets/projectiles to engage



our early years primary school students with STEM education. Using space and rockets/ projectiles as a theme we encourage our students to become interested and engaged in mathematics, science, technology and engineering lessons. We encourage active learning throughout, with an emphasis on questioning, observing, decision-making, designing, making and researching. It is through active enthusiastic learning that our students engage with STEM and arts subjects.

#### INSPIRING TECHNOLOGY

Stand number 109 Country Italy

Teacher Christian Blaas

Institution G.S. Kastelruth (Bolzano) Subjects Technology, science, language

Based on a package of technical and non-technical materials, primary school children invent and design their own workpieces on various given topics like "ingenious bridges" or "ingenious machines". Especially the combination of apparently incongruous materials promotes the creative process. Working with the material package creates creative freedom, appeals to all children and challenges them to their limits. At the end of the construction phase, the focus lays on the presentation of their "invention" and the exhibition of the workpieces as part of a school fair.

#### CREATIVE PLAY-DOH (CREATIVE PLASTICINE)

Stand number K02 Kazakhstan Country

Teachers Dana Salkhayeva, Gulnar Zhakupova Institution National School of Physics and Math

Subjects Mathematics

The project 'Creative Play-Doh' aims to develop the abstract thinking of students in maths. The activties in the project increase the interest of students in the subject of maths and help to develop good motor skills. Particularly, the use of plasticine is relevant in explaining mathmatical concepts, such as of addition and subtraction of natural numbers, proportions, solving linear equations and motion. With this project we try to identify the hidden abilities of students and nurture their development.

#### AND YET IT MOVES

Stand number K05 Country Latvia Teacher Zintis Buls

Institution Zemgale Region Human Resource and Competences Development

Centre

Subjects Physics, science, sport

A series of experiments and demonstrations to further kids' understanding about the effects rotation has on the things around us - from toys to planets and galaxies. Experiments are performed with simple, easy to find materials. They demonstrate physical phenomena that are touched upon lightly or not at all in the elementary school curriculum. The aim is for the knowledge and experience gained from these activities to help children understand the associated laws of physics when they are introduced in the curriculum in primary and secondary school.

#### COLOURS

Stand number 110 Country Poland Teacher Beata Żarska

Institution Primary School No. 68 in Wroclaw Subjects Physics, biology, chemistry

In extra-curricular science activities, our children made interesting observations and experiments (mainly elements of physics) and experienced the emotions of young explorers. When we learned about the Science on Stage festival, we decided to present our projects on stage. The children chose the most interesting (in their opinion) experience; we gave them the common title "Colours." To present the science on stage, the kids came up with everything from scenario and costumes to acting and music. The successful presentation of our children was shown not only at our national Science on Stage festival, but also at our school community and at an "Academy of Young Explorers" event in Wroclaw in front of a few hundred people.

#### TEENS FOR KIDS

Stand number K03 Poland Country

Teacher Maria Dobkowska

Primary Integration School no 339 in Warsaw Institution Subjects Physics, technology, sociology, human life

I present exhibits and documentation of my work with students in the project "older students for younger colleagues". The aim of this project is to explore the secrets of science through attractive activities and games for first and second grade elementary children led by their older colleagues. Older students use funny toys and other objects during the classes or meetings to illustrate the phenomena they want to explain to children.

#### TRAVEL TO THE LAND OF GEOMETRY

Stand number L06 Country Poland

Teacher Izabela Kaleta

Institution Primary School in Wola Jachowa

**Subjects** Mathematics, geometry, art, music, design, literature, drama, circus

pedagogy, physical education

An interdisciplinary educational and mathematical-artistic project taking place during extra-curricular classes as a part of the school activities of a drama club, called "CBT - TO BE CONTINUED" Theater. We want to awaken and develop children's passions, talents, and mathematical and artistic interests. This project is aimed at developing mathematical skills and creative thinking as well as show a possibility of combining the intellectual effort with fun and creativity.



#### MOON SHELTER

Stand number J11 Country Portugal

Teachers Marta Ferreira, Sandra Vasconcelos
Institution Ag. Escolas Pedro Eanes Lobato
Subjects Science, English, Portuguese

We are celebrating the 50th anniversary of the moon landing. In our project we want to get students interested in the earths' natural satellite, the moon! After some theoretical input we want to give students a closer look into space and the needs of astronauts. Activities like building and coding a bionic arm and investigating space food aim to spark the interest of students.

#### PLAYING WITH SCIENCE

Stand number L02
Country Portugal
Teacher Sofia Ranito

Institution Escola EB1/JI Cesário Verde

**Subjects** Mathematics, computer science/ICT, science, Portuguese

Our small classroom projects promote students' development of critical thinking. The bases are simple experiments with daily materials following an inquiry-based approach to science learning. The goal is to lead the students to learn everything about what surrounds them and to discover the unknown.

# WORLD SCIENCE DAY AS A TOOL TO ATTAIN SUSTAINABLE DEVELOPMENT

Stand number 107 Country Portugal

Teachers Raquel Loureiro, Rosa Pereira

Institution Colégio Luso-Internacional do Porto, CLIP Subjects Physics, biology, chemistry, science

UNESCO promotes education for a sustainable development by harmonizing environmental, societal, cultural and economic considerations in the pursuit of an enhanced quality of life. As a joint initiative from the Science Department at CLIP, every 10th November the World Science Day (WSD) takes place. The day was made up of a host of science based activities with the aim of inspiring students and extending their knowledge and understanding of science through fun and hands-on activities. This year, WSD for Peace and Development offered an opportunity to demonstrate how science is relevant to our daily lives and to engage the students and the community.

# FIGHTING AGAINST RURAL DEPOPULATION USING TECHNOLOGY: OUR MOBILE APPS

Stand number 108 Country Spain

Teachers Bárbara De Aymerich, Nerea Martinez Baranda Institution Escuela de Pequeñ@s Científic@s Espiciencia

Subjects Technology, science, social sciences, rural development, inclusive

science

Rural depopulation is a pressing problem in our region (Castilla v León), a situation that gets worse in the peripheral localities and with adverse climatological conditions, as in the locality in which we live, Espinosa de los Monteros. There, the access to science and technology is complex, but it is a very powerful weapon to fight against the loss of active population. Thanks to this project, girls between 7 and 11 years of age have been able to devise, develop and promote three mobile applications linked to three key aspects in improving the quality of life in rural areas: access to services, education and health care and the environment

#### THE EFFECTS OF ACID RAIN ON PLANT GROWTH

Stand number L05 Spain Country

Teacher Alfonso Ales Tejero Institution CEIP Ioaquín Costas

Subjects Mathematics, computer science/ICT, science, literacy

A group of students of 5th and 6th grade of primary education carried out an experiment about the effects of acid rain on plants in their zeal to see with their own eyes the impact of this environmental issue in their own village (Graus). It was hypothesised that acid rain would affect the growth of local plants negatively. Therefore, tomatoes and green beans were planted in four types of local soil and watered with different types of water, from the most basic to the most acidic. The results of this experiment, after four weeks of observation, were as expected. Through the scientific method, they could prove the negative effect of acid rain and opened other lines of investigation.



#### CODE FOR MARS

Stand number L04 Country Turkey Teacher Nazlican Top

Institution Bahcesehir Bornova Özel Okulu Subjects Technology, science, art, astronomy

The students will be able to design life scenarios on Mars with and science knowledge and programming via Lego Education and Scratch. They discussed about Mars and jobs needed for life-sustaining conditions. They were given problems and designed a scenario with the help of their assigned jobs' competency, firstly paper-based, then on a computer. They found solutions for environmental disasters and searched for information about old Mars spaceships regarding their shape, efficiency, and technology. They designed their Lego vehicles designed for the atmosphere of Mars. Robots were programmed. They presented their scenarios in Scratch. They tested their results and developed the product. Action research was conducted.

#### SING A SONG OF SCIENCE

Stand number 103

United Kingdom Country Teacher Sharon Durant Institution Bexhill Academy

Subjects Physics, biology, chemistry

Science has its own language - special vocabulary that needs to be used in particular ways. Songs have long been a valuable tool in language teaching and here we combine singing and scientific knowledge to create useful curriculum-based songs to help retain the important ideas and words for various topics across scientific disciplines and student age groups.

# ECHO TECH YOUTH

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YEARS

Stand number D09 Country Albania

Teacher/Institution Arbana Hallya/Fadil Gurmani primary school

Teacher/Institution Mailinda Hasanai/Hasan Prishtina secondary school

Subjects Technology, science, IT

The project starts with informative sessions and workshops from an environmental expert. They show our current environmental situation and present ways in which we can improve it. One way will be through the usage of microcontrollers. In this project, we use microcontrollers, such as Arduino and Raspberry Pi, and code them to measure temperature. air purity, water purity, humidity, and the moisture of soil. The end product will be a coded corner of plants planted and nurtured by students and the devices built by them to measure the above mentioned environmental parameters. Showing such ways of technology use, makes not only coding more interesting, but also attracts the attention to environmental issues in an interactive way.

# CONTRUCTING A CIRCULATING FLUIDISED BED LABORATORY UNIT

Stand number E04 Country Austria

Teacher Bernd Schaunitzer

Institution Polytechnische Schule Leoben

Subjects Computer science/ICT, technology, engineering, metalwork and

mechanical engineering, commerce and clerical work, nature studies

and ecology

Within the framework of a project between the Polytechnische Schule Gleisdorf and the Montanuniversitaet in Leoben, school pupils planned and constructed a circulating fluidised bed unit for use in the university laboratories. Pupils specialising in electrical engineering, information and communication technology, metalwork and mechanical engineering, as well as commerce and clerical work contributed to the creation of the unit, from planning and building the frame to programming the built-in microcontroller for collecting and analysing the generated data. The unit is currently in use at the university in Leoben, where it contributes to the research on thermal processing technology.

#### FOLK BELIEFS ABOUT WEATHER AND ASTRONOMY

Stand number E03 Country Bulgaria

Teacher Radka Kostadinova Institution High School "Ivan Vazov" Subjects Physics, astronomy

Are the position and the visibility of astronomical objects connected to the local and traditional believes of what the weather will be like? The aim of this project is to investigate folk believes about the dependence of the weather on the position of different astronomical objects such as the sun, the moon, and the different constellations as well as to check their credibility. To achieve this, our team defined the following research tasks: to establish the folk believes about the weather relations to the position and the visibility of astronomical objects; to observe and capture (photograph) sunset and sunrise daily; to do the same for the moon. The respective data was recorded.

# INTRODUCING EDUCATIONAL ROBOTICS AND CREATION DIGITAL LEARNING ENVIRONMENT IN THE TEACHING OF MATHEMATICAL CONCEPTS

Stand number B01 Country Cvprus

Teacher Georgia Mylordou Institution Asinou Primary School

Subjects Mathematics, technology, design

The present work is a didactic approach in which two subjects, mathematics as well as design & technology, are involved. This didactic approach is based on the



use of educational robotics (LEGO Mindstorms EV3 educational core set) for teaching mathematical concepts. It has been applied to children aged 11-12 years and is based on experiential-exploratory learning. The basic concepts that could be taught by using robotics are proportions, distance measurement, negative and positive numbers, and understanding basic geometric properties such as the perimeter. There is also the possibility of intuitive awareness of complex phenomena such as the relationship between speed, time and movement.

#### SIMPLE PHYSICS EXPERIMENTS IN COMPUTER SCIENCE LESSONS AND BEYOND

Stand number A04

Country Czech Republic Teacher Peter Žilavý

Gymnázium Pierra de Coubertina. Tábor Institution Subjects Physics, biology, computer science/ICT

At present, the computer is a basic tool for communication, information search, data processing and document creation. However, we can also use it with a minimum of peripherals for real school experiments to connect computer science lessons to physics or biology. Several experiments on colour vision, properties of hearing and acoustics in general are presented. "High-tech" computer experiments should be balanced with experiments using simple aids or things around us. As an example, a set of electrostatic experiments using decorative stainless steel garden balls or a beer glass is demonstrated.

#### KALEVALA GOES SCIENCE

Stand number C09 Country Finland

Teachers Johanna Eskelinen, Päivi Mustalampi

Institution Ioutsan Yhtenäiskoulu

Subjects Physics, biology, chemistry, computer Science/ICT, literature, crafts.

health education

Interdisciplinary learning modules are part of the curriculum in Finland. The students always read and write at school in their mother tongue and literature plays a secondary role in these studies. We decided to do this the other way: literature comes first and we look at it with a scientific view point. We chose Kalevala, our national epic because the pupils study it during their final school year anyway. We studied the main parts of the story and chose 13 subjects for scientific projects. Every group in the project made up a scientific question based on the plot. They continued the work by finding theoretic information and doing practical research. The work was put on the website with some extras.

#### YOUNG PEOPLE LEARNING STATISTICS

Stand number D03 Country Finland

Teachers Aira Karassaari, Hanna Littow Institution Keminmaan keskuskoulu Subjects Mathematics, languages

Practice is a way to learn statistics. By choosing interesting topics and then preparing questionnaires, reports, presentation materials and a column (e.g. for the local newspaper) in a digital environment, students learn very useful tools for processing information. Working this way provides opportunities for experimentation and active learning and increases students' sense of responsibility. Exploratory and inquiry learning have both been taken into consideration when this practice has been developed over the years. In our school, practice combines math and native language studies but it is easily transferred to any subject and any age group. The practice is strongly based on our national core curriculum for basic education.

#### AUGMENTED REALITY SANDBOX

Stand number A05 Country France

Teacher/Institution Marie-Amélie Cazelles-Serin/Collège Anna de Noailles

Teacher/Institution Arnaud Chanet/Collège d'Ussel Teacher/Institution François Coutarel/DANE Adjoint Teacher/Institution Gaël Glandières/IA-IPR SVT

Subjects Biology, geology

The Augmented Reality Sandbox is a technological device which combines a real situation with virtual elements. The real data, usually collected outside, can be greatly enhanced through the use of virtual resources which increases the students' knowledge as it relates to real life situations. Therefore, the AR Sandbox allows us to understand, in a more efficient way, natural events such as floods, tsunamis, volcanic eruptions along with the associated risks and the measures that can be taken to decrease the negative effects of such natural events.

#### MACHINE LEARNING IN SCHOOL

Stand number B06 Country Germany Teacher Daniel lanssen

Institution Gymnasium Dionysianum Subjects Computer science/ICT

Neural networks, deep learning, machine learning - these catchwords have generated a tremendous media response in recent years. This project examines not only the technical side, but also the social and ethical impact of this development. Pupils learn how artificial neural networks are constructed and how these can learn in a self-organizing way. They design neural networks, compete to see which group achieves the highest recognition rates in the famous IRIS data set and design their own face model in order to recognize faces and calculate recognition rates. As deep learning techniques will determine our daily life even more in the future, a critical examination of this topic is important in modern STEM education.

#### MINT-EC CAMP AUTONOMOUS DRIVING

Stand number D02 Country Germany

Teachers Bastian Schatz, Christoph Selbmann

Institution Schiller-Gymnasium Hof

Subjects Physics, mathematics, computer science/ICT, engineering sciences

The topic of autonomous driving is currently on everyone's mind and is seen as a major upheaval in future mobility. The project aims to give students a practical insight into this diverse field. In groups, typical scenarios such as lane keeping, obstacle detection, autonomous overtaking or orientation and route finding on realistic car models are developed. The Arduino platform is used to evaluate the sensor data and to control the actuators. In addition to the experimental-practical work on the car models, the program also includes an expert lecture and an excursion to a company (Hamm AG).

#### CO2DUINO

Stand number **B**05 Country Greece Teacher Vasilis Noussis

Institution Laboratory Centre of Physical Sciences of Thesprotia

Subjects Physics, biology, chemistry, mathematics, technology, engineering

The project presented is of long duration and has a wide scope; Fourteen students of the 8th and 9th grade were first taught the basics of Arduino programming, and then, using knowledge from science, technology, engineering and mathematics, they studied different aspects of the umbrella theme, carbon dioxide, from chemistry, physics, biology and environmental points of view.

#### OPTICAL TWEEZERS: THE NOBEL PRIZE IN PHYSICS 2018 AT YOUR SCHOOL

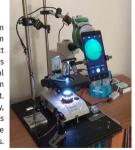
Stand number D06 Country Greece

Michalis Orfanakis/General Lyceum of Makri Gialos, Gymnasium Teacher/Institution

of Koutsouras

Teacher/Institution Mikis Mylonakis/IESL - FORTH Physics, biology, chemistry Subjects

Light carries energy and momentum and it can be reflected or refracted while it travels from one transparent medium to another. This project demonstrates how the above-mentioned characteristics of light can be utilized for the development of "optical tweezers". They are used for trapping and manipulation of particles and biological samples with light. Optical Tweezers have many applications in biology, biomedicine and physics. The Nobel Prize in Physics 2018 was awarded to the pioneer scientist who led the research effort for the development of optical tweezers. This project provides students with the opportunity to



have a hands-on experience with the 2018 Physics Nobel Prize.

#### ESCAPE ROOM TO GO

Stand number C06 Country Hungary Teacher Csilla Képes

Institution BGSZC Szász Ferenc Secondary and Vocational School Subjects Physics, biology, chemistry, computer science/ICT, geography

When I first heard about the escape room concept, I immediately thought about how good it would be to use it in education. It seemed so amusing that I knew the students would love it. I wondered a lot about how this could be done with ICT tools and limited to one classroom. In this challenging, unpredictable game, you have to solve various logical tasks and tricky puzzles together with your teammates. Practical application of scientific knowledge is the goal. Due to the variety of tasks, it can be used from the 7th grade until the 12th grade. But it is advisable to schedule it for 2-hour classes.

#### TECHLAND: MATHEMATICS AND SCIENCE IN A VIRTUAL WORLD

Stand number B03 Country Italy

Michelina Occhioni Teacher Institution LC. San Cesario di Lecce

Subjects Mathematics, technology, science, art

Techland is an OpenSim virtual group of educational and service islands focused on maths and science for students in grade 6-8. The main aim of this project is to engage students and help them to learn more efficient. Students and teachers log in as avatars and explore, collaborate, build and code, while expressing their their creativity and knowledge. Year by year teachers' and students' activities have continuously developed and improved, tending to be harmonized and blended together. Learning by doing and collaborative learning join together in the IBL methodology where teachers facilitate and support learning.

#### WALKING ALONG THE CHROMOSOMES

Stand number D04 Country Italy

Teacher/Institution Cinzia Grazioli/CusMiBio, Milano

Teacher/Institution Livia Pirovano/ITIS Marconi di Gorgonzola, CusMiBio

Subjects Biology, genetics, bioinformatics

Adopt a chromosome is a CusMiBio project for high schools in Lombardy, Each school adopts a chromosome and the students create gene cards in Italian and English of some of the most relevant genes. On a poster they present the chromosome with annotations of gene positions and names. In addition they create QR codes to access the information on gene cards. Guidelines to prepare gene cards, to create QR codes and the formats to collect homogeneous information and how to draw chromosomes are given.

# MODERN SCIENCE CLASSROOM

Stand number

B02

Kazakhstan Country Teacher Mnuar Yernat

Institution Regional specialized boarding school for gifted children named after

Nygmet Nurmakov

Subjects Science

This project will show how to captivate children with science by investigating every day problems and questions. In cooperation with PASCO, which is allowing teachers and students to demonstrate and conduct STEM education experiments, as well as a number of scientific experiments on university level. A serious mathematical apparatus of a digital laboratory allows you to analyse and derive any existing pattern. We try to introduce PASCO technologies to the classrooms and modernise the science lessons.

#### PROGRAMMING ROBOT (TEACHER ASSISTANT)

Stand number D01 Country Kazakhstan

Teacher Baglan Kuturbayey Institution National School of Physics and Math

Subjects Computer science/ICT

This project aims to help students understand basic programming algorithms. We believe that physical models will help students to visualise and eventually understand programming better. In this project we used the Arduino UNO microcontroller and a prewritten simple code to visualize how algorithms work. Our concept in our examples is the same: visualisation of a one-dimensional array.

#### CREATING ANIMATION AND VIDEO IN SCIENCE SUBJECTS

Stand number C07 Country Latvia

Teachers Liene Krievina, Liene Sabule Institution Jelgava State Gymnasium

Subjects Biology, computer science/ICT, geography, computer literacy, English

Computer literacy teachers with natural sciences (biology, geography) and English teachers collaborated in the project. The pupils created animations and videos and covered various science subjects in the project. As a result, we have found that pupils' progress

in science and English has improved as well as cooperation and digital skills. Another benefit was the promotion of teacher cooperation in various fields and the enhancement of pupils' competences. The project will continue next year, expanding the number of teachers involved.



#### PROTEOMICS, MASS SPECTROMETRY APPLIED TO PROTEIN ANALYSIS

C03 Stand number

Country Netherlands Teacher

Andrea van Bruggen-van der Lugt Institution Willem van Oranje College

Subjects Biology

In this project students learn how to interpret mass spectra of fragmented peptides. In the theoretical part students learn about proteomics, trypsin digestion and solving amino acid sequences from peptide fragment spectra. In the practical part students purify normal and sickle cell haemoglobin and digest them into peptides, which are analysed by mass spectrometry. Finally, the students run the mass spectra data in Mascot to find out which is the native or mutant version. The project ends in predicting mass spectra of the native and mutant peptide fragments of the BRAF protein.

# STRUCTURED PROGRAMMING AND THE INTERNET OF THINGS

Stand number C04 Country Norway Teacher Ola Lie Institution Askim vg skole

Computer science/ICT, operation and maintenance (VET programme Subjects

area ICT service)

Today, billions of "things" have integrated microchips and are connected to the Internet. Data is sent to the cloud, analysed and acted upon by means referred to as artificial intelligence. neural network, and deep learning among others. It is called the Internet of Things (IoT). Is it possible to teach this technology in upper secondary education and training with handson exercises within reasonable costs and 13-year-old curricula? Yes, we run IoT projects in both university-preparatory and vocational education programmes, and our students are satisfied. We use Raspberry Pi computers with Sense HAT add-on boards and the ThingSpeak TM IoT platform from MathWorks®.

#### CHEMANALYSE - YOUR APPLICATION TO DO CHEMISTRY LABORATORIES

Stand number C05 Country Poland Teacher Danuta Borek

Institution II High School of Mieszko I in Szczecin

Subjects Chemistry, technology

This is a trial to change a typical chemistry laboratory into a computer lab. We know that many students in Poland (and all around the world) do not conduct practical experiments during chemistry lessons. Because of a lack of money and time during classes, we try to create some substitutes for laboratory exercises. In our application everything (what was possible) is the same as in a typical laboratory. You have contact with test tubes, solutions and each other and you can learn chemistry more effectivly. Other teachers can use our application during school classes instead of teaching only theoretical descriptions of some experiments.

#### SAFE FLIGHT - INNOVATIVE MODIFICATION OF A WING

Stand number D11 Country Poland

Teacher Elżbieta Nowak

IV High School in Poznań Institution Subjects Physics, aeronautics

In today's world the aviation industry is developing rapidly. Engineers constantly need improved technologies to make planes more efficient and safer. As a pilot I have noticed that sharp transitions between the aileron and the wing might be the cause of a lot of accidents. This project is dedicated to finding a solution for this problem by experimenting with flexible material to make a smooth transitions between the aileron or a flap and the wing.

#### STROBOSCOPE AND BEYOND

Stand number F01 Country Poland

Teacher Dobromiła Szczepaniak

Institution High School No V of Jakub Jasiński in Wrocław

Subjects Physics, electronics

After watching a video on the in internet with water drops "frozen" in stroboscopic light. students attending our Science Club wanted to see this phenomenon in our lab. We had a stroboscope, but the range of frequency did not satisfy us. So we decided to prepare our own stroboscope using high-power LEDs. We started with a simple circuit with a 10W white power LED with driver build on integrated circuit LM555 and ended up with a battery of colour LEDs giving 1200W in pulse driven with microcontroler build on Atmega8, which we present in the fair.

#### ATMOSPHERE CONTROL OF A HOUSE

Stand number C11 Country Portugal Teacher Inês Madaleno

Institution Externato Cooperativo da Benedita

Subjects Physics, mathematics, electronics, electricity, programming, robotics

The project was developed with 10th grade students of the vocational course "Mechatronics Technician", with the general aim of involving several subjects, changing the teachinglearning methodology and holding students accountable for their learning. The specific goals of learning were: knowing the operation of the Arduino board and sensors; studying the position of several components in the electric circuit, according to the characteristics and objectives of the project; using the sensors for collecting information, controlling and executing actions; knowing the language of programming needed for collecting information, controlling and executing actions.

#### BRAGA THROUGH A DIGITAL LENS

Stand number D05 Country Portugal

Teachers Liliana Fernandes, Jorge Reis Institution Ag. Escolas de Alberto Sampaio

Subjects Mathematics, computer science/ICT, history, robotics, language.

social studies

This project will lead students to produce a historical script of the city Braga, including historical references of its most important monuments. This script, produced by the Robotics Club's students, using videos produced with stop-motion, will be accessible to tourists, national and foreign, trough QR codes, strategically allocated along a previously drawn route. This project will contribute to ease the access to local history to town visitors, contributing thus, in an ecological way, to tourism development. Special features concerning special needs will be implemented, in order to open this project to tourists with disabilities.

#### IMMERSIVE SCIENCE

Stand number E01 Country Portugal

Teacher Maria do Rosário Tavares Institution Ag. Escolas de Carcavelos Subjects Science, natural science

In recent years, the increase of technology used in schools introduced the students and the teachers to a new way to transmit knowledge; a way that is fun, inclusive and exciting. ImmersiveScience was created and it explores the potential of immersive environments, where students have the feeling of being present in a virtual lesson. These immersive environments are chosen to stimulate the students to search for the information of the given lesson.

#### MANGUALDE STEM ACADEMY

Stand number F04 Portugal Country Teacher Didier Dias

Institution Mangualde Municipality

Subjects Physics, chemistry, mathematics, technology, science

This initiative aims to support schools in achieving true equity and inclusion in the quality of learning, of both students with learning difficulties and high achievers, through the use of educational technology, project-based learning, collaborative and interdisciplinary curriculum development and innovative learning methods. The project is the implementation of a STEM collaborative curriculum development process in a Portuguese school cluster across multiple years, emphasising the local context and research-based pedagogies.

#### SCHOOL IN HUMANITARIAN CAUSES

Stand number A01 Country Portugal

Teacher Isabel Oliveira, Cláudio Sousa Institution Azambuia Secondary School

Subjects Physics, biology, technology, sociology

We are a school concerned with global society and sustainability. So, we have developed two projects:

FingerMed+ aims to improve relief provision emergency medical services, at a time when natural (or not) disasters have increased in intensity, frequency and damage caused, using a glove that has several medical devices integrated that are used in a first evaluation of a patient: oximeter, thermometer, heart rate meter and light to evaluate the pupillary response.

CardMe: Blindness is a medical condition that affects millions of people worldwide. Therefore, we proposed the creation of a smartphone app (CardMe) to help them in distinguishing different cards, such as discount cards, debit/credit cards and others.

#### SCIENCE! AND NO MATTER STORY

Stand number **B04** Country Portugal

Teachers Isabel Oliveira, Rui Mouro Institution Azambuia Secondary School

Subjects Physics, chemistry, Portuguese, English, teather, photography, video

editing, post production, multimedia

The aim of this project is to show science in scene dialogues with the perspectives of science education and scientific dissemination. Based on a book by G. Gamow, Mr Tompkins explores the atom, intent on visualizing the constitution of matter. "The 7th valence electron of the chlorine atom doesn't want to be alone. In an attempt to find a friend, he tries all quantum possibilities, even those that contradict harmony. While on this journey through the various quantum layers Electron 7 experiences all sorts of chemical bonding and unravels mysteries of the life of a particle, all with the help of a magician."

# SOS - SOUNDS OF SCIENCE

Stand number **D08** Country Portugal

Teacher/Institution Mário Correia/Escola Secundária Adolfo Portela Teacher/Institution Álvaro Folhas/Escola Secundária Marques Castilho

Subjects Physics, mathematics

Students need to learn science through "minds-on" and "hands-on" approaches, preferably from subjects that are related to realities they know and using equipment which they are most familiar with (computers, tablets and smartphones) and, if possible, in an interdisciplinary way because reality is interdisciplinary. This work uses computers and smartphones/tablets to, through music, learn physics (waves) and mathematics (graphic representation of functions) on an inquiry basis, stimulating and improving sciences skills.

#### TEACHING PHYSICS WITH LEGO EV3

Stand number A06 Country Portugal

Teacher Teresa Carvalho Institution

Subjects Physics, mathematics

Ag. Escolas Dra Laura Avres

The use of robots in space exploration can be helpful to introduce the study of physics. mathematics and programming, relating the sciences with the use of sensors and programming. Using robots to reproduce everyday situations and exploration activities promotes more meaningful learning and motivation. The planned activities are not intended to teach any programming language. They were developed to use sensors in research activities and test physical concepts. The activities can be adapted to other levels, depending on students computing skills.

#### QUALITATIVE ANALYSIS OF WATER SAMPLES FOR YOUNG SCIENTISTS

Stand number D07 Country Slovakia Teacher Anna Mišianiková

Institution Pavol lozef Šafarik University in Košice

Subjects Biology, chemistry

Qualitative analysis of water is very important and has great potential in biology education and strengthening interdisciplinary relationships. The project presents activities for analysis of selected physicochemical parameters of different water samples and for determination of water purity based on biomonitoring aquatic indicators. Students evaluate samples in terms of pH, conductivity and dissolved oxygen concentration by measuring systems and determine basic chemical parameters of water using a litmus test kit. Students learn to identify selected bioindicating species of aquatic invertebrates and algae and determine the water quality index.

#### VISITING THE MUSEUM? THE ROBOT HELPS!

Stand number C02 Country Portugal

Teachers Teresa Ferreira, Paulo Torcato Institution Ag. Escolas de Portela e Moscavide

Subjects Physics, mathematics, computer science/ICT, Portuguese, English,

history, geography, arts, programming

Visiting a museum with a guide inspired us to create a guide robot that would help a person to take a particular route through a building, exhibition or even company. Upon arriving at the entrance of the museum, the visitor chooses the route in a central robot, signalled by a colour, and this gives the information via Bluetooth to our guide. After that, just follow the guide robot and it will lead you throughout the visit, stopping only in the chosen places. So visitors with difficulties will have a more pleasant visit. A guide robot like this one provides visitors with a more original, interesting and fun visit and is especially helpful for people with difficulties and or special needs.

# BABY SAFETY – DEVELOPMENT OF SYSTEMS FOR THE PREVENTION OF SUDDEN INFANT DEATH

Stand number A02 Country Spain

Teachers David Ballesteros, Iria Ollero

Institution Aulas Tecnopole Subjects Technology, health

Sudden infant death syndrome is the sudden death of a baby without an apparent cause. Today, its causes are unknown but it is known how to reduce the risk. I have developed 4 devices that allow me to monitor the baby in the crib and in this way reduce the risk for this syndrome. Two systems allow me to control the baby's position in the crib, a third the simultaneous control of the temperature of the room and of the baby and the fourth allows us to monitor their pulsations while the baby is sleeping.

#### STEAM CENTER: INTERNET NETWORK FAILS

Stand number D10 Country Spain

Teacher Josep M Perello Institution IES Torre Vicens

Subjects Mathematics, technology, engineering, science

The STEAM Center is a STEM project where students develop science, technology, engineering and mathematics competences in a specific and transversal way. Moreover, it also includes digital competence and 21st century competences. The project is based on finding the solution to a problem, namely that the Internet network fails. There is a huge threat in which someone wants to destroy the internet access worldwide and students have the mission to reach the main server. Students should solve this problem by choosing different profiles, mathematicians, scientists, engineers and computer scientists, and work in teams to find the deactivation codes.

#### DYNAMENE - SCIENTIFIC RESEARCH EQUIPMENT BUILT BY HIGH SCHOOL STUDENTS

Stand number C08 Country Sweden

Teachers Jens Bjelvenmark, Pernilla Wegén

Institution Gullmarsgymnasiet

Subjects Physics, biology, engineering, coding

The making of scientific equipment can be a fantastic driving force to inspire young people in the field of science. The maker movement has enabled schools, teachers and students to create scientific instruments that can be very powerful and cheaper than commercial products. By building their own instruments students come to understand that these often are based on basic scientific principles they understand and know. Dynamene is an ocean current drifter based around an Arduino microcontroller and was developed together with high school students. We are currently in the process of producing building instructions and code so that it can be built by students anywhere.

#### FUN PROJECT FOR INTEGRATING ART WITH CIRCUITS INTO FINISHED PROJECTS

Stand number E02 Country Sweden Teacher Talal Mohamed Institution Elin Wägnerskolan

Subjects Computer science/ICT, technology

The project is focused on discussing teaching methods such as possible and effective teaching sequences; offering a simple programming language so students can focus on the syntax: choosing several problems to solve independently from any programming language. This project is connecting programming with different subjects including physics, mathematics, technology, arts and chemistry. Overall learning goals for my project are:

- Design, use and evaluate abstractions for realistic problems with physical systems.
- ·Understand several important algorithms that reflect computer science thinking (eg search and sorting); use logical thinking to compare different algorithms that solve the same problem.

#### CHOREOGRAPHIC VISUALISATION OF THE SEARCH **ALGORITHMS**

Stand number C10 Ukraine Country

Teachers Liudmyla Gryzun, Valentyna Pikalova Institution Bogodukhiv Gymnasium Nº1, Kharkiv region Subjects Mathematics, computer science/ICT, choreography

Search algorithms as classical informatics problems form a basis for schoolchildren's digital literacy today. The aim of the project is to implement a technique based on cognitive visualization and dance activity as a focus for interdisciplinary creativity to master algorithms. The project novelty stems from the fact that the students' work includes polysensory information processing as well as integration of analytical and creative practices, which facilitate the understanding of algorithms and increase students' motivation and morale. The project results in the technique itself and in video choreographic miniatures, visualizing the details of various search algorithms in arrays.

#### EXPLORE NATURE TOGETHER

Stand number F03 Ukraine Country

Teachers Tetiana Andrieieva, Olena Antykuz Institution Prestyzh Kurakhove Gymnasium

Subjects Physics, biology, chemistry, mathematics, English, geography,

astronomy

Modern society needs specialists who know new technologies and explore natural phenomena, and, at the same time, can speak foreign languages fluently. The aim of the project is for students to develop compentencies on the topic "Thermal phenomena" (physics, chemistry). The project's goal is the improvement of the following skills:

- 1) to use modern technical tools during the experiment,
- 2) to study the resulting graphics,
- 3) to use natural science concepts and terms in English.

The project proposes a system of experimental tasks using the digital laboratory "Einstein" and household rubbish. The development of students' creativity is stimulated by the nonstandard usage of sensors with tasks in different levels.

# PHITO-PICTURE IN THE COMPUTER SCIENCE ROOM

Stand number A03 Ukraine Country Teacher Yuliia Melnik Institution School # 8 Melitopol

Subjects Physics, biology, mathematics, technology

In the project, students created a "Phyto-picture", a painting made of living plants. The main components for implementation: the basis for the picture, drip system, water supply, soil, plants, Arduino Uno and Raspberry Pi, jumpers, model board, pump, multimeter, sensors (humidity, smoke, air temperature, illumination), phyto lamp. To implement the technical component of the project, students were introduced to the Arduino board, the different sensors and a smoke detector. The "Phyto-picture" was created for the computer room with the definition of soil moisture for the automatic irrigation of plants and with the definition of illumination level of the room for automated control of the phyto lamps.

# HOW IS BIOMETRIC SECURITY CHANGING THE WORLD WE LIVE

Stand number F02

Country United Kingdom Teacher Audrev Bovd

Institution St Mary's Primary School, Fivemiletown

Subjects STEM

This project was designed to engage pupils in STEM investigations and develop their scientific enquiry skills. The world of biometric security is ever changing and the pupils are directly affected by this change as they are the citizens of tomorrow's world. A series of biometic experiments were carried out; Investigating uniqueness, individual finger printing, DNA, heart rate experiment and a crime scene chromatography experiment. A field trip to our STEM partner. Besur, a local biometric security company, brought this project to life and demonstrated how an individual's ECG can be used for biometric authentication and utilised to tackle the growing threat of cyber-crime in today's world.

#### URBAN TREES AS CLIMATE MESSENGERS

Stand number H05 Austria Country

Teacher Carola Helletsgruber

Institution Uni. Salzburg

Subjects Biology, young citizen science, geography

Urban trees are not only green; they provide shading, have a cooling effect on their surroundings, filter fine dust and produce oxygen. But how much of these ecosystem services are they capable of providing and which tree species are adapted to climate change? The project objective is to contribute to a better understanding of the linkages between growth. phenology and ecosystem services of urban trees. The trees are equipped with beacons that connect via Bluetooth to a tailor-made app. The app is used for phenological monitoring, to display microclimate measurements and to broadcast information. We demonstrate an exemplary application of environmental monitoring in a young citizen science project.

# DOCTOR. IS MY WATERCOURSE SICK? CAN WE CURE IT? ADOPT IT?

Stand number H03 Country Canada

Teacher **Huguette Thibeault** Institution Cégep St-Hyacinthe

Subjects Physics, biology, chemistry, mathematics, ecology, microbiology,

social skills, communication

A classical laboratory in freshwater ecology-in the lab and in the field-as part of the course "Evolution and Diversity of the Living" (part of the pre-university program Natural Sciences) and also in "Lab techniques: Biotechnology specialization" inspired in 2006 the project: "Adopt a Creek" in the field in partnership with the Committee for the Enhancement of the Beauport River (CVRB). Now the Education and Water Monitoring Action Group (G3E-EWAG). has been operating in Québec, and on a pan-Canadian scale, for more than 25 years. They teach practices in the field or in the laboratory while enriching citizen science. The important contribution over many years from the G3E-EWAG will be shared.

#### DROPS AND DROPLETS

Stand number E07

Country Czech Republic Teacher Věra Koudelková

Gymnázium Českolipská, Praha 9 Institution Subjects Physics, biology, chemistry

Main topic of the contribution is the behaviour of water on different surfaces. In the first part visitors can compare water droplets on different surfaces. The main goal of this task is to show, that wetting of (not only water) depends on both - the liquid and the surface. The next part concerns modification of surfaces or liquids, which we used for less or more wetting. How impregnation and detergents work can be seen on water droplets (on same surface with and without impregnation or water with and without detergent on the same surface). Last part of the activity is about the behaviour of water on hydrophobic surfaces. Some very attractive experiments can be shown in this part of activity.

# ENVIRONMENT AND SUSTAINABILITY IN PHYSICS CLASS

Stand number E08 Country Denmark

Teacher Lars Elkjær Jørgensen Institution Alleroed Gymnasium Subjects Physics, chemistry

The basic idea of the project is to understand CO<sup>2</sup> equivalents as a measure for a given process's environmental sustainability in analogy to the Joule unit being a measure for energy in widely different physical processes. The fact that the various forms of energy for widely different physical processes can be transformed into other energy forms, and that energy quantities can be calculated in one calculation and with one energy unit (the Joule). is a deep insight worthy of our full attention. In this project, we use the energy concept and the energy unit Joule as a basis for the students to create a new goal for a given process's environmental sustainability in an innovative way.

#### YOUR BEST MISTAKE - AN ENGINEERING PROJECT FOR STUDENTS IN 3RD GRADE (10 YEARS)

Stand number G05 Country Denmark

Teacher Pernille Haugaard Iensen Institution Naturcenter Amager Strand Subjects Engineering, science

The last 3 years, during the "Engineering weeks", students have been working and using their science knowledge to develop and test practical solutions to societal challenges. There is a



shortage of housing in Copenhagen - how to build a floating city? Storm floods and rising sea levels - how to protect the city? Air pollution by cars - how to build a wind powered truck. Students build prototypes, test and improve them. The focus is on learning from mistakes. We collaborate with the local schools, so that pre- and post-work is done at the school. Planning, building and testing are at the Nature centre. Most work is done in a realistic environment on the beach (can also be adapted to the school).

#### DUSTRACK'R

Stand number E10 Country France

Teacher Anne-Claire Chenus

Institution Saint-Charles High School, Orléans Subjects Physics, computer science/ICT

Particulate matter (PM) is a type of air pollution generated by human activities, which can travel long distances in the atmosphere and causes a wide range of diseases and a significant reduction of life expectancy. Our project is to develop a portable device at low cost to map with a high precision and in 3D the pollution. DusTrack'R performs real-time computation of prediction models to calculate PM concentration using a set of sensors (temperature, pressure, humidity, GPS), which were assembled, programmed and validated in various conditions. DusTrack'R can be attached to a drone and its accuracy is comparable to expensive stations for air quality monitoring in use by the French government.

#### ROUFFACH. A LAND OF VINE AND WINE

Stand number F05 Country France

Teachers Catherine Demangeat, Rémy Greiner

Institution Collège Jean Moulin Subjects Physics, biology, chemistry

Wine-growing is a major economic sector in Alsace, more particularly in Rouffach, Pupils have the opportunity of taking part in grape harvest, visiting vine plots, discovering Alsatian grape varieties as well as the work with grapes after the harvest. They can also experience and discover the scientific aspect of wine production by meeting scientists. They can observe new environment friendly procedures and study the biodiversity in a context of traditional growing vs organic growing. The fulfilment of this project is based on the local wine-growing context: the agricultural college of Rouffach and the French National Institute for Agricultural Research (I.N.R.A.) of Colmar.

#### SOLAR LIGHT

Stand number G11 Country France

Teacher **Emmanuel Richit** Institution Lycée Chaplin

Subjects Physics, biology, mathematics, computer science/ICT, technology, earth

science

"Solar Lighting" is a project that brings together several scientific subjects around the same goal. The theme of the project is: Eco-friendly solar lighting to provide natural light for buildings which don't have it by using a motorized mirror. It must lead to the realisation of a functional prototype in order to validate the technical choices. The studies necessary to carry out this project are multiple and call upon knowledge taught in several scientific subjects like physics, math, computer science and technology.

#### WEATHER ROTOSMART

Stand number H02 Country France

Teachers Vincent Guili, Véronique Ridard

Institution Lycée René Descartes

Subjects Engineering, science, natural science

Weather RotoSmart is a weather controlled plant wall designed to grow crops while optimizing water intake. It is meant to:

- ·limit water comsumption on a planetary level because lentil and buckwheat co-cultivation can provide all essential amino acids and therefore replace meat based protein sources which require large amounts of water to be produced
- ·limit water loss of our culture thanks to the rainwater recycling and the integrated pump · optimise crop growth thanks to seedling spatial distribution, the panel's rotation and the symbiosis provided by rhizobium bacteria on the lentil crops
- ·limit usage of fertilizers which are harmful for the groundwater and thus provide cleaner drinking water.

#### BRAIN OF OLCHING - THE SCIENTIFIC CASTINGSHOW

Stand number E09 Country Germany

Subjects

Thomas Drexler, Florian Gärtner, Martin Hölzel, Carola Müller, Tanja Teachers

Neufeld, Miriam Plank, Oliver Schuppach

Gymnasium Olching Institution

Physics, biology, chemistry, computer

science/ICT, geography

Students develop scientific projects on sustainable development. Following the example of "The Voice of Germany", the project groups will present their work status repeatedly on stage. For the complete show, which lasts an entire school year, the project groups will be supervised by coaches, the teachers.



#### ENERGY: LOOK AT ITS FORMS! FIND OUT ITS CONVERSIONS. IN A ... FANTASTIC BIKE RIDE!

Stand number H01 Country Greece

Sotiris Mandiliotis/Laboratory Centre of Physical Sciences of Teacher/Institution

Serres

Teacher/Institution Eleni Paloumpa/Laboratory Centre of Physical Sciences of

Sparta

Physics, chemistry, nutrition, environmental science, hygiene. Subjects

entertainment

Teaching about energy is not an easy task. In this work, with a fitness bicycle connected to many different devices, a multidimensional school experiment is attempted. The bicycle works as a generator in which the cyclist's kinetic energy (coming from the chemical energy of food) is converted into electrical, chemical, potential, light and other forms of energy. The experiment aims, among other things, for the cultivation of students' skills for the future by understanding the concept of energy, its forms and its uses. With the necessary adaptation, the idea can be implemented on every educational level.

#### HYPERBARIC CHAMBER

Stand number F07 Country Greece

Teachers George Marakis, Antonios Margaritis Institution Experimental General Lyceum of Heraklion

Subjects Chemistry

It is known that the pressure exerted at a point within a stationary liquid equals the sum of the external and the hydrostatic pressure. The hydrostatic pressure is due to the weight of the liquid above that point and increases with depth. According to the Pascal's principle, the external pressure exerted on the free surface of the stationary fluid is transferred unaltered to all points of the liquid.



The pressure under the water surface increases depending on the depth. High pressure causes inversely proportional variation in the volume of gases by altering the power of buoyancy of the objects. With the help of the transparent Hyperbaric Chamber, we can present these phenomena in an understandable way.

#### EARTH DAY - OUR EARTH IS OUR WORTH

Stand number F11
Country Hungary
Teacher Zsuzsanr

Teacher Zsuzsanna Pataki
Institution Eötvös József Gimnázium

Subjects Physics, chemistry, mathematics, geography, astronomy

Earth Day - about our special atmosphere for smaller and bigger students. The Earth's atmosphere is warming fatally. The process began as a result of carbon dioxide emissions from human activity in the early 20th century. Due to the warming, the ever-frozen Arctic soil began to melt. This is a problem from the climate perspective, because the huge amount of methane, which was so far bound in the permafrost, is now released and gets into the atmosphere. Methane is an even stronger greenhouse gas than carbon dioxide... On our educational session organized on the occasion of Earth Day, we wanted to draw students' attention to the vulnerability of our atmosphere and the importance of reducing carbon dioxide.

# THE COLOURS OF NATURE – THE ROUGE OF THE JEWELLER, AZURE OF THE SEA, RED OF THE BERRIES

Stand number G01 Country Hungary

**Teacher** Éva Dobóné Tarai

Institution Berzsenyi Dániel High School
Subjects Biology, chemistry, art, art history

In these experiments, we are going to show some pigments made in an environmentally friendly way. To produce colourful pigments we chose chemical reactions which are based on using less harmful and toxic chemicals e.g. salts of copper or iron. Later we made our pigments from different parts of plants: from leaves of spinach (green), from black-, straw-or blueberry (blue, red or lilac) or from turmeric powder (ochre). Rust was used to prepare a pigment, called "rouge of the jeweller", or charcoal to black pigment. The binding material can be yolk, beeswax or linseed oil. The science teacher could show them during the lessons or the students can conduct the experiments in groups.

#### THE FIGHT SPHERES

Stand number H11
Country Hungary
Teacher András Róka

**Institution** Eötvös Loránd University, Faculty of Science, Institute of Chemistry

Subjects Chemistry, bio-physical chemistry, environmantal science

My project is a short story of the development from the perspective of sustainability. At first, I would like to introduce the formation of spheres. This period is the age of unsustainability due to irreversible processes. Then I present the self-sustainable processes, which lead to the formation of the biosphere. In the third part I try to recall that humankind has created further but not self-sustaining spheres with continuous intervention. This is not only the period of fantastic scientific revolution, but the fight of spheres also begins. Finally, I would like to mention the consequences of the accelerated development which drove to the demand for sustainable development.

#### THE AWARENESS OF A WATER FOOTPRINT

Stand number F06
Country Ireland
Teacher Sinead Kellv

Institution St. Olivers Community College

**Subjects** Sustainability, global food, production

The water footprint is the measure of how much water is used to produce the goods we use, eat or drink. Calculations are based from the start of the making of the product to the end. A bar of chocolate actually takes 1800 litres of water to produce from growth to final production, and a litre of actual water needs 5 litres of water to make it to the shelves. These conversations were the ignition for our project. Students researched and calculated their own water footprint for favourite foods. We collaborated with a local primary school by asking for photos of their lunchboxes and researched the water footprint for the students.

#### EHAND (EFFECTS OF HUMAN ACTIVITIES ON NATURAL DISASTERS)

Stand number F10 Country Italy

Teacher Franca Sormani Institution Liceo Maiorana, Desio

Subjects Physics, mathematics, technology, science, history, philosophy,

English

According to research studies, it is very likely that human activities will affect future catastrophes, while population growth and urbanisation make communities much more vulnerable to natural hazards. The Erasmus+ project eHAND involves seven partners and aims at arming students with the necessary skills to be future "good citizens" and contribute to the achievement of the goals of the Europe 2020 strategy and Agenda 2030. It focuses sharply on more complex social issues, such as the links between environmental quality, human equality, human rights and peace, and on the critical role of science and technology in understanding and mitigating the effects of extreme events.

#### SCIENCE AND SUSTAINABILITY: LET'S BUILD A HYDROPONIC

Stand number G03 Country Italy

Barbara Callerani Teacher Institution I.E.S.S. Reggio Emilia

Subjects Biology, environmental education

One of the most serious problems which humanity is facing in today's world is the impossibility of obtaining food sources in every part of the world. For some years now. an innovative method of cultivation has been proposed,



called 'indoor' or 'above-ground farming'. This is a new agricultural technique, which could prove to be the solution to the problem of world hunger. The method that allows such soil-free agricultural is called hydroponics. Our project proves that it is possible to build a prototype of hydroponics with medium skills and easily available recycled materials.

#### SEISMOGRAPH WITH ACCELEROMETER

Stand number H10 Country Italy

Teacher Michela Poggi

Institution Collegio san Giuseppe de Merode, Roma

Subjects Physics

A seismograph operates on the principle that an accelerometer is able to detect the inertia of a mass when it is subjected to an acceleration. A defined mass, in our case a fishing weight of 175 g, is suspended to an elastic element (the accelerometer) which is composed of three springs. In presence of an acceleration, the mass moves from its resting position with a vertical motion proportional to the acceleration detected. The head of a hard-drivedisk made integral with a fishing wire constitutes the sensor that transforms the shift into an electrical signal acquired using the software Audacity. This program shows a graph of the waves as soundwaves in a timeline.

# SMARTPHONES AS DIDACTIC TOOLS FOR APPROACHING GEOSCIENCES

Stand number E06 Country Italy Teacher Marina Porta

Institution Liceo Scientifico Antonio Banfi, Vimercate Subjects Chemistry, history, law, geosciences, economy

How to link chemistry and earth sciences in high school? Chemistry is considered a difficult subject by teenagers because of its language and subject matters, which are far away from reality. Geosciences are often left behind because the topic of minerals and rocks is considered particularly boring! It is important to find new ways to ensure that students get interested in these disciplines. In our project we adopt an inquiry-based methodology where students pose and answer questions in different steps, for example 'How many chemical elements can we find in a mobile phone?' or 'Where do they come from?'.

#### AIR GARDEN

Stand number G04 Kazakhstan Country

Teachers Kymbat Dyussembayeva, Serik Mukanov Institution Nazarbayev Intellectual School Astana

Subjects Physics, biology, chemistry, computer science/ICT, technology

In this project we created an aeroponic vertical garden with vegetables and herbs. During the process we used various improvised items such as plexiglas, black paint, hoses, water pumps, an RGB LED strip, a LEGO EV3 microcomputer and more. With the software Lego Mindstorms EV3 we coded programs of automatic watering and lighting. The result was a visual model that helps students to study the vertical cultivation of plants using aeroponic system. This project is for all the students who love plants and are interested in science, may it be biology, physicy, chemistry or informatics.



#### ALBATROSS PROJECT

Stand number F09

Country Netherlands Teacher Conny Jasperse Institution Het Nieuwe Lyceum

Subjects Science

In this project students aim to create awareness about the problem of plastic waste in an innovative and agile way that prepares them for future challenges. After watching parts of the movie 'Albatross' students tackle the following question: 'What measures could you take in your personal environment to make sure that more albatross chicks live to grow into an adult bird instead of dying premature?' After they planned and presented their project, they got the chance to improve it with the help of environmental experts. The project is completed with a classroom discussion.

#### GROWING FOOD CROPS UNDER EXTREME CONDITIONS

Stand number H04 Country Netherlands

Teacher Saskia van der Jagt Institution Coornhert Gymnasium

Subjects Biology

The students look at the year 2050 and work around the issue of feeding 9 billion humans while the worldwide area for agriculture will have shrunk due to climate change. The main question is 'How can we cultivate enough crops to feed those 9 billion people?'. A variety of tasks about cultivating crops under extreme circumstances is supported by lectures about the growth of plants, photosynthesis, modelling of ecosystems, natural cycles etc. In teams the students focus on sustainable solutions for cultivating crops in one specific ecosystem for example desert, mangrove or tropical rainforest. At the end each team pitches their solution on an 'international conference' with the topic of the world food problem.

#### HOW DOES YOUR SMARTPHONE HURT YOUR BODY

Stand number H09 Country Poland Teacher Aneta Mika

Institution XIV High School with Bilingual Classes in Szczecin

Subjects Physics, biology

Introduction to biophysical modelling - a simplified method of solving particular problems associated with the usage of smartphones, such as spinal and hand disorders, as an interesting motivational method of action and prevention.

#### EDUCATE TO INNOVATE

Stand number F08 Country Portugal

Teachers Francisco Borges, Honorata Pereira

Institution **EPTOLIVA** 

Subjects Physics, biology, chemistry, mathematics, computer science/ICT

Educating to innovate is a teaching/learning methodology that allows socially responsible innovation as a chain reaction. It provides tools for building knowledge based on solving community problems and on students as agents of change. It offers innovative scenarios that address specific educational needs and local issues. Finally, it offers ways and tools to evaluate and reflect on practices and provides guidance for future action.

#### LIGHT ON THE RISKS OF UV

Stand number G10 Country Portugal

Teacher Maria Celestina Henriques Institution Ag. Escolas de Valongo Subjects Biology, chemistry

One of the major risk factors for skin cancer is ultraviolet (UV) radiation. UV radiation comes from the sun, ultraviolet lamps and solariums. The risk of developing skin cancer is related to the exposure to UV radiation during life. The best way to prevent skin cancer is to protect yourself from the sun. Children, in particular, must be well protect so it is important to limit the time of exposure to the sun and avoid other sources of UV radiation. What protects us from UV radiation can reduce the risk of developing skin cancer. Are we more protected in water, with dark, thin clothes, with sunglasses or sunscreen?

#### OUR HOUSE: CAN IT BE SUSTAINABLE?

Stand number E05 Country Portugal

Teachers Luís Carreiró, José Rodrigues Institution Ag. Escolas de Santa Comba Dão

Subjects Physics, chemistry

The social and technological changes that took place in the 20th century led us to a concept of useful houses based on a more rational use of energy - using energy in a more efficient way, keeping the same levels of comfort. On the other side, the use of renewable energy sources to satisfy energetic needs is one of the most efficient ways of reducing the consumption of fossil fuels. The 21st century house is based upon these two principles. This way, throughout this project we intend to reveal some ideas that can be applied in a house to make it comfortable, consuming the least amount of energy possible and being environmentally friendly. As final result, we built the model of a house.

#### SCIENCE CLUB - LEARNING SCIENCE IN A SUSTAINABLE WAY

Stand number G02 Country Portugal

Teachers Teresa Diniz, Rosário Proença Institution Ag. Escolas Francisco Simões

Subjects Physics, biology, chemistry, mathematics

The project is based on the involvement of students of different age levels in school activities in the area of science. These activities are implemented using low-cost solutions. It is intended as an integrative approach to knowledge guided by different scientific areas, namely by the subjects of the school syllabus. An important aspect is the sharing and mutual aid based on the contributions of older students in supporting the experimentation and learning of the younger ones.

#### SINTRA'S MOUNTAIN

Stand number E11 Country

Portugal Teachers

Sandra Leal, Carlos Mota Institution Ag. Escolas Leal da Câmara

Subjects Physics, biology, chemistry, geology, geography, history, citizenship

and development

This activity is an inquiry into the factors that may influence seed germination and seedling growth. The activity is used as an introductory activity for plant studies in biology or as an environmental impact investigation in earth science. environmental science. Students in pairs or groups must fully design and carry out an investigation that should solve the problem of germination and maintenance of autochthonous forests



#### STUDYING THE ENVIRONMENT USING DIY ROVS AND DRONES

Country Portugal Teachers César Marques. Luís Bettencourt Escola Profissional Institution

Stand number

de Almada Subjects Physics, chemistry,

electronics, CAD

H08

In this project students build ROVs (remotely operated vehicles) and drones. They create and develop a scientific mission to perform using the machines they constructed. The ROVs and drones

are equipped with a set of sensors, connected to an Arduino, which serve to fulfil the scientific mission. Students receive the data remotely, at a control station or on their mobile phones.

#### INQUIRY ACTIVITIES WITH BICARBONATE SODA AND VINEGAR

Stand number H06 Country Slovakia Teacher Ivana Sotáková

Institution Pavol lozef Šafarik University in Košice

Subjects Physics, biology

"Inquiry" has been a fundamental approach in science teaching and learning in the last decades (NRC, 2012). In Slovakia, the demand for inquiry-based approaches in the subject of chemistry is embodied in the State Education Program for Upper Secondary Schools (ISCED 2). For this purpose, we have created s set of inquiry activities with bicarbonate of soda and vinegar. The set consists of four inquiry activities on the following topics "Exothermic and Endothermic Reactions" and "Factors Affecting the Rate of Chemical Reactions". The inquiry activities are created according to the 5E Instructional Model (Bybee et al., 2006) and they are intended for the guided inquiry to increase students' activity.

#### SOAP BUBBLES ON THE WOOD

Stand number H07 Slovenia Country Teacher Daša Soier Institution OŠ Domžale Subjects Science

Wood is made of xvlem tissue and transports water from the roots to the leaves. In freshly cut down wood there is some water, which can be reduced by drying. When xylem



contains only a little water, it becomes transient to air. We can prove this with a simple experiment using shampoo. We rub some shampoo on part of a log (a cross section) and blow onto the log from the other side. If any soap bubbles appear, it is a sign that the wood is dry enough. We can use this experiment in biology lessons and also in everyday life when we decide to buy firewood. Burning wood with a higher water content has some negative impacts on the environment because more emissions are produced.

# THE SUSTAINABLE CITY

Stand number G06 Country Sweden Teacher Pernilla Malmgren

Institution Paradisskolan Subjects

Physics, biology, chemistry, mathematics, technology, design, civics.

geography, art

How do we build a city that is sustainable in many different aspects? This is the question that meets the students of grade 9 at Paradisskolan. It is a multidisciplinary project which includes most of the school subjects. The project is designed to make the students see the connections between school subjects and the reality outside of school. We work in cooperation with the municipality to get that "real" feeling and to emphasize that their ideas really matter. Together the class is making a city from scratch, planning everything from the outline of the city, to the housing and everything that a city needs to work. The project ends with a fair where they show the model of their city to interested visitors.

#### THE HILYTE BATTERY

Stand number G07 Country Switzerland

Teachers Patricia Descombes, Annick Vidonne

Institution Gymnase de Renens Subjects Physics, chemistry

This battery was first thought of and built as a clean and affordable source of energy in developing countries. The first aim of the hiLyte battery is to produce enough power to both charge a phone and give light to a room for one night. The hiLyte battery has then been adapted for education. The advantage of this battery is that all its components can be assembled separately ensuring a full comprehension of the set-up. Knowing that one cell produces about 0.9 V and 0.5 A, the students may have to adapt and optimize their set-up by connecting their cells in series according to the device they would like to power.

# COSMIC ROLE OF PHOTOSYNTHESIS

Stand number G08 Country Ukraine

Teacher Liubov Morozova

Institution Pavlohrad State Secondary School number 11

Subjects Physics, biology, chemistry, mathematics, computer science/ICT,

art-technology

Children are eager to discover new things. How should we make them interested in learning and research? Objective: To create an "Automated School Oasis", where lighting, watering and heating processes are monitored and controlled automatically using communication technology. Current experience: We can encourage students to study using inquiry-based learning methods, for example with an experiment with wheat sprouts that includes exploring the most appropriate conditions for plant growth such as the amount of light, water and heat. Students are able to search and use the necessary information to make conclusions. Outlook: To develop the idea of creating an artificial system for photosynthesis!

# SUSTAIN ABLE **EVELOPMENT IN** SCIENCE **EDUCATIO**

#### GLOBAL GOALS, GLOBAL INVENTORS WITH MIGHTY **FUTURES**

Stand number G09

Country United Kingdom Teacher Louise Maule

Institution North Tyneside Learning Trust

Subjects STFM

Children are introduced to the UN Global Goals, and the concept that by 2030 they will be 'grown ups'; it is up to them to solve some of these problems! We want children to think about how they could make a difference both now and in the future through inventing, innovating and campaigning. All children in the project design an idea that could make the world a better place.

#### PAPER ROCKETS@GIBS

Stand number S01 Country Austria

Teachers Patricia Raposo-Weinberger, Ursula Schatz Institution Billingual International School Graz

Subjects Physics

This project involved students at age 11-13 and through a hands-on project, the students were not only learning physics (Newton's laws) but also developed problem solving and decision making skills. Starting from an initial design, the students had to decide the size of the rocket and shape of the fins, tackling with the physics of aerodynamics. The students tried the initial design, evaluated the model's flight path and adapted the rocket to make it more stable. After the launch, the students compared their model with the NASA rockets and physics of rocket launching. The project's impact on the physics lessons is visible: the students are more motivated for practical work in class and more engaged in hands-on projects.

#### PLANETARIUM - A TENT IN THE CLASSROOM AND OUTSIDE

Stand number 502 Country Bulgaria Teacher Ivo Jokin

Institution Municipal center for extracurricular activities

Subjects Astronomy, ecology, art

The project presents an integrated approach to non-formal learning in physics and astronomy, ecology and fine art through the use of cheap materials and mobile phone applications. The main activity is to introduce the children and students to the starry sky - the constellations in different seasons of the year, the brightest stars and the polar star orientation. The planetarium is an ordinary tourist tent, which, on the inside with the help of fluorescent paints, draws the constellations and their configurations. In the planetarium, solar and lunar eclipses can be demonstrated using a flashlight, an inflatable beach ball (Earth model), and some fruit-orange, apple, etc. (moon pattern).

#### EXOPLANETS AND ROCKETSCIENCE

Stand number **S03** Country Denmark Teacher Ole Ahlgren Institution Roende Gymnasium

Subjects Physics

#### The project is two-fold:

- 1. The search for exoplanets (planets around other stars) has been intensified in recent years and several thousands have already been found. The methods of finding exoplanets are described with images and graphs and a simple experiment is created with a record player, small balls and a light meter to illustrate the discovery of exoplanets.
- 2. Rocket science can be difficult to understand and a number of simple experiments illustrate various aspects of this, such as the rocket principle, weightlessness, movement without air resistance and stay in empty space.

#### DREAMING STARS TO LIVE BETTER ON EARTH

Stand number **S04** Country France

Teachers André Le Noa, Pierre-Yves Royer

Institution LEPT Saint Jospeh Subjects Physics, mathematics

The project is structured according to different stages:

- An experiment with a "nano-rocket" in class in order to set up information decryption techniques:
- An exhibition in the CDI, made available by the Espace des Sciences in Rennes and which is the subject of oral presentations in French classes
- The construction of a micro-rocket by students using drawing software and 3D printing. part of the material was obtained through Planète Sciences;
- The launch of rockets at the Vannes Meucon aerodrome in compliance with safety rules, and by retrieving flight information;
- classroom analysis and modelling.

#### CONTROL MOMENT GYRO

Stand number **S05** Country Greece

Teacher Astrinos Tsoutsoudakis Institution Gazi Senior High School

Subjects Physics

A control moment gyroscope (CMG) is an attitude control device generally used in spacecraft attitude control systems. The particular CMG consists of a spinning rotor and one motorized gimbal that tilts the rotor's angular momentum. As the rotor tilts, the changing angular momentum causes a gyroscopic torque that rotates an aluminium frame.

#### FROM EARTH... TO MARS

Stand number T01 Greece Country Teacher Petros Poutos

Institution 1st Vocational Lyceum of Salamis

Subjects Physics, mathematics, astronomy, analog and digital electronics,

robotics, power electronics, data acquisition, automation,

microcontrollers, data transfer, telecomunications, programming

This is a full STEM project covering the exploration of other planets. It consists essentially of two main and functional constructions: a) a satellite model, and b) a model of the Mars rover (Curiosity). The purpose is to present students in an impressive way, through

an interactive simulation, the methods and mechanisms that are used to remote navigate special vehicles on other planets, as well as acquisition of video, photo, and measurements of various physical magnitudes from their atmosphere and soil, and their transmission to the earth. In this way, students can get acquainted with the relevant and involved sciences, and also acquire skills for the demanding future.



#### EARTH AND ITS SATELLITES THREATS COMING FROM SPACE

Stand number S06 Country Poland

**Teacher** Grażyna Linder

**Institution** I Social High School of STO in Slupsk

Subjects Physics, astronomy

Meteorites, asteroids and radiation pose a risk to life on Earth as we know it. In addition to these natural occurring threats, humanity added another one: space junk. Fragments of space vehicles, inactive artificial satellites and other objects left in the Earth's orbit by humans. The aim of this project is to get students interested and involved in astronomy and physics. The astronomy work that students created includes astronomical observations of a meteor shower and of solar activity, meteorite exploration, investigation using applications such as Stellarium and SkyView as well as learning how to remove cosmic waste in cooperation with the company OptiNav.

#### IS A BLACK HOLE AT THE MILKY WAY CENTER?

Stand number T04 Country Romania

Teacher Georgescu Dumitru
Institution "Mihai Viteazul" College
Subiects Physics, astronomy

Black holes are mysterious cosmic objects that incite the imagination but are hard to describe from a physical point of view. The publishing of the first picture of a black hole in April 2019 – about 100 years after the first theory about the existence of these entities – shows the difficulties and challenges researchers in this field face. For students, black holes are a constant source of questioning, stimulated by the rich literature and SF film industry. Given the fact that the rigourosity of this subject is not possible at this level, and observing it through an ordinary telescope is, obviously, impossible, we chose a strategy which allows the transition from a simple mind exercise to a simpler approach accessible to students.

#### ASTRONOMY WITH ART

Stand number\$07CountryPortugalTeacherCarlos Pinto

Institution Ag. Escolas de Rio Tinto

Subjects Physics, chemistry, science, geography, drawing

This project promotes the vertical articulation between students of different levels through inquiry and the use of arts for learning astronomy and acting in the community. It can be used for designing interdisciplinary projects.

Also at the beginning, using the software Stellarium, students can learn astronomy by developing group and inquiry activities.

# LOW-COST ASTROBIOLOGY STUDIES

Stand number S08
Country Spain

Teachers Maria Pilar Orozco, Juan Antonio Prieto Sánchez

Institution Huerta de la Cruz school

Subjects Physics, biology, chemistry, astronomy

When we decided to embark on this project, we considered it to be very pretentious to demonstrate that life could have existed, has existed or will exist on other planets in the same way that it exists on planet Earth. Based on the capacity of extremophilic organisms which are able to adapt to very harsh environments, two very different types of microorganisms have been subjected to extreme conditions in order to observe their ability to overcome these life threatening environments. Our main aim is to establish the possibility that terrestrial microorganisms could survive in other planets than Earth.

#### RADIO STATION CONNECTED TORRE VICENS

Stand number T02 Country Spain

Teacher Marc Llorenc Batlle Aixalà

Institution IES Torre Vicens Subjects Physics, technology

This project consisted in designing and mounting a radio connected satellite station made with low-cost materials. The components that we have used were mainly three: An antenna, a receiver (rtl-2832) and an SDR (computer software that allows us to decode waves). Once we had all the pieces, we tried to connect with different broadcast signals. After some attempts installing drivers and adapters, we finally got it. We had a radio connected station that allowed us to listen to the radio, but we wanted to cover more distant horizons and we decided to build a new more powerful aerial that would allow us to receive signals from the farthest satellites.

#### DIY STARGAZER - LET'S BRING THE STARS TO EARTH!

Stand number T03 Country Sweden Teacher Emma Lindahl Institution Älghults friskola Subjects Astronomy, crafts

When you teach astronomy to children, they will start to think widely about space and our place in it. This project gives young students of age 6-9 a chance to get fascinated about the universe by taking the stars and the constellations closer to Earth, making them visible day and night. The project is based on a few creative activities, which I will show at the fair: how to create your own telescope/stargazer, showing the constellation of your choice. Sew a starry sky with colourful beads and test your knowledge by taking a quiz that requires binoculars. It's all done by using cheap, easy to find materials and ready to be used by your pupils, indoors and outdoors.

#### THE SYSTEM OF SUN TRACKING

Stand number T05 Ukraine Country

Teacher Nataliia Naidon

Institution School Nº1. Horishni Plavni

Subjects Physics, mathematics, computer science/ICT, drawings, handicrafts.

astronomy

The main goal of the project is to create a system for sun tracking which is based on Arduino. Solar trackers are useful for solar power stations. The plane with the photocell has to be perpendicular to the sun's rays. A servo is used for rotation on the horizontal and vertical axes. The angle of rotation depends on the illumination of the photoresistors. The developed algorithm compares the values of four sensors. The results of the project have experimentally proven that the maximum energy from a solar battery can be obtained with a perpendicular placement of the apparatus to the sun's rays.

#### EXPERIMENTAL BOX FOR KIDS

Stand number M07 Country Austria

Teachers Angelika Fussi, Franz Kutschi

Institution NMS Feldbach Subjects Physics, chemistry

The attitude towards electricity should pass from "danger" directly into "fascination with deep knowledge". A firstly possible and actually successful approach to electricity is to equip each student with material for experimentation. Assembling an "Experimental Box" with 40 basic experiments on electricity, electrostatic, electromagnetism and electrochemistry is the top project of the New Middle School Feldbach in the field of our science subjects. This experimental box includes more than 40 experiments, e. g. a lemon-based battery, conductivity tests and galvanic element or electrolysis of water on a very small scale. 350 students benefited from their self-made experimental boxes for their own use.

#### CHEMICAL REACTIONS IN PETRI DISHES

Stand number M09 Country Belgium Teacher Hamad Karous Institution University of Liège Subjects Chemistry

Experiments at the microchemistry scale will be presented. These easy experiments in Petri dishes can be done in class by the students to help them understand basic phenomena of electrochemistry. For each proposed experiment, we will develop the didactic interest, in particular the possibilities of modelling at sub-microscopic level of the observed phenomena. The active participation of students is promoted through the following activities: realising and observing experiments dedicated to various concepts, modelling the associated results individually or in groups, taking part in guided discussions supervised by the teacher.

#### MATHSMAGIC

Stand number P05 Country Austria Teacher Dieter Kadan

Institution Austrian St. Georgs Kolleg, Istanbul

Subjects Mathematics, magic

There are a lot of magic tricks with a mathematical background and there are many students at secondary level who hate and are scared of mathematics. I will present and explain mathemagical tricks for teachers who want to solve this problem.

#### PHYSICS EXPERIMENTS WITH YOUR SMARTPHONE

Stand number 007 Country Belgium

Teachers Evelien Urkens, Andreas Van den Bergh Institution

University of Antwerp

Subjects **Physics** 

Every smartphone comes with some standard sensors, e.g. the microphone. By combining this simple sensor with the speaker in your phone, we can already do a measurement of the speed of sound! Other sensors like the accelerometer, gyroscope and magnetometer give plenty of tools to work with while conducting science experiments. It seems like everyone has a portable lab in their pocket, and the app Phyphox gives us the possibility to access it.

#### SIMPLE EXPERIMENTS. BIG IMPACT

Stand number 011 Belgium Country Teacher Patrik Claes

Institution Spelenderwijzer vzw Subjects Physics, chemistry

To get the attention of your students, nothing works better than a spectacular experiment. However, a spectacular show is not the aim but just the mean to make your students wonder what scientific principle might explain the experiment. In our science shows, we show simple adaptations to turn cheap materials into surprising experiments with a twist. Sometimes spectacular, but sometimes just getting the curiosity of the students because the results are so mind-blowing. Lasers popping balloons, floating a tinfoil boat the cheap way, experiments with human bodies, shooting objects by blowing and suction, lifting 10 people with human breath, and an explosive butane demo, you'll see it all!

#### THE PHYSICS OF A DIY SAND PENDULUM: A PROJECT ABOUT PHYSICS. MATHEMATICS. ENGINEERING AND ART

Stand number Q01 Country Belgium Teacher Nicole Fux

Institution Buslevden Atheneum campus Pitzemburg

Subjects Physics, mathematics, STEM

The multi-dimensional pendulum is a fascinating handson device which is excellent for integrating physics, mathematics, art and engineering into one project. Designing and constructing the pendulum will lead the students to further investigation on the physics of the simple harmonic motion, the mathematics of Lissajous curves and the various applications in astronomy, electromagnetism and art.



Stand number U03 Country Belgium

Teacher Michel Huyberechts

Institution Centre Scolaire Ste Marie La Sagesse

Subjects Physics, biology, chemistry

Spectrometry analysis is an important part of analytical chemistry.

Many applications propose to 'transform' a smartphone into a spectrometer in the visible light range (400-750nm), based on a DVD or quite expensive devices (+/-400€). Few proposals are made in the IR light. Here, we propose the development of a low cost IR spectrometer, based on a smartphone as a receptor and a TV remote control as an IR source. Both items are included in a shoebox (or a wooden wine box). On a scientific point of view, this would allow analysis of organic functional groups (e.g. C=O around 1750 cm-1) in for example polymers or chlorophyll's reflectance (red edge/680-730 nm).

# AFFORDABLE EXPERIMENT FOR EVERY PUPIL

M08 Stand number Country Bulgaria Teacher Nasko Stamenov

Institution National High School of Science and Mathematics

Subjects Biology, chemistry

The project aims to give a sustainable and cost efficient solution for school experiments in some regions. The reasoning behind making the science experiment affordable is that experiments in class have been shown to improve students' understanding of the topic. For an experiment to be of use we should consider two factors - the materials needed and the teacher's experience and knowledge. This project is tailored to meet the needs of experienced and motivated teachers who (or whose schools) aren't able to afford everything needed for a complete proper laboratory. This solution is cost effective, intuitive for the students and illustrates adequately all the phenomena in the curriculum.

#### CHEAP SCIENCE - REAL PHYSICS

Stand number 010 Country Bulgaria

Teacher Antoniva Petrova

Institution Profiled Nature-Mathematical

Subjects **Physics** 

present classical physical phenomena in the fields of mechanics. electrostatics, thermodynamics etc., studied in textbooks for grades 7, 8, 9 and 10. We demonstrate 12 experiments from the study material that can be made with what's available in each house

# LIOUID WORLD

Stand number Q06 Country Bulgaria

Teacher Nikola Karavasilev

First Private Mathematical High School Institution

Subjects **Physics** 

Our project uses materials we can find in everyday life to demonstrate different experiments with liquids. It can help many students with forming a better understanding of the concepts of temperature, pressure and density, as well as some exotic occurrences in the liquid world.

#### RECYCLE, PLAY, DISCOVER - ALTERNATIVE TO EXPENSIVE TOYS

Stand number U02 Country Bulgaria

Teacher Svetlana Hristova Institution Kindergarden "Radost" Subjects Physics, mathematics

The main activity for children up to 7-years old is playing games. Through games and toys. children discover the world, the properties of different materials, the purpose of objects, and the laws of maths, physics and chemistry. We offer an alternative with toys made from common household objects. Our goals are for kids to discover the properties of different materials (paper, magnets, sand), e. g. dimensions and quantity, for them to develop fine motor skills, but also for them to concentrate and pay close attention in addition to encouraging their curiosity.

# MAGNIFYING CURIOSITY - FOLDSCOPES

Stand number 006 Country Canada Teacher Paul Stinson

Institution Sun West Distance Learning Centre

Subjects Biology, STEM

A glass sphere is an example of an object that can magnify and bring us closer to viewing and understanding the hidden microscopic world first-hand. So is a water droplet, Foldscopes are inexpensive, cardboard origami microscopes that use a glass bead as a magnifier, and can magnify about 140x. The simple yet effective technology allows for connections to biology/life sciences, physics/optics, as well as an exemplar of engineering/design. Whether in a classroom, home school environment, or on a field trip, foldscopes allow students to not only explore the world around them, but to share and collaborate with others through an online community.

# HIGH AND LOW PRESSURE

Stand number N08

Country

Teacher

Czech Republic Zdeněk Hubáček

Institution Gymnázium Uherské Hradiště

Subjects Physics, biology

My project will show the DIY construction of a simple vacuum chamber (for education purposes and for everyday use in the kitchen), a U-pipe manometer (which will measure your blood pressure and the pressure in your lungs), a pneumatic lifter (to lift yourself up) and a multifunctional pressure chamber. I also will show a set of experiments enabled by this equipment. All devices are light, portable and clearly show the principles behind them.

# PLAYING WITH SOUND

Stand number 004

Country Czech Republic Teacher Dana Mandíková Institution Mensa gymnázium

Subjects **Physics** 

In my contribution, I deal with sound from a variety of views. I show how sound is created and how it propagates. It is possible to measure the speed of sound in the air. Some options for sound recording and reproduction as well as unconventional sound sources are shown too. The participants will have an opportunity to try the experiments themselves and make their own simple science toy.

#### A MYSTERIOUS CUP

Stand number M10 Country France

Jean-Brice Meyer Teacher

Institution I P2I Subjects **Physics** 

A cup is able to produce sounds that are sometimes strange, such as the one you can hear when you strike a cup that contains hot milk and in which you added powdered chocolate. Indeed, the frequency of the sound keeps growing with every shot. How can we explain this? Since we know that the frequency increases, it means there is a parameter that moves over time. So, what is this parameter? Temperature? Bubbles? And how can we prove the various possibilities considered? To understand the origin of this increase of frequency, we have followed a scientific process with experiments. Each step of this process has helped us to get more information leading us to the answer to the riddle.

### AOUASUN

003 Stand number Country France

Teacher Philippe Mancini Institution Collège Louis Clément

Subjects Physics, biology, mathematics, technology, arts

Aquasun is an innovative, economical drop-by-drop watering system which costs less than 1€ and is made from recycled materials. It allows automatic autonomous watering (without electricity) with a varying flow rate which depends on the amount of sunshine and responds in this way to the water needs of plants. Students adopt an engineering approach. First, they study existing commercial systems, then they design an equivalent device that meets the specifications by providing technological innovation. Finally, they imagine a wide drip irrigation system. Students cooperate, experiment, model and use mathematics, physics, biology and their creativity. This project was carried out in collaboration with an engineer from the CEA.

#### FLYING IN THE FLOW

Stand number T07 Country France Teacher Maxime Biet

Institution Collège Hippolyte Rémy

Subjects Physics, mathematics, computer science/ICT, technology

After the study of the flight of paper planes, we notice that it's also possible to fly over the water thanks to hydrofoils. So, we wondered if it would be easier to fly in the air or over the water. Therefore, we decided to use our wind tunnel to study the flight of a wing. Nevertheless, while the flow around a wing is quite laminar, the airflow in our wind tunnel was very turbulent. We had to improve it. Moreover, we had to imagine an experiment to test the flight of a hydrofoil in the water. After hours of research, and several partnerships, we succeeded in clearing up the mystery ...

# MAGIMATIC

Stand number U01 Country France Teacher Jean-Baptiste Aubin Institution University of Lyon Subjects Mathematics

Simple properties of mathematics can lead magicians to do astonishing feats of mathematics mentally, lightning calculations, etc. These tricks are really demonstrations of strict laws based on probability, sets and theory of numbers, and - more important - they are easy to improve!

#### BORE-HOLE MAKING MACHINE ..WOODPECKER-1"

Stand number N06 Country Georgia

Teacher Vazha Tetunashvili

Institution Maidani Public Scool, Abasha Municipality Subjects Physics, mathematics, technology

The main idea of the project is arranging a borehole in the school yard based on low cost technologies by using the golden rule of mechanics and after that creating the borehole making machine "Woodpecker-1" which will work with electricity.

Project participants: students in grade 9-11; teachers of different subjects and representatives of the school administration including the principal of the school. Project objectives:

- · Raising motivation for learning physics
- · Facilitate development of students' inquiry skills
- Encourage students to focus on solving a practical task using different types of leverage.



<sup>&</sup>quot;Magimatic" is a contraction of "magic" and "mathematics".

# DOUGH. COW DUNG (OOPS...:) AND SCIENCE

Stand number 003 Country Georgia

Teacher Ketevan Tatishvili Institution Buckswood School Thilisi

Physics, chemistry Subjects

Different experiments are presented that facilitate teaching with modern approaches - teaching based on the projects, problems and inquiries - and are very interesting and impressive for students. The students make conductive and nonconductive "dough" with



household ingredients such as flour and vegetable oil and perform various experiments. In a second activity the students learn about the loss of forests due to the need for firewood and investigate alternative fuel sources such as organic waste and cow dung. In our activities students discover things independently and the experiments are low-cost with easy to find materials.

# DEVELOPMENT, MANUFACTURING AND TESTING OF MUSICAL INSTRUMENTS

Stand number N11 Country Germany Teacher Matthias Franke Institution Bettina-von-Arnim-School

Subjects Physics, music, industry-work-technics

"Pipes and sounds - musical instruments made of aluminium and polyvinyl chloride": The students build a metallophone using only materials available in a store for construction materials (DIY market). It does not only sound fantastic, it is also interesting to hear and to actually see, how the sounds that are generated by the activation of air oscillations depend on the length of the aluminium bars and polyvinyl chloride pipes. In one version, it is possible to play three full octaves on the metallophone. To round things up, four guitars made of wood from a DIY market were built to add to the metallophone during play.

# FOUR FANTASTIC PHOTOSYNTHESIS EXPERIMENTS

Stand number 004 Country Germany

Teachers Ulrike Hölting, Birgit Schuh Institution Gymnasium Mariengarden Subjects Biology, chemistry

At the heart of this project is an experiment that demonstrates the need of light for the process of photosynthesis. It replaces the classic bubble counting method. Using the simplest means, the students can develop further experiments, which show the influence of temperature, light intensity, wavelength of light and carbon dioxide content on photosynthesis. In addition, a new simple method for obtaining a crude chlorophyll solution is presented, which either demonstrates the production of starch or the fluorescence and quenching effect by using mobile or LED flashlight. Finally, the students repeat the classic photosynthesis experiment by Joseph Priestley.

# THE TOMATO PROJECT

Stand number 007 Country Germany

Laura Schmandt, Franziska Langer. Teachers Institution Burggymnasium Friedberg

Subjects Biology

In 2015, we started to plant tomatoes in our school. At the beginning, each student received seeds of a different breed and documented the process. In 2017, we additionally started to cross the four most suitable breeds with each other and again documented the process. With this, we wanted to retrace the ideas of Mendel and his rules of heredity focusing on the three characteristics of size, colour and shape.

# VERIFICATION OF THE PHYSICAL MODEL IN COMPUTER GAMES BY MOTION ANALYSIS

Stand number U06 Country Germany

Teachers Lars Eskildsen, Eckhard Pehlke

Institution **BB7** Dithmarschen

Subjects Physics, mathematics, computer science/ICT

Within the project, we will analyse the throwing motion used in computer games. The first step is recording a suitable part of a computer game using a screen recorder. After that we analyse the scene with a video analysis tool. Using the data of the analysis, we can develop the functional relationship and compare it with the classical throwing motion. The gravitational acceleration is the main measure of quality.

### DENSITY AND PRESSURE THROUGH PARTICLE THEORY

Stand number P04 Country Ireland Teacher Seán Kelleher

Institution Coláiste Choilm Swords Subjects Physics, chemistry

This project aims to apply particle theory concepts in explorations of density and pressure concepts using simple models constructed from low-cost/recycled materials. By employing particle theory as a framework of explanation, in some density and pressure experiments/ demonstrations, it is hoped that an element of consistency may be introduced which will aid the prevention of misconceptions among students.

# SIMPLE EXPERIMENTS ON BREADBOARD IN THE CLASSROOM AND AT HOME. APPLIED TO EDUCATION OF ELECTRICITY AND TO OTHER AREAS OF PHYSICS

Stand number R01 Country Hungary Teacher Venczel Borbély

Institution Piarista Gimnázium és Kollégium

Subjects Physics, electricity, optics, thermodynamics, modern physics

Commercially available electronic components are usually very cheap, so for a school it may be easier to buy them. The electricity learning packages offered by school equipment manufacturers are usually very expensive, it is more difficult to develop or supplement them, and they can mainly be used to teach electricity only. The "package" that I will present is relatively cheap, expandable to any degree and can be used in other areas of physics, too. Students can experiment with it in class or at home, so they can develop a deeper understanding of the phenomena. It also opens up the possibility of introducing and learning the use of microcontrollers to make the teaching of physics even more interesting.

# FRESCO AND THE HIDDEN CHEM

Stand number N09 Country Italy Teacher Giorgia Messori Institution ITI Fermi Modena Subjects Chemistry, science, art

The aim of the project is to bring students closer to the hidden chemistry in art and particular in the pictorial technique of fresco. The name Fresco paint derives from the fact that it is conducted on a fresh plaster with several layers, the "arriccio" and the "intonachino" (mixtures of lime and sand where the former is richer in sand) and painted in one day ("giornata"). The students will prepare a small fresco investigating the best recipe for the mixture of lime, sand and water. They will describe the involved reactions, prepare a pigment and live the experience of being an apprentice of an ancient workshop of painters.

### HOW MUCH MATHS THERE IS IN FRUIT AND VEGETABLES!

Stand number P03 Country Italy

Teacher Maria Teresa Gallo

Institution Secondary School F. Corridoni

Subjects Mathematics, science

When we talk about dimension, we are talking about length, surface area and volume. It's often easy to estimate the surface area of a flat object, but most things in the world are not flat. This project gives students the opportunity to think about surface area in terms of everyday items such as fruits and vegetables. This project aims to show students a way of calculating any surface area, whether flat, curved or irregular (like that of fruit or vegetables) or the space by volume that any object occupies. This allows students to acquire more familiarity with these concepts in an experimental and playful way.

# ORANGES AND LEMONS

Stand number R10 Country Italy

Teachers Francesca Butturini, Gordon Kennedy Institution Educandato Agli Angeli, Verona

Subjects Chemistry, organic chemistry, physical chemistry, optical physics

Using the chiral molecule limonene as a focal point of the project, third, fourth and fifth year high school students were engaged in a number of different grade-level appropriate laboratory experiences to isolate and characterise the compound. The students isolated the two forms of limonene from oranges and lemons using steam distillation. They studied the extracts using simple chemical analysis, polarimetry and colorimetry, for which they were challenged to build a functioning polarimeter and colorimeter. Through observations, the students made connections to aspects of biology, chemistry, physics and even mineralogy.

#### STEAM FOR STEM

Stand number V01 Country Italy

Teacher Marco Nicolini Institution Liceo Tassoni, Modena Subjects Physics, chemistry, history

The subject matter of thermodynamics is a difficult concept to understand for students in higher secondary schools. The main reasons for that lies in the fact that it is difficult to set up experiments with gases, steam, and simple machines. It takes a big effort to imagine systems with billions of particles, described with just three macroquantities. For this reason, we decided to take a look at simple but effective historical machines, steam engines and hydraulic machines, which could be easily built during lab time. The first machine we built was the Newcomen atmospheric steam engine, built to raise water with the help of vacuum. Following some descriptions, we also assembled a simple steam machine from low-cost materials.

# MY STEAM DEMONSTRATIONS

Stand number **R08** Country Kazakhstan Teacher Ainur Smagulova

Institution Nazarbayev Intellectual School Shymkent

Subjects Physics, science

Demonstration is everything! In this project, we aim to interest students in science education with the help of demonstrations and by looking at everyday objects or situations in a scientific view. With simple demonstrations of these situations, we give students the opportunity to participate in the process of problem solving. Simple questions like 'What gloves are the best choice in winter?' or 'How to separate metal things from other components in a recycling facility?' are investigated.

### LIVE. NOT SURVIVE!

Stand number Q09 Country Latvia

**Teachers** Iveta Labunska, Inese Pickaine **Institution** Skrunda Secondary school

Subjects Physics, biology, chemistry, STEM, health education, geography

In collaboration between two Skrunda secondary school teachers - primary education and chemistry, natural sciences and biology - an interactive project with workshop stations was created: "Live, not survive!". There are visual materials and awareness-raising experiments integrated in chemistry, physics, biology and science. Experiments give a clear representation of the situations in nature and their impact on the environment, and they promote analytical problem-solving skills using resources with minimal costs. The material is based on the tooics included in the learning standard for sustainable development of the environment.

# THE CHALLENGE OF QUANTUM REALITY

Stand number P07 Country Lithuania

**Teachers** Rigonda Skorulskiene, Loreta Tarvydiene

**Institution** Kaunas Jesuit Gymnasium

Subjects Physics, science

Peeking into the quantum world means we have to let go of some of the comfortable, often intuitive, notions we develop from day-to-day living. One of the most important experiments in quantum physics is the double-slit experiment. In this experiment, individual quantum objects, such as electrons or photons, are fired at a barrier with two narrow slits. After passing through the slits, they produce an interference pattern on a detector screen on the other side of the barrier. This result leads to one of the deep mysteries of quantum physics—wave-particle duality—the fact that electrons and other quantum objects behave like waves in some situations and like particles in others.

# **BONI SCIENCE CENTER**

Stand number 009

**Country** Netherlands **Teacher** Wilma Akkerman

Institution St. Bonifatiuscollege Utrecht

Subjects Science

In this project, students become acquainted with the science and technology behind everyday objects in an easily accessible way. For inspiration, we visited a science museum and the students encountered for example the science behind soap bubbles, the reason why a bridge does not collapse and the illusion of moving images. The students are challenged to ask questions about the ordinary things around them. Back in school, they investigate one chosen exhibit in detail and design a replica. The students are encouraged to use materials present in the classroom, or bring some material from home. These projects resulted in an open exhibition where parents and colleagues were invited to come, see and learn from the students.

# BUILD A WINNING WINDCAR

Stand number R09

**Country** Netherlands

**Teachers** Martijn Hoogland, Koen Verheggen

InstitutionCoornhert GymnasiumSubjectsPhysics, chemistry

Chemistry and physics are the key subjects in understanding climate change and sustainability, so in this interdisciplinary project for students in 3rd grade we aim to introduce children to new energy solutions such as wind energy. In teams, the students work out their design goals and requirements for their wind car and make a technical drawing of their wind cart. After building their car, we had a competition with a big fan in the hall. The students report their project on Edmodo, where they can give and get peer-feedback on their project.

# EMBODIED SIMULATIONS

Stand number V02

Country Netherlands

Teacher Ingeborg van der Neut

Institution Ludgercollege

Subjects Biology

The challenge for biology teachers is to find ways to let students explore and experience seemingly distant worlds of micro and macro biology. Embodied simulations is our solution for this problem. We use everyday materials and make students part of the process. Imagine, pupils going around in your classroom with Lego as glucose, working on the dissimilation in order to get as many ATP (monopoly-money) as possible. Or a classroom acting out the menstrual cycle, complete with an estrogen choir! Or pretending to be blood in the gill of a fish, to find out that they do get almost 100% of the oxygen out of the water. Embodied simulations help them understand and remember difficult processes in a fun and different way.

# **MURDER CASE**

Stand number P08 Country Norway

Teachers Line Mari Flornes, Cecilie Anine Thorsen

Institution Sandvika vg skole

Subjects Science

At the end of the school year, we wanted the students to revise as much of the curriculum as possible in a project. We wanted to summarize the topics in a new, interesting and funny way. Hence the project "Murder Case". To make the project more realistic, we arranged a murder scene, one the students could recognize from TV shows like CSI. We made the evidence not conclusive on purpose, in order to get the students to review the evidence in a critical way. By doing it this way, it forced the students to make compelling arguments for their hypothesis.

# THE BUDDING RESEARCHER

Stand number **R05** Country Norway

Teacher Marianne Fløttum Institution Sykkylven ungdomsskule

Subjects Science

The aim of the project was for the students to formulate testable hypotheses and to plan and undertake hypothesis testing in the laboratory; further to be able to discuss their observations and present their results in a report, in addition to a digital presentation in class. This project was not only low-cost project but also inclusive, possible for all my students. It was implemented in a general science course with students at age 14-15. My students chose to test the following hypotheses:

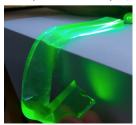
- Can a pencil lead power?
- Can we make ice cream without a freezer?
- Can lemons be used as a battery?
- How much can a plastic bag withstand?
- Can we make our own bath bomb, and how does it work?

# EXPERIMENTS WITH GELATIN AND SUGAR

Stand number 005 Country Poland

Teacher/Institution Adam Buczek/Poznan University of Technology Teacher/Institution Wiesława Idziak/I High School of Tadeusz Kościuszko in Jarocin

Subjects Physics, biology, science



This project aims to develop students' exploratory skills from a basic level of operations and techniques to an advanced one. The project adresses all the teenagers who are willing to explore the world of physics and are interested in building an autonomous construction of optical units for sight corrections.

# HOW TO SEE THE SOUND AND CURIE ENGINES

Stand number **R07** Country Poland

Teacher Małgorzata Masłowska

Institution III High School of Nicolaus Copernicus in Kalisz

Subjects **Physics** 

In this project we want to demonstrate the luminous Lissaious curves to the rhythm of a song and also the Curie effect in the classroom. In our case one student composed the beautiful music, and another one wrote the lysircs. They performed their own song together. The audio signal was receivied by a cathode ray tube of an old TV which created the luminous Lissaious curves to the rhythm of their song. This project is not only adressed to all songwriters and composers but also to all the students who want to learn more about the Curie engines and temperature.

#### TOP MODEL

Stand number V03 Country Poland

Teacher Zofia Ruszkowska

Institution Primary School of Tadeusz Kościuszko in Złoty Stok

Subjects Physics, biology, chemistry, mathematics, technology, ecology,

mechanics

The main goal of the educational project "Top Model" is to present various phenomena, physical and chemical laws and biological processes used in various inventions, devices and living organisms. During the performance, the participants present their own models in the form of a "fashion show on stage". The models show various topics, such as

hydraulic and pneumatic lift, air pump. carousel, catapult, horn, heart, kidney, digestive system, chemical compound, hurricane lamp or treatment plant. While implementing the project we try to answer the question "Which model was, is and perhaps will be the most important for humanity?"



#### A PORTUGUESE SONG, FOR SURE!

Stand number M11 Country Portugal Teacher Teresa Paiva

Institution Salesianos de Lisboa - Colégio Oficinas de S. Iosé

Subjects Physics, chemistry, visual arts, history of science, literature

"Uma casa portuguesa, com certeza!" is a STEAM project based on the lyrics of a Portuguese fado with the same name. A set of simple experiments, like electrolysis of wine, or a battery made with little aluminium cake forms, is presented to explore at different levels the three main types of chemical reactions (redox, acid-basic and precipitation) using inquiry. Some students produced a video clip where they sing, play Portuguese guitar and do the experiments. A special relation with visual arts is made with a painting by Amadeo Sousa Cardoso that can lead students to paint with self-made watercolours produced with pigments from materials mentioned in the fado.

# HISTORY OF MATHS IN CLASSROOM: AN EDUCATIONAL CHALLENGE

Stand number NO7 Country Portugal Teacher Paulo Gil

Institution Escola Sec.de Pinheiro Subjects Mathematics, history

This project intends to show the role of the history of mathematics when it is used in the classroom context, aiming for the development of communication and mathematical argumentation, as well as problem solving strategies. The integration of the history of mathematics arises through the proposal of tasks based on historical sources, involving different thematic areas, such as geometry, algebra and probabilities.

### RECYCLED SENSORS

Stand number 002 Portugal Country Teacher Luís Afonso

Institution Escola Iosé Gomes Ferreira

Subjects Physics

The project main goal is to recycle old sensors. As an example, we use photogates and measure gravitational acceleration and other physical quantities. The photogates are attached to an Arduino board with a shield that sends data to a mobile phone via Bluetooth. This low-cost electronic system can be used with other old sensors to promote recycling. This work is useful to students as well to teachers to enable the realisation of many projects.

#### THE IMPORTANT MR. PIGMENT

Stand number **R03** Country Portugal

Ana Paula Rodrigues Teacher

Institution Escola Quinta das Palmeiras

Subjects Physics, chemistry, natural science, arts

It is thanks to the visible light that we can experience the colourful compostions of art. Centuries ago scientists startet to explore the vast field of colours. However, the magic of colours is due to chemistry!

Which pigments are responsible for skin or fruit colours?

Why can leaves not be blue?

Why do autumn leaves change colour?

What is the role of chlorophyll?

Through simple experiences students are led to answer these questions.

# SCIENCE, ROBOTICS AND ART

Stand number P09 Country Portugal Teacher Ioão Cunha Institution Ag. de Escolas de Freixo

Subjects Physics, computer science/ICT, technology, arts

Our goal is to build mobile robots using low-cost or recycled materials. The design will be suitable for existing materials, but for the ease of construction we will make robots with wheels (not mandatory). Students are free to create their simple robot with sensors and the ability to make upgrades. In the end, the robots will be able to move forward, turn right and left and to move backward. With the low-cost sensors the robot should follow a black line. With the ultrasound sensor you should be able to avoid obstacles.

# THE PERIODIC TABLE OF THE SMARTPHONE

Stand number U04 Country Portugal Teacher César Marques

Institution Escola Profissional de Almada

Subjects Chemistry

Today all students have a smartphone but... what substances and mixtures is it made of? This is the starting point of the activity. Using printed cards, with different geometric images, students arrange ways to group these cards together. After knowing what substances and mixtures are, students organize the supplied elements (Bohr model of atoms) based on their characteristics, making predictions of elements, as Mendeleev did, thus understanding the importance of the periodic table and the information that it gives us.

# CLOTHES PEG AND PAPER PHYSICS

Stand number P02 Country Slovakia

Teacher Monika Vanyová Institution Basic School Tvrdošovce

Subjects **Physics** 

The project is aimed at experimentation with low-cost materials, such as clothes pegs or paper, which offer many opportunities to explain and understand different physical concepts. The experiments involve measuring mass, length, volume, density or force on a clothes peg, a clothes peg toy to determine its centre of mass, clothes peg catapult, a toy cannon made of a clothes peg and a metal ball, equilibrium with clothes pegs on a lever and many others using paper. They can be conducted by the teacher or a more inquirybased approach can be used when students themselves design, prepare and present the experiments in front of the class or during a school day for other students, teachers or even parents.

# PREDICT - OBSERVE - EXPLAIN

Stand number R06 Slovakia Country

Teacher Slávka Ropeková Institution Basic school I. Novomeského Košice

Subjects **Physics** 

The project presents the ideas and techniques of the science experiment competition conducted at a lower secondary school. Teams of pupils of the same age compete in two levels. In the first part the teacher asks a multiple-choice question that can be answered with an experiment. Firstly, teams discuss the situation, design the experimental procedure to test their prediction and finally predict the correct answer. The second phase involves experimenting and observing the results. Pupils compare results with their prediction and explain what happened and why. Observing and assessing pupils' achievements, the teacher gets feedback about the development of their inquiry skills and their understanding.

#### DINNER FOR TWO

Stand number P06 Country Slovenia

Teacher Alenka Perko Bašeli Institution Gimnaziia Moste

Subjects Physics, biology, chemistry

The project "Dinner for two" is a creative approach to observing and explaining the complex phenomenon of fluorescence. Teacher and students are working together from idea to execution in the dynamic process of interdisciplinary project work. Students feature as waiters and customers in a restaurant serving everyday dishes and drinks of amazingly unexpected and unusual appearance. This way learning and entertainment intersect, which means the audience learns about fluorescence as well as consolidate the acquired knowledge. The show requires communicative students who, at little to no cost, manage to excite the audience's curiosity for learning from a real life example.

# GIMLIT FORTRESS

Stand number R02 Country Slovenia

Teacher Branko Koprivnikar Institution Gimnazija Litija

Subjects Physics, computer science/ICT

#### Dear Prince.

Your Princess has been incarcerated in GimLit Fortress.

Some resourcefulness, some high school knowledge of physics and a bit of luck can help you save your Princess from the frightening dragon.

Let us give you some good advice:

- Your microfilm contains some useful data. Into the keyboard, located on the safe, you type an ID and a 4 digit PIN from the film.
- ·Using the accessories, found in the auxiliary room, you will construct a train that will enable you to travel through the tunnel into the heart of the fortress.

Dear Prince, the Princess is anxiously awaiting your arrival. Hurry up, the dragon hasn't had anything to eat today...

### TANNIN - TAN FOR LEATHER. INK OR MEDICINE

Stand number V04 Country Slovenia Teacher Renata Flander Institution OŠ Davorina lenka

Subjects Chemistry, science, natural science

Experimenting with tannin increases the interest for science among young people. It addresses students with different interests. Some students like to know more about tanning leather (tannery in the neighbourhood), others more about medicine (enjoy learning about themselves) and some more about ink (surprised when invisible ink becomes visible). For higher motivation, we also included some ICT. Students searched for information on the internet, took photos about the experiments and created a guiz using the application Quizizz. The experiment also increases the interest in cultural heritage; students can visit the museums where historical tannery craft is presented.

# SEARCHING FOR PYTHAGORAS

Stand number 011 Country Spain Iria Vidal Teacher Institution IES La Florida

Subjects Mathematics, technology, history, music

This year the students of La Florida secondary school travelled to the Pythagorean community under the slogan "Everything is number" and with the tetraktis and the pentagram. We worked on their musical scale with a cello. Also on their concept of the universe and the crisis they had when they discovered the irrational numbers. But the great star of our trip has been the theorem: we built a rope of twelve knots, we made models with explanatory videos to check it, we have elaborated geometric puzzles, and we have used it to verify that the right angle is well constructed. Our trip has been a success and now we are ready to show the world the secrets of Pythagoras.

### SUPERFICIAL CHANGES, NEW PROPERTIES!

Stand number P01 Country Spain

Teacher/Institution Carme Artigas/La Salle Montcada

Teacher/Institution Fina Guitart/CESIRE Department of Education

Subjects Chemistry, digital technology

Obtaining materials with special properties is one of the main challenges of our time. This is exemplified in this project by dealing with hydrophobic sand and sticky sand. Properties of so-called magical, kinetic sands compared with common sand are explored by performing simple and surprising experiments. Phenomena are explained with the support of digital technologies, in order to stimulate students' creativity in elaborating explanations and interpreting phenomena. Animation software to represent processes, molecular viewers, and 3D printing of molecules are used. Home experiments to make these amazing sands using common sand are also performed, as well as colouring sand processes.

# TO A LOW-CARBON ECONOMY IN THE HIGH SCHOOL

Stand number R11 Country Spain

Teacher Carolina Claviio Aumont

Institution IES Itaca

Subjects Physics, biology, chemistry, mathematics, technology

Every year CO<sup>2</sup> emissions increase. The sources of these emissions vary, but people are the final cause. Our society is not concerned about the importance of this, but if we make people aware from youth, the situation will change. Our investigation examines the environmental situation of our schools concerning different environmental aspects: water and electric consumption, waste and recycling, green areas and noise. Our objective is to propose various improvements in the educational sector to reduce carbon emissions, our impact in nature and economic spending which could be utilized in other sectors, too.

# WHAT DOES THE UMAMI TASTE?

 Stand number
 V05

 Country
 Spain

 Teacher
 Javier Julián

 Institution
 IES Ramón Muntaner

Subjects Biology, chemistry

Umami comes from a Japanese word that means delicious taste. The cellular receptor for umami was discovered at the end of the 90s, then umami was internationally recognized as the fifth flavor. Surprisingly, we discovered that some people find the umami taste quite unpleasant and disgusting. This observation was the starting point of our research. All biology teachers can implement this study when they teach the sense of taste. They can also investigate the percentage of people who like, dislike or are insensitive to glutamate in the classroom or in their population.

#### FLASH AND THUNDER - LET'S TALK ABOUT ENERGY!

Stand number T06
Country Sweden
Teacher Pia Johansson
Institution Hamnedaskolan
Subjects Physics

Lightning occurs - when the charges are large enough - either inside a thundercloud, between clouds, or between a cloud and the ground. My project will mimic a lightning strike with some simple, low cost experiments around static electricity. The challenge for the students is to learn and predict the outcome of the experiment and explain the results to their classmates. The project encourages the students to become more curious, motivated and interested in working with science, technology and mathematics. I will show how you can simulate a flash on a very small scale. I will also show how to easily let the students understand the principle of getting sunlight in a room that lacks lighting.

# EXPERIMENT WITH SCRAPYARD FINDINGS

Stand number Q02
Country Sweden
Teacher Dan Englundh
Institution Martin-Koch gymnasiet

Subjects Physics

Searching for material to reuse for educational purposes is one of my hobbies. The material should be easy to find, cheap and reusable. One place you can bargain on is the scrapyard, as I did. This experiment is an excellent way for the students to have fun and learn how to practical handle scale, calliper, measurements with value figures for figuring out density and mean density. They discuss what these words really mean as well as how they can affect them by altering parameters. This experiment also includes a low-cost setup for a whole class and is very flexible, depending on what you can find in your scrapyard.

# PROJECT TIME MACHINE

 Stand number
 Q10

 Country
 Switzerland

 Teacher
 Felix Speerli

 Institution
 Primarschule Zwillikon

 Subjects
 STEM, language

This project is not about time travel. We use the time machine just to bend time to make processes visible that you wouldn't be able to see with the naked eye. For this time-lapse or slow motion project, you only need a camera, for example from your smartphone. The pupils can chose their experiments by themselves, so they have a huge variety of mysteries to explore. We teach them the competences they need to conduct their research for example planning the experiment, noting observations, speculating, the use of a camera or presenting the results. It's a very simple idea, but it had a great impact on the pupils.

# SIMPLE SPECTROPHOTOMETER

Stand number Y01 Switzerland Country

Teachers Océane Patiny, Luc Patiny Institution Hackuarium, EPFL Subjects Biology, ecology

A spectrophotometer is often an expensive black box that measures spectral components of light. We have constructed an open source spectrophotometer that allows to really understand the principle of this tool. Now, we are designing various applications in collaboration with Swiss schools. The instrument is highly precise, customizable and allows to conduct various experiments in the fields of chemistry (determination of the quantity of blue pigment in candies, kinetic, activation energy) and biology (monitoring cell division). It is a perfect instrument to teach.

#### FUNNY LABYRINTH

Stand number Y02 Country Turkev

Teacher Taylan Özgür Oral Institution Zağnospaşa Ortaokulu

Subjects STFM

In this project the students learn the first 16 element symbols in the periodic table with a STEM activity. We prefer part-structured project based teaching, the activities are chosen on educational games. The goal is to teach in a funny and cooperative learning environment which encourages all students to participate. At the end of the discussion, the students start to build a labyrinth according to the instructions. After they finish the labyrinth, they learn the names, symbols and usages of the 16 elements. During the whole process, all the students use cooperative problem solving skills and participate in the lessons actively and with enthusiasm.

# BIOCUBE PROJECT-BIODIVERSITY-"SLOW DOWN AND LOOK AT CLOSELY"

Stand number P11 Country Turkev

Teachers Sinem Mankir Öztan, Bertan Sabahattin Öztan

Institution Açi Okullari

Biology, citizen science, natural science Subjects

The project is a study to help students slow down and focus on those around them and to realize that living diversity is hidden in small places. All work done before, during and after the field study in Atatürk Arboretum will be shared. The cubes, which are made from cables and wooden sticks, will be placed in a specific area that will be observed with magnifying glass and tweezers. Students cooperate, make observations, take notes, make drawings and take pictures. Then they compare their own biocube areas with the others and identify the environmental factors that influenced them. I'm inspired by the exhibition at the Smithsonian Natural History Museum.

# IONIC BOND PUZZLE

Stand number 008 Turkey Country

Teacher Semih Esendemir

Institution Emine Emir Şahbaz Science and Art Center, Eskişehir

Subjects Chemistry, science

This educational material is designed to teach the subject of ionic bonds more effectively. Foam balls of different colours represent the elemental atoms in this educational material. Each element has its own distinctive holes and bulges according to the number of electrons in the final layer. Thus, the puzzle pieces are created. To observe the effect of the educational material, the pretest-posttest model with experimental and control groups was used. This educational material has significantly increased the academic achievement of the experimental group students. In this sense it can be said that using these educational materials is an effective method to increase academic achievement

#### MULTI-COLORED CHEMISTRY

Stand number Q05 Ukraine Country Teacher Irvna Haididei

Institution Private educational complex "MIR" in Kharkiv

Subjects Chemistry

Children's fear to learn natural sciences makes it necessary to find methods that present the information in a way that reconciles reality and theory. The main goal is to encourage the students to think about the problems themselves by forming questions such as "How?" and "Why?" First, children conduct scientific experiments and then come to a theoretically correct explanation for the phenomenon by formulating logical questions. A mentor supports them where necessary. This approach removes the barrier in front of the material from the textbook; it gives the opportunity to independently build a logical chain to follow any science.

# PHYSICS OUT OF THE POCKET

Stand number V06 Ukraine Country Teacher Tetiana Kravets

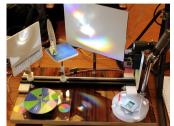
Institution Educational complex «Gymnasium HEART», Kharkov

Subjects Physics, art-technology

I am going to present a set of simple experiments at the fair. They can be done using some household objects and household waste. Physics is still considered a school subject that causes difficulties for a majority of students. This is related to the fact that for a child it is abstract, i.e. unconnected to the direct perception of the real world. I suggest to demonstrate enthralling experiments that will motivate children to understand the laws of physics. To make an experiment really enthralling, it should be vivid, bright and clearly exposing the concrete physical phenomena. I suggest using things which are simple and accessible to the children as the basis of such an experiment.

#### PHYSICS LABORATORY FROM ELECTRONIC WASTE

Stand number 008 Ukraine Country Teacher Nina Hodovana Institution Kharkiv college of State university of telecommunications Subjects Physics, mathematics



Where can a physics teacher get modern equipment for a physical laboratory? The purpose of this project is to create a school physical laboratory using electronic waste,

such as computers, displays, telephones, optical discs and other electrical appliances. These things are also high-tech products and can be used for conducting experiments about optical interference, diffraction, polarization, photoelectric effect, total internal reflection etc. It allows students to understand physical working principles of fiber-optic communication lines. liquid crystal displays, recording information and CCD-matrix. This way of teaching physics aims to develop creativity and keep students motivated.

# A THOUSAND PAPER CRANES: TEACHING RADIATION IN CONTEX

Stand number N10

United Kingdom Country Teacher Caroline Riggs

Institution St Andrew's CofE High School for Boys, Worthing

Subjects Physics

The project gives the topic of Radiaiton a different context. It highlights global, historical and ethical reasons for teaching this subject. Using low-cost materials the class considers their own views on issues such as nuclear weapons. Based on the novel 'Sadako and the Thousands Paper Cranes' the students were confronted with the subject matter of radiation and its positive and negative impacts on humanity. The paper crane project sparked interest in the younger pupils about the topic.

### BE A MAGICIAN! USING MAGIC ILLUSIONS TO TEACH SCIENCE

Stand number 001

United Kingdom Country Teacher Adrian Allan Institution Dornoch Academy Subjects

Physics, chemistry

Spectacular science demonstrations and magic tricks share many things in common such as practice, showmanship, audience interaction and suspense followed by a moment of astonishment. Magic illusions were performed to pupils, the science behind the illusions was explained, then the pupils performed these tricks to parents and other pupils. They passed a solid coin through rubber, bent wire with their minds, vanished water, cut and restored newspaper and appeared to make objects levitate and become invisible. Students learned science concepts and developed confidence and communication skills, in addition to having the great feeling of being able to astonish others.

# THE HULA-HOOP HUNDREDS-AND-THOUSANDS HADRON COLLIDER

Stand number P10

Country United Kingdom Teacher Robin James

Institution Exeter Road Primary School

Subjects Physics

How do you interest primary-age children in particle physics? And how do you explain to them the sort of work that scientists do at CERN? Not an easy task! Children can struggle to comprehend the fact that there are some things which are too tiny for them to see. A visit to the Large Hadron Collider, in December 2017, inspired this simple activity which uses a playground hula-hoop and a measure of hundreds-and-thousands (cake sprinkles) to generate a wealth of data and discussion, and might even inspire your class in a hunt for their own elusive Higgs boson.

# USING IUNK TO MAKE A DEVICE THAT COLLECTS ENERGY FROM THE SUN

Stand number **R04** 

Country United Kingdom Teacher Nick Baker

Institution Oueen Elizabeth's School, Crediton

Subjects Physics

One day space explorers will have to survive away from the energy infrastructure of Earth. I challenge groups of students to use "junk modelling" to produce a working device that will collect energy from a star (the sun). They plan their device and collect the bottles. tubes, bags, foil, PV cells, motors that they need. After making their device, they test its effectiveness against other teams to see which performs best. More importantly, they learn about teamwork, energy, recycling, space, perseverance, organisation and collaborative science.

# YOU'RE FIRED! A DRAMATIC APPROACH TO PRIMARY SCIENCE

Stand number U05

United Kingdom Country Teacher Kathrvn Horan

Institution Pudsey Waterloo Primary, Leeds

Subjects Science, drama, speaking & listening skills

Drama activities can have a great impact in the classroom when used during science lessons. These easy-to-implement strategies can be applied to a broad range of topics and adapted for all age groups. These activities can be used to support learning, for reporting findings or as an assessment tool, and allow all children to share and celebrate their learning, regardless of their attainment in other areas of the curriculum. Techniques include 'Sell me Something, 'Newsflash,' and 'You're Fired!'

# NATURAL PHARMACY

Stand number K08 Country Bulgaria

Teacher/Institution Rumyanka Galchavova/High School "Vasil Levski"
Teacher/Institution Vasilka Krasteva/Fifth Primary School "Hristo Botev"

Subjects Physics, biology, chemistry, ecology

"Natural Pharmacy" recreates nature's knowledge and skills as an invaluable gift to everyone's life, based on the four pillars of education defined by Jacques Delors. It is done in interest classes at Secondary School "Vasil Levski" in the Silistra region in Bulgaria, where a large number of students are bilingual. Results: rethinking free time; working with various information sources; advanced practical skills and key competences, not only in natural sciences; products of different character and scope - technological/educational; school nature pharmacy with herbal products; leaflets, individual notebooks and a folder of recipes; demonstrational sessions.

# ANISHINABE CULTURE AS A TOOL FOR SCIENCE LEARNING IN THE FIELD

Stand number LO8 Country Canada

Teacher Suzanne Nottaway

Institution Western Québec School Board
Subjects Physics, biology, chemistry

Anishinabe's rich culture has for millennia provided sound education for generations regarding the ways to live within a given environment. Medicine plants and food gathering were at the centre of their lifestyles. Games, legends, spirituality, and tools to support survival in the environment were handed down by elders to children. In this way, each community could ensure the coming of next generations. Native learning in science is a systemic process which involves the mind and the heart of the learner. The intent of this project is to foster this 'One mind, one heart' approach which brings together knowledge, emotions, and experiential learning by getting one's hand and mind in action.

# EMBODIED MATHS FOR 21ST CENTURY - INCLUSIVE EDUCATION: AN INNOVATIVE LEARNING MODULE

Stand number M01
Country Cyprus
Teacher Effie Dariou

Institution 1st Primary School of Tseri
Subjects Mathematics, technology, design

The present module promotes the teaching of mathematics (geometry) and design and technology (systems and control technology) to students aged 10-12 years. The purpose of this learning module is to exploit innovative educational tools such as multi-sensory and motion-based technologies, which support the pedagogical approach of embodied learning, in order to create learning opportunities for all students, with different abilities and disabilities, in the activities of the four embodied learning stations. The implementation of the present learning module seems to have multiple benefits for the students' academic, emotional and social development.

# HERE COMES THE SUN

Stand number K09 Country Cyprus

Teachers Donna Kontou, Antonis Ktoris Institution Archangelos Gymnasium

**Subjects** Physics, biology, chemistry, mathematics, technology

Agentic engagement theory suggests that students construct their own learning environments. To achieve this we implemented the sun and its impacts on Earth into a daily lesson, leading to various interdisciplinary teaching activities. Students are taught sciences through constructions relevant to the sun. Their main achievement was the construction, from scratch, of an innovative greenhouse that uses solar energy to heat the water in the greenhouse's underfloor pipe system. Students also constructed solar panels from recyclable materials, a huge sundial in the schoolyard, a variety of models, solar cars and many others. What they learned during this process was their biggest achievement.

# DIY BOATS (FOR KIDS)

Stand number

K10

Czech Republic Kateřina Lipertová

Country Teacher Institution

Církevní gymnázium Plzeň

Subjects

Physics, mathematics, engineering, art

We present a collection of DIY boats for kids to make. They are easy and inexpensive. using recycled materials - PET bottles, cans, old DC motors etc. Kids love building these boats, and then the best part - seeing if they can set them afloat in a sink, pool or pond. Visitors of our stand will see a rubber band paddleboat, a balloon powered boat, a DIY electric rowing boat, an electric boat with a propeller, a solar boat, a pot pot boat, an ice cube powered boat, and much more.

# EXERCISE, WELL-BEING AND MEASUREMENT COURSE IN IYVÄSKYLÄ TEACHER TRAINING SCHOOL

Stand number NO1 Country Finland

Teachers Kirsti Koski, Hannu Moilanen, Tom Nevanpää Institution Teacher Training School, University of Jyväskylä Subjects Physics, chemistry, physical education, psychology

Initially, an optional "Exercise, well-being and measuring course" was arranged first in our school in the spring of 2017, 2018 and 2019. The course included the new Finnish national curriculum multidisciplinary thematic studies for the upper secondary school. The course integrated different disciplines (physics, chemistry, physical education, health education, biology, maths, ICT and psychology) and themes of the course were physical activity, stress and time management, sleep and nutrition. The aim of the course was that students measure different physical quantities from their own body and body movement with modern sensor technology and linking the measured data to the studied phenomena.

# SHARING SCIENCE - IUNIOR ENGINEERS FOR SPACE EXPLORATION

Stand number MO4 Country France

Teacher/Institution Marion Bugnard/Ecole élémentaire Marcel Cachin, Fontaine Teacher/Institution Eric Martinet/Cité scolaire internationale/Académie de Grenoble

Subjects Physics, engineering, earth, sciences, planetology

Students aged 9 to 11 from Grenoble's disadvantaged areas are taking off on a space exploration adventure with the "Sharing Science 2019" scientific community. The 12 classes work in laboratories to carry out missions entrusted by 8 Grenoble university (institute Phelma) engineering school students. The seven teams are, respectively: Exobiology, Navigator, PropusionLab, PowerEngineering, MaterialSciences, MeteoRisk and Bio-Inspired'Tech. Each team is assisted by 4 high school mentors aged 16-17. They end of the project is a "project review" and a workshop in May 2019 sponsored by the Grenoble University Space Center, which will also be launching its first nanosatellite AMICalSAT.

# CONSTRUCTION OF A MYOELECTRIC PROSTHESIS

Stand number K11 Country Germany

Teachers Thomas Kluge, Alexander Köhler

Institution Gymnasium Riedberg

Subjects Physics, computer science/ICT

Generally, this two-year course can be broken down into four semesters. The 1st semester was mainly for providing the students with all the content of biology and physics lessons necessary for the project realisation. In the 2nd semester, the students then soldered their own Ardunio shield in small groups as foundation for the final product. In the 3rd and 4th semesters, the students then used the acquired knowledge to develop a working myoelectric prosthesis using the self-made Arduino shield. Note: This context-oriented and project-like course could very well be carried out, with some adjustments, in about one semester or less.

### CRATER AND SUMMIT – TWO FACES OF A CANDLE

Stand number NO2 Country

Germany

Teachers Institution Subjects

Tobias Mahnke, Tania Schapat Carl-Strehl-Schule blista Chemistry, science, general

studies

Fire is a fascinating phenomenon for humans. When it comes to teaching this concept, there are limitations. Grasping fire in a literal sense is close to impossible. This is why teachers often rely on



graphics showing the different areas of a flame with corresponding temperatures. This method is purely academic and can be boring while posing additional problems for visually impaired students. Swell-paper can be used to create a horizontal thermal profile of a flame, which can be grasped afterwards. This thermogram can be interpreted on different levels, depending on the age, class and preferences of the students. This method makes fire a topic that can be accessed through different media, not only by blind students.

# LEARNING BY SOLVING REAL PROBLEMS

Stand number M<sub>0</sub>3 Country Hungary

Teachers Bence Tóth, Zsolt Zsigó

Institution Center of Vocational Centre Bánki Donát Polytechnical School and

Dormitory

Subjects Applied engineering

The gap is growing between the skills that children learn and what they need in life, so today's education does not give them the necessary knowledge. We are not just talking to students, we are talking with them. We are helping them if they are stuck, giving them a book, showing an article. In the course of their work, we try to create a potential secondary school framework for applied engineering, looking for a future user. The result of the developments is always a working prototype, an oscilloscope made from a mobile phone, an underwater research robot, an intelligent fire suit, or sign language gloves.

#### THE INTERNET TOO HOT TO HANDLE

Stand number Country

L07 Ireland

Teacher Thomas McMahon

Institution Firhouse Community College Subjects Mathematics, science

Who has access to quick and reliable internet and who does not? The project gives students an insight into the small portion of the population that have access to fast knowledge through fibre optic internet. Exploring the role of politicians, industry and capital in steering the decision of who gets access to this fast information. Looking at the social aspect of how the current Irish internet roll out policy, The Broadband National Plan, affects how internet is distributed.

# **FOLLOW HOPE**

Stand number K07

Country Portugal Teacher Elisabete Silva

Institution Ag. de Escolas de Freixo

Subjects Physics, chemistry, ICT, arts, natural sciences, robotic

Students with severe physical/psychological disabilities are a reality in the classrooms and to integrate them becomes a need. The project "Follow Hope" was developed trying to respond to the individuality of each and alert the social and educative community to the need to provide all the necessary tools for students to be able to have a normal biopsychosocial development. This project was created to help a student with a progressive neuromuscular dysfunction and was developed by students from the Robotic Club and from the class of the disabled students. It consists of a semiautonomous robot

# PHYSICS AND CHEMISTRY'S HANDS ON ACTIVITIES FOR A BLIND STUDENT

Stand number NO3 Country Spain

Teacher Miguel Hernández Institution IFS Victoria Kent Subjects Physics, chemistry

The integration of a blind student in the physics and chemistry class has been done creating materials and activities



that allow him to understand science. The materials used are easy to get and support the student interpreting what surrounds him with the language and methods of science. Hands on activities have been complemented with the technical resources provided by the ONCE. We have adapted the objectives, contents, methodology and evaluation of this subject to a slower learning pace. All these practical activities are aimed at blind students learning the basic contents of physics and chemistry, and provide them with benefits in their daily lives.

# MAKING CHEMICAL BONDING CRYSTAL CLEAR

Stand number L09 Sweden Country

Teachers Daina Lezdins, Anna Stiby Institution Nacka gymnasium

Subjects Chemistry

This chemistry project combines crystals with chemical bonding and it is both practical and theoretical. We conducted a lesson study with upper secondary school students in order to improve their learning of chemical bonding. The lesson study lasted two lessons. The students grew fast-growing molecular crystals and slow-growing ionic crystals, observed their crystals and filled in a worksheet. We are going to show the crystals that the students cultivated. We will also have a hands-on activity, where the public can cultivate fast growing crystals of urea. Further, we will have a crystal exhibition, handouts of laboratory protocols and the worksheets from the lesson study.

### IT'S ALL IN OUR HANDS

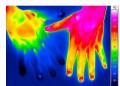
Stand number M05 Switzerland Country

Teacher/Institution Sacha Glardon/Gymnasium Bäumlihof Teacher/Institution Thomas Scheuber/Gymnasium Kirschgarten

Subjects Physics, biology, chemistry

We have it always with us, we can communicate with it, we can play and write with it: It's not the mobile phone, but our hands. With a variety of simple but also complex experiments,

we will demonstrate different aspects and basic concepts of biology. The hand serves us a model organ and allows us to investigate problems of anatomy, physiology, neural and behavioural biology, genetics and evolution. The hand is used as a starting point for problem-based learning mainly, but not only, in biology. The students learn about phenomena such as right- and left-handedness, the inheritance patterns of polydactyly or the fact that real handwashing is not that easy.



# GEOMETRY BY GEOGEBRA

Stand number M06 Country Turkey Teacher Faden Topuz

Institution Ferhat Uzunlulu Ortaokulu

Subjects Mathematics

The aim of the project is to observe secondary school students' experience with using GeoGebra by introducing it for geometry subjects. We conducted a case study with 15 students of six graders in the academic year 2017/18. Data was collected from different sources: worksheets, records of screen shot saving software, informal observations and lastly from opinions taken at the end of project. Content analysis, descriptive statistics and direct quotations were used and benefited the data analysis. Students were able to coordinate developments of the drawingfeatures, check accuracy of solutions and have a deeper look at shapes. The plan is to continue the project in other classes.

#### MIND GAMES

Stand number NO4
Country Ukraine

Teacher Olesia Likhachova

Institution NVK for the blind named after Korolenko

Subjects Biology, mathematics

The problem of any teacher concerning the organization of extracurricular activities is creating an activity that would interest students and further their development. The objective of this project: Using different kinds of gamification to increase the students' motivation for school and promote the development of cognitive skills and creativity. Games:

- Burysel` development of cognitive excitement and self-assessment skills
- MathTraveling practicing mental arithmetic skills and deepening the understanding of the world
- Penguins-Halves developing spatial perception, attention, imagination
- GeometriX developing sensory etalons, spatial perception, logical mind.

# SENSORY INTEGRATION IN MATHEMATICS

 Stand number
 L10

 Country
 Ukraine

 Teacher
 Olena Kovalova

 Institution
 Secondary school №8

 Subjects
 Mathematics

Teaching mathematics to children with autism or intellectual disabilities requires effective methodological techniques and tools. The purpose of the project is to create and use the visibility of SensoryMath-Lapbook when studying fractions and the use of a special environment, a sensory room with soft modules, while learning mathematics. The visual and tactile support helps children with autism; they expand and perfect the idea of the whole and parts. The result is that students are better aware of the topic fractions. They notice the connection between the number of equal parts and the name of each part better. Sensory stimulation helps the children stay focused and attentive longer.

# CAN WE POWER CLASSROOM OBJECTS WITH RENEWABLE ENERGY?

Stand number L11

Country United Kingdom Teacher David Rigmand

Institution Brediland Primary School

Subjects Mathematics, technology, engineering

Brediland Primary and its pupils have been on an exciting STEM journey. A variety of engaging STEM experiences have driven forward attainment for the children of Foxbar, Paisley. These innovative, engaging, inclusive and cultural capital focussed experiences have ultimately led to the school being asked to represent the UK at the Science on Stage festival. The children involved this year are developing a wind turbine, alongside Glasgow Caledonian University, to explore 'Can we power classroom objects with renewable energy?' A unique partnership in which masters students are creating a wind turbine for the school as their final project; a sustainable approach with boundless opportunities.

# DEVELOPING A SCIENCE CAPITAL APPROACH FOR PRIMARY SCHOOLS

Stand number NO5

Country United Kingdom
Teacher Paul Tyler

Institution Mearns Primary School

Subjects STEM

The Science Capital Teaching Approach (Archer; 2017) was developed following the ASPIRES report (Archer; 2013) which examined young people's engagement with, and aspirations about, careers in science. The approach was developed for secondary schools but I believe that developing science capital needs to start as young as possible at primary school. Evidence from ASPIRES, the Institute of Physics and 'Drawing the Future' strongly suggests that if children aren't interested in science, and don't see themselves as possible scientists, by the age of 10 then they are unlikely to engage in it. Mearns Primary has led the way adapting the Science Capital Teaching Approach for primary schools.

# FOOTBALL, SPACE AND SCIENCE SKILLS

Stand number

Country

Teacher

M02

United Kingdom Sarah Eames

Institution Sandfield Close Primary School

Subjects Science, literacy

Working with cooperation partners. I have created lessons that link space and football, promote working scientifically, are practical and look at different methods of enquiry. Leicester City has two great assets; their football club and the National Space Centre. By creating science lessons that promote the two, we were hoping to capture the enthusiasm and interest of all the children and ensure they developed independent science skills. Each lesson looks at a different area of science

- 1. STEM at the football ground
- 2. What were the best conditions to grow a pitch on Mars?
- 3. How does the pressure of a ball effect its bounce?
- 4. Kick it, fire it, rockets and football projections
- 5. Friction and momentum.

# BEYOND THE WATER

**INCLUSIVE SCIENCE** 

Stand number 101

Italy - United Kingdom Countries

Teacher/Institution Frederico Andreoletti/Istituto salesiano "Don Bosco". Brescia

Teacher/Institution Emma Crisell/Richard Taylor CE Primary

Subjects Physics, mathematics, science

'Beyond the water' is a joint project developed by an international team of teachers including Federico Andreoletti from Italy, Emma Crisell from the United Kingdom and Nataliya Kazachkova from Ukraine. This project involves students from age 9 to 12 and asks them to carry out four experiments about water and to share their activities with photos, videos, messages and suggestions. The four experiments are about 'Static soap bubbles', 'Oil drops in water', 'Non-Newtonian fluid' and 'Hydrogel water marbles'. The main aim is not to explain water in itself but to arouse the students' interest in all the scientific laws they connect.

# COALA - CODE A LITTLE ANIMAL

Stand number 102

Countries Spain - Germany

Teacher/Institution Imma Abad/Cor de Maria Teacher/Institution

Mirek Hancl/Lessing-Gymnasium Uelzen Subjects Biology, computer science/ICT, science

Which child does not want to own a pet? The subject of "pets" is not only part of the curriculum in primary schools, but also in secondary schools in biology where students learn how dogs were bred from wolves, the basic needs of a pet and which requirements owners need to meet. To find out which pet is the most suitable for you, students of the age 9-13 constructed a simulator that is controlled by a single board computer and uses external sensors to imitate the needs of a pet (eating, drinking, moving, petting, and correct body temperature maintenance).

### ESCAPING WITH SCIENCE

Stand number

103

Countries

Cyprus - Greece

Teacher/Institution Teacher/Institution

Christina Aristodimou/St. Paul & St. Peter High School, Limassol Georgios Villias/2nd High School of Agioi Anargiroi, Athens

Subjects Physics, biology

This joint project attempts to bring the worlds of physics and biology closer together, as well as groups of Cypriot and Greek high school students, through the design and implementation of several syllabus-focused (e.g. linear motion, circulatory system, etc.) educational escape room activities (EERs). EERs are innovative game-based didactic approaches that offer an immersive learning experience, promote active participation and facilitate students to develop problem solving and other 21st century key skills (critical thinking, creativity, collaboration, communication). The emblematic figures of Isaac Newton and Charles Darwin will be our guides in this journey of knowledge, adventure and mystery.



# FROM THE MOUTH TO TOILET

Stand number

101

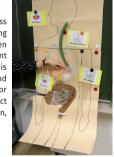
Countries Teacher/Institution Germany - Netherlands

Mira Büllesbach/Grundschulverbund Bergheim-Mitte Teacher/Institution Stephanie Cremer/Lessingschule ZiBB Freiburg Teacher/Institution Bert Nagel/Toermaliin primary school Lelystad

Subjects

Biology, chemistry, science, maths, technology, engeneering, arts.

With this joint project we aim to improve childrens' awareness about the secrets of their body. The project includes exploring the way of the food from the mouth to the toilet. Children from different countries explain to each other the different steps in English or using explanatory pictures. Through this inquiry based approach they will come up with questions and hypotheses and design their own experiments with more or less guidence from the teacher. All children can join the project and learn together because it is independent of cognition, culture or language of the children.



# GEOQUEST PROJECT

Stand number 103

Countries Iceland - Italy Teacher/Institution

Ásdís Ingólfsdóttir/Kvennaskólinn í Reykjavík Teacher/Institution Sabina Maraffi/IC Poggiali-Spizzichino, Roma Teacher/Institution Francesco Maria Sacerdoti/E-voluzione s.r.l.

Subjects Physics, science, mineralogy, geology, volcanology, humanities

GeoQuest Project is a Computer Class Role Playing Game (CCRPG), based on a new technology, designed for deeper learning of science, technology, engineering and mathematics, combined with arts (STEAM) and social sciences and humanities. It could improve the innovation and creative capacities of learners and support the new role of the teacher as a coach, using a new interface (students use their own tablet or smartphone to interact with the game): it's naturally a mixed reality learning environment, giving the students the feel to be IN the adventure environment". The idea is to develop a software platform to create user-defined role-playing adventures.

# HEAR TODAY - GONE TOMORROW

Stand number

105

Portugal - United Kingdom

Teacher/Institution

Countries

Nelson Correia/Escola Secundária Maria Lamas

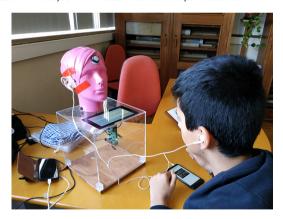
Teacher/Institution

Jennie Hargreaves/Lockerbie Academy

Subjects

Physics, biology, mathematics

Anecdotal evidence suggests that students are damaging their hearing by using ear buds and listening to loud music, but this is hard to prove. The aim of this project is to obtain some evidence of hearing problems in students and to compare the found results from Portuguese and Scottish students. Students' hearing (frequency range and detectable sound levels) is tested with audiometers. The sound levels of music, through the students' headphones, is tested with a specially designed head with a Raspberry Pi and a microphone. The tests and the analysis of the results are carried out by the students.



# HOW DID WE GET HERE? AN EVOLUTIONARY IOURNEY THROUGH TIME

Stand number 104

Ireland - Denmark Countries

Teacher/Institution Declan Cathcart/Temple Carrig School Teacher/Institution Line Mikkelsen/Baunehøiskolen

Subjects Biology, chemistry, mathematics, geology, history, philosophy,

sociology

This Irish-Danish joint project explores active/game based approaches to teaching the subject matter of evolution. The students will carry out different activities and experiments. They will learn by role-playing, storytelling and travelling through time of evolution themselves. Students' ideas and misconceptions of evolution will be explored and challenged. The activities are sequenced to scaffold student learning. Activities are formative and assessment milestones are built into the overarching game structure. The activities were cross-curricular, included numeracy and digital skills (virtual labs and bioinformatics), but were always low-cost and applicable to international science classrooms.

# LET'S BUILD A SUSTAINABLE FUTURE - TOGETHER!

Stand number 105

Countries Norway - Germany

Teacher/Institution Gerald Decelles III/Skagerak International School Teacher/Institution Ulrike Englert/Willibald-Gluck-Gymnasium

Subjects Integrated science

Our world is facing unprecedented challenges. We need future generations that are willing to take on these challenges, work collaboratively across cultures, and make meaningful changes to their own life. These are the guiding principles that we approached our project from. This project is an extension of two projects presented at Science on Stage (SonS) 2017 in Debrecen. One project (Norway) looked at designing energy efficient sustainable housing through the use of computer software which students then used to build the houses they designed, while the other project (Germany) sought to automate environmental controls on a school building in order to improve energy efficiency.

# PHYSICAL PROPERTIES OF SNOW

Stand number 102

Countries Slovakia - Finland

Iveta Štefančínová/Gymnázium Jána Adama Raymana Teacher/Institution Teacher/Institution Kalle Vähä-Heikkilä/Lauttakylä upper secondary school

Subjects Physics

Snow plays an important role on Earth. It is an environment for many living organisms, it protects animals and plants, reflects light back to the sky and is a source of joy to people who like to ski, slide and play with snow. The physical properties of snow are an unknown topic in the curriculum of physics although the subject could be easily connected with students' everyday life. This joint project focuses on how to measure physical properties (friction, thermal conductivity, density and sound) of snow quantitatively. This out of the classroom project with homemade equipment gives deeper qualitative and quantitative understanding about snow.

# SUITABLE AND QUALITY FOOD FOR ASTRONAUTS

Stand number 104

Countries Bulgaria - Spain

Daniela Georgieva/Fifth Primary School "Hristo Botey" Teacher/Institution

Teacher/Institution José Luis Olmo Rísquez/IES Azuer Subjects Physics, biology, chemistry, technology

One of the most important challenges for trips or stays in space is feeding the astronauts. The students investigate the special requirements the food must fulfil and to realize its main function is to cover the astronauts' nutritional and energy needs. At the same time, the food should have certain properties, such as being lightweight and easy to store longterm. The students look at the kinds of food that are convenient for astronauts in space and preparation methods in order to meet these requirements. The teams turn to old national Spanish and Bulgarian traditions that could be employed in the preparation, storing and packaging of food products for astronauts.



# OPENING CEREMONY

# Thursday, 31 October, 17:00 | Auditorium

This year was and still is a very special year. We are celebrating the International Year of the Periodic Table; the 50th anniversary of the Moon Landing and the first steps of humans in our natural satellite; the 100th anniversary of Arthur Eddington Expeditions to Brazil and São Tomé and Príncipe, that helped to prove general relativity; the 500 years of Fernão de Magalhães circumnavigation around the Earth: the 100th anniversary of the International Astronomical Union. and much more.

Considering these important milestones but also the critical moment we are living, recognised by many the turning point in our existence as living beings in this beautiful blue planet, we are opening Science on Stage 2019 with brilliant minds that are helping pave the way towards our sustainable future, change makers that will share their provoking ideas with us.

This opening ceremony will be the beginning of four days where we want to hear from you, teachers, your ideas to change the world to a more fair and sustainable planet. Science on Stage is a unique platform where teachers are the main key players. Let's start our engines and make the world know how powerful this festival is.

Rosa Doran

# UNDER ONE SKY: OVERVIEW OF EDUCATIONAL **ACTIONS ON THE IAU 100TH ANNIVERSARY CELEBRATIONS**

Thursday, 31 October - Opening Ceremony | Auditorium Jorge Rivero González - Observatory of Leiden, Coordinator of IAU100 celebrations

In the framework of the International Astronomical Union 100th anniversary in 2019 (IAU100, see www.iau-100.org), the IAU is organising a year-long celebration to increase awareness of a century of astronomical discoveries and to support the use of astronomy as a tool for education. development and diplomacy under the central theme "Under One Sky". Throughout the year, over 4000 activities have taken place at local, regional, national and global scales in 135 countries. In this talk I will give an overview of educational actions and resources developed during the anniversary celebrations and opportunities for further involvement of teachers.



# VIALONGA YOUTH FNSFMBLF **Musical Performance**

# Thursday, 31 October - Opening Ceremony | Auditorium

The Vialonga Orchestra was founded in 2007 as a pedagogical project that promotes social integration through music, at the Vialonga Cluster of Schools (AEV). It was the natural follow-up of a violin teaching project that emerged two years earlier due to the vision of Prof. Armandina Soares, format school director.

Currently, AEV is part of the public network of artistic schools with integrated musical education. It offers a Basic Music Course for children and young people that includes all permanent instruments of a symphony orchestra. Several students from AEV have already had the opportunity to pursue their studies at professional schools of music, and some are getting degrees in higher education institutes. The Vialonga Youth Ensemble (Ensemble Juvenil de Vialonga), that will perform at the festival, is a string chamber ensemble, that includes students from the Basic Music Course (middle school) as well as students who have completed the Basic Music Course and are musically active under the direction of Prof. Eurico Cardoso.

Over the Years, the Vialonga Orchestra has been supported by the

Municipality of Vila Franca de Xira, Junta de Freguesia de Vialonga, and Sociedade Central de Cerveias Bebidas, S.A.



# SOCIAL EVENTS

# FRFF WAI KING TOURS by Cascais Jovem

Saturday, 2 November, 18:30 Sunday, 3 November 16:00



Join our local volunteer guides\* in this adventure and allow yourself to get to know Cascais, along with all its history, secrets and curiosities.

**BOOK YOUR VISIT AT:** https://jovem.cascais.pt/pt-pt/node/1259 It is mandatory to book your walking tour at least two hours in advance.

Meeting Point: Estoril Congress Center - main entrance.

The guide will be waiting for the group and they will take the train to Cascais together. The train ticket is not included.

\*All walking tours are accompanied by young students with university education in Tourism Information.

# **DINNER - KAIS RESTAURANT**

# Friday, 1 November, 20:00 | Lisbon

The 2019 Science on Stage Festival dinner will be in Lisbon, in the charming Kais Restaurant. This restaurant was born from the recovery of an old warehouse by the Tagus river, where, late in the 19th century, was generated power to the trams that still roam the streets of Lisbon.

Carry on your conversations in one of the most sophisticated restaurants in town, with an international menu and industrial-chic ambience.



How to get there: take the train from Estoril Station to Santos Station (30-35 minutes). The restaurant is 2 minutes walk from Santos Train. Station.

Address: Cais de Viscondessa, Rua da Cintura, 1200-109 Santos, Lisboa

You'll find more information about the restaurant here: https://www.visitlisboa.com/en/places/kais-restaurante-bar

# CLOSING CEREMONY

# Sunday, 3 November, 12:00-13:15 | Auditorium

Writing a description of a closing ceremony is a very hard task.

After several months of preparation, intensive days of exchange of best practices with some of the best science teachers in Europe it will certainly be very hard to say goodbye. So we decided to prepare a few nice activities that we hope will stay in your hearts forever.

During the whole festival we will have a few challenges and prizes to deliver. A nice surprise is also awaiting for all of you, nothing that you can take in your luggage but for sure you will take in your hearts. We will end with the hope that this was just the beginning of many other adventures and partnerships.

I end this description with a big THANK YOU from the bottom of my heart, and in name of all NUCLIO and Science on Stage Portugal team we wish you warm farewell and quick return.

Até sempre e obrigada!

Rosa Doran





# **CASCAIS**

Cascais is on the west coast of Portugal, right on the edge of mainland Europe and only 30 kilometres from Lisbon, a perfect location for attracting international events.

Considered the Charm of the Atlantic Coast, Cascais is also the ideal place for a break, with the genuine atmosphere of a peaceful seaside town, always very friendly, with beautiful beaches protected by sand-dunes, cliffs and the nearby mountains. Cabo da Roca Cliffs, Sintra Unesco World Heritage site, and the National Park of Sintra-Cascais are all reachable within 20 minutes' drive. What's more, you can take full advantage of its privileged location by popping into Lisbon for a fascinating stroll through the vibrant streets of a bustling European capital.

The region became a pioneer of Portuguese tourism when in 1870 the Portuguese royal family chose Cascais, more specifically the Cidadela, as its summer residence due to the excellent location, natural surroundings, temperate climate and high quality of the local sea and spa waters.

Cascais area was a place of immense strategic importance during the Second World War and became a major hub of international diplomacy and espionage as one of Europe's safe havens during this time of crisis. Ian Fleming was here at that time and it is rumoured that it was in Hotel Palácio Estoril that he got his inspiration for James Bond.

For more information, please see https://www.visitcascais.com

# **ESTORIL CONGRESS CENTER**

Estoril Congress Center is the ideal venue for all types of corporate, institutional, cultural and social events.

Has a privileged location on the Estoril coast, only 25 km away from Lisbon airport, and right next to the famous Casino Estoril, with its surrounding gardens and sea view.

It was designed to be widely flexible, with different means of use and state-of-the-art technology and is suitable to host several activities simultaneously, so it is perfect for hosting the Science on Stage festival.

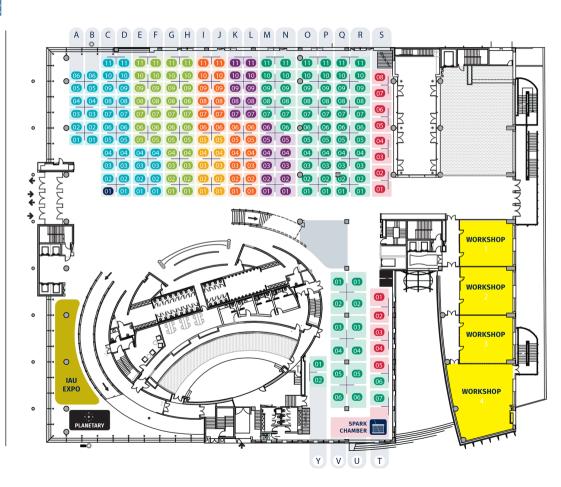
Estoril Congress Center is the only venue in Portugal certified as a Green Venue (EarthCheck's Gold Certification) for its good environmental practice and commitment

to sustainable business.

Please visit http://www.estorilcc.com/en/

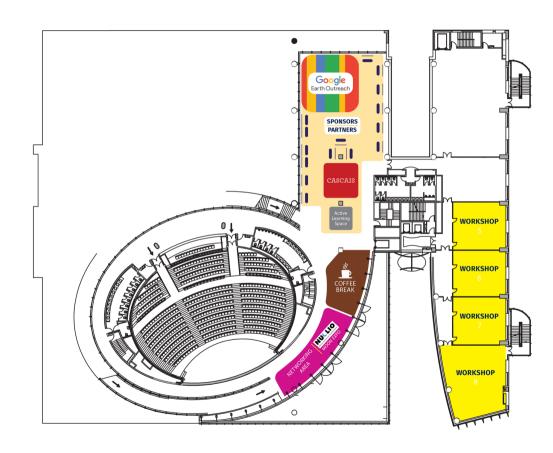
# EVENT MAP | GROUND FLOOR

- **O** GUIDING THEMES
- DIGITAL LITERACY AND SCIENCE EDUCATION
- SUSTAINABLE DEVELOPMENT IN SCIENCE EDUCATION
- O JOINT PROJECTS
- SCIENCE IN EARLY YEARS
- ( INCLUSIVE SCIENCE
- LOW-COST AND RECYCLED SCIENCE
- ASTRONOMY AND SPACE EXPLORATION IN SCIENCE EDUCATION
- WORKSHOP AREA
- IAU 100 YEAR Expo
- PLANETARY
- COSMIC RAY SPARK CHAMBER



# EVENT MAP | FIRST FLOOR

- **WORKSHOP AREA**
- **SPONSORS / PARTNERS**
- **GOOGLE EARTH OUTREACH**
- CASCAIS STAND
- **ACTIVE LEARNING SPACE** By Promethean & Steelcase
- COFFEE BREAK
- **NETWORKING AREA NUCLIO MOON EXPO**



# EVENT PROJECTS | STANDS

- A06 Teaching Physics with LEGO EV3 (PORTUGAL)
- A05 Augmented Reality Sandbox (FRANCE)
- A04 Simple physics experiments in computer science lessons and beyond (CZECH REPUBLIC)
- A03 Phito-picture in the Computer Science room (UKRAINE)
- A02 Baby Safety development of systems for the prevention of sudden infant death (SPAIN)
- A01 School in Humanitarian Causes (PORTUGAL)

- B06 Machine Learning in school (GERMANY)
- B05 CO2duino (GREECE)
- SCIENCE! And no MATTER Story (PORTUGAL)
- B03 Techland: mathematics and science in a virtual world (ITALY)
- B02 Modern Science Classroom (KAZAKHSTAN)
- B01 Introducing educational robotics and creation digital learning environment in the teaching of mathematical concepts (CYPRUS)

- C11 Atmosphere control of a house (PORTUGAL)
- C10 Choreographic visualisation of the search
- CO9 Kalevala goes science (FINLAND)
- C08 Dynamene scientific research equipment built by high school students (SWEDEN)
- CO7 Creating animation and video in science subjects (LATVIA)
- CO6 Escape Room To Go (HUNGARY)
- CO5 Chemanalyse your application to do chemistry laboratories (POLAND)
- CO4 Structured Programming and the Internet of Things (NORWAY)
- Proteomics, mass spectrometry applied to protein analysis (NETHERLANDS)
- Visiting the Museum? The Robot Helps! (PORTUGAL)
- CO1 SCIENCE ON STAGE EUROPE

- D11 Safe flight innovative modification of a wing (POLAND)
- D10 STEAM CENTER: Internet network fails (SPAIN)
- D09 Echo Tech Youth (ALBANIA)
- D08 SoS Sounds of Science (PORTUGAL)
- Qualitative analysis of water samples for young scientists (SLOVAKIA)
- Optical Tweezers: The Nobel Prize in Physics 2018 at your school (GREECE)
- D05 Braga Through a Digital Lens (PORTUGAL)
- D04 Walking along the Chromosomes (ITALY)
- D03 Young people learning statistics (FINLAND)
  - Tourist people learning statistics (FINEAND
  - MINT-EC Camp autonomous driving (GERMANY)
  - Programming Robot (teacher assistant) (KAZAKHSTAN)

- E11 Sintra's Mountain (PORTUGAL)
- E10 DusTrack'R (FRANCE)
- E09 Brain of Olching The Scientific CastingShow (GERMANY)
- E08 Environment and sustainability in Physics class (DENMARK)
- E07 Drops and droplets (Czech Republic)
- E06 Smartphones as Didactic Tools for Approaching Geosciences (ITALY)
- E05 Our house: can it be sustainable? (PORTUGAL)
- E04 Contructing a circulating Fluidised Bed Laboratory Unit (AUSTRIA)
- Folk beliefs about weather and astronomy (Bulgaria)
- Fun project for integrating art with circuits into finished projects (SWEDEN)
- E01 Immersive Science (PORTUGAL)

- F11 Earth Day (HUNGARY)
- F10 eHAND (effects of human activities on natural disasters) (ITALY)
- F 19 Albatross project (NETHERLANDS)
- F08 Educate to Innovate (PORTUGAL)
- F07 Hyperbaric Chamber (GREECE)
- F06 The awareness of a Water Footprint (IRELAND)
- F05 Rouffach, a land of vine and wine (FRANCE)
- F04 Mangualde STEM Academy (PORTUGAL)
- F03 Explore Nature Together (UKRAINE)
- F02 How is biometric security changing the world we live in? (UNITED KINGDOM)
- F01 Stroboscope and beyond (POLAND)

- 11 Solar Light (FRANCE)
- 10 Light on the risks of UV (PORTUGAL)
- G09 Global Goals, Global Inventors with Mighty
  Futures (UNITED KINGDOM)
- G08 Cosmic role of photosynthesis (UKRAINE)
- The hiLyte battery (SWITZERLAND)
- G06 The sustainable city (SWEDEN)
- Your best mistake an engineering project for students in 3rd grade (10 years) (DENMARK)
- G04 Air Garden (KAZAKHSTAN)
- G03 Science and Sustainability: Let's Build a Hydroponic (ITALY)
- G02 Science Club Learning Science in a sustainable way (PORTUGAL)
- The Colours of Nature the Rouge of the Jeweller, Azure of the Sea, Red of the Berries (HUNGARY)

- 11 The Fight Spheres (HUNGARY)
- H10 Seismograph with Accelerometer (ITALY)
- H09 How does your smartphone hurt your body (POLAND)
- H08 Studying the environment using DIY ROVs and Drones (PORTUGAL)
- H07 Soap bubbles on the wood (SLOVENIA)
- H06 Inquiry activities with Bicarbonate Soda and Vinegar (SLOVAKIA)
- Urban trees as climate messengers (AUSTRIA)
- Growing food crops under extreme conditions (NETHERLANDS)
- Doctor, is my watercourse sick? Can we cure it? Adopt it? (CANADA)
- Weather Rotosmart (FRANCE)
- HO1 Energy: Look at its Forms! Find out its Conversions, in a...Fantastic Bike Ride! (GREECE)

# **EVENT PROJECTS | STANDS**

- 111 Life of plants (CZECH REPUBLIC)
- Can you see the light? To see, feel and understand the properties of light (GERMANY)
- Gaming Lab (GEORGIA)
- Fighting against rural depopulation using technology; our mobile apps (SPAIN)
- World Science Day as a tool to attain
  Sustainable Development (PORTUGAL)
- 106 If it is a legend it might be science (CANADA)
- Let's build a sustainable future together!
- Suitable and quality food for astronauts (BULGARIA SPAIN)
- 103 ESCAPING with SCIENCE (CYPRUS GREECE)
- Physical Properties of Snow (SLOVAKIA FINLAND)
- 101 Beyond the Water (ITALY UNITED KINGDOM)

- Moon Shelter (PORTUGAL)
- [10] Colours (POLAND)
- 109 Inspiring Technology (ITALY)
- STEM Exploration through Rocket/Projectile Launching (IRELAND)
- 7 First Kiss with Science (HUNGARY)
- Oh that gravity! (GREECE)
- Hear Today Gone Tomorrow
  (PORTUGAL UNITED KINGDOM)
- How did we get here? An evolutionary journey through time (IRELAND DENMARK)
- 103 GeoQuest Project (ICELAND ITALY)
- CoALA Code A Little Animal
- J01 From the mouth to toilet (GERMANY NETHERLANDS)

- K11 Construction of a myoelectric prosthesis
- K10 DIY boats (for kids) (CZECH REPUBLIC)
- K09 Here Comes the Sun (CYPRUS)
- K08 Natural Pharmacy (BULGARIA)
- K07 Follow Hope (PORTUGAL)
- K06 The travel to the moon 2019 (DENMARK)
- K05 And yet it moves (LATVIA)
- KO4 Play a role and learn (FINLAND)
- K03 Teens for kids (POLAND)
- KO2 Creative Play-Doh (Creative Plasticine)
- K01 We become insulation experts! (GERMANY)

- Can we power classroom objects with renewable energy? (UNITED KINGDOM)
- L10 Sensory integration in mathematics (UKRAINE)
- Making chemical bonding crystal clear
- Anishinabe Culture as a tool for science learning in the field (CANADA)
- .07 The Internet Too Hot To Handle (IRELAND)
- Travel to the Land of Geometry (POLAND)
- The effects of acid rain on plant growth (SPAIN)
- L04 Code for Mars (TURKEY)
- O3 Sing a Song of Science (UNITED KINGDOM)
- 02 Playing with Science (PORTUGAL)
- L01 Visit famous scientists and discoverers with us (CZECH REPUBLIC)

- M11 A Portuguese Song, for sure! (PORTUGAL)
- M10 A mysterious Cup (FRANCE)
- M09 Chemical reactions in petri dishes (BELGIUM)
- MO8 Affordable experiment for every pupil (BULGARIA)
- M07 Experimental Box for Kids (AUSTRIA)
- M06 Geometry by Geogebra (TURKEY)
- M05 It's all in our hands (SWITZERLAND)
- MO4 Sharing Science Junior engineers for space exploration (FRANCE)
- M03 Learning by Solving Real Problems (HUNGARY)
- M02 Football, Space and Science Skills (UNITED KINGDOM)
- MO1 Embodied Maths for 21st Century Inclusive Education: An Innovative Learning Module (CYPRUS)

- N11 Development, manufacturing and testing of musical instruments (GERMANY)
- N10 A thousand paper cranes: Teaching radiation in context (UNITED KINGDOM)
- N09 Fresco and the Hidden Chem (ITALY)
- NO8 High and low pressure (CZECH REPUBLIC)

  History of Maths in Classroom: an educational
- NO7 History of Maths in Classroom: an educational challenge (PORTUGAL)
- N06 Bore-hole Making Machine "Woodpecker-1" (GEORGIA)
- NO5 Developing a Science Capital Approach for Primary Schools (UNITED KINGDOM)
- NO4 Mind Games (UKRAINE)
- N03 Physics and Chemistry's hands on activities for a blind student (SPAIN)
- NO2 (GERMANY)

  Crater and summit two faces of a candle
- NO1 Exercise, well-being and measurement course in Jyväskylä Teacher Training School (FINLAND)

- 011 Searching for Pythagoras (SPAIN)
- O10 Cheap Science Real Physics (BULGARIA)
- 009 Boni Science Center (NETHERLANDS)
- 008 Ionic Bond Puzzle (TURKEY)
- OO7 Physics experiments with your smartphone (BELGIUM)
- 006 Magnifying Curiosity Foldscopes (CANADA)
- O05 Experiments with gelatin and sugar (POLAND)
- Four Fantastic Photosynthesis Experiments (GERMANY)
- 003 Aquasun (FRANCE)
- 002 Recycled sensors (PORTUGAL)
- 001 Be a magician! Using magic illusions to teach science (UNITED KINGDOM)

- Biocube Project-Biodiversity-"Slow down and look at closely" (TURKEY)
- P10 The Hula Hoop Hundreds And Thousands Hadron Collider (United Kingdom)
- P09 Science, Robotics and Art (PORTUGAL)
- P08 Murder Case (NORWAY)
- P07 The Challenge of Quantum Reality (LITHUANIA)
- P06 Dinner for two (SLOVENIA)
- P05 MathsMagic (AUSTRIA)
- P04 Density and pressure through particle theory (IRELAND)
- P03 How Much Maths there is in Fruit and Vegetables! (ITALY)
- Clothes peg and paper physics (SLOVAKIA)
- P01 Superficial Changes, New Properties! (SPAIN)

# EVENT PROJECTS | STANDS

- 011 Simple experiments, big impact (BELGIUM)
- 010 Project Time Machine (SWITZERLAND)
- 009 Live, not survive! (LATVIA)
- Q08 Physics Laboratory from Electronic Waste
- 007 The Tomato Project (GERMANY)
- 006 Liquid world (BULGARIA)
- 005 Multi-colored Chemistry (UKRAINE)
- Q04 Playing with sound (CZECH REPUBLIC)
- Q03 Dough, cow dung (oops... :) and science
- 002 Experiment with scrapyard findings (SWEDEN)
- The physics and mathematics of 2-dimensional oscillations based on a DIY sandpendulum (BELGIUM)

- R11 To a low-carbon economy in the high school
- R10 Oranges and Lemons (ITALY)

(POLAND)

- R09 Build a winning windcar (NETHERLANDS)
- R08 My STEAM Demonstrations (KAZAKHSTAN)
- How to see the sound and Curie engines
- R06 Predict Observe Explain (SLOVAKIA)
- R05 The Budding Researcher (NORWAY)
- R04 Using junk to make a device that collects energy from the Sun (UNITED KINGDOM)
- R03 The important Mr. Pigment (PORTUGAL)
- R02 GimLit forttress (SLOVENIA)
- R01 Simple experiments on breadboard in the classroom and at home, applied to education of electricity and to other areas of physics (HUNGARY)

- S08 Low-cost astrobiology studies (SPAIN)
- S07 Astronomy with Art (PORTUGAL)
- Earth and its satellites threats coming from space (POLAND)
- S05 Control Moment Gyro (GREECE)
- Dreaming stars to live better on earth
- S03 Exoplanets and rocketscience (DENMARK)
- S02 Planetarium a tent in the classroom and outside (BULGARIA)
- S01 Paper Rockets@Gibs (AUSTRIA)

- From Earth...to Mars (GREECE)
- T02 Radio Station Connected Torre Vicens (SPAIN)
- T03 DIY Stargazer Let's bring the stars to Earth! (SWEDEN)
- T04 Is a black hole at the Milky Way center?
- T05 The System Of Sun Tracking (UKRAINE)
- T06 Flash and thunder -Let's talk about energy!
- T07 Flying in the flow (FRANCE)

- U01 Magimatic (FRANCE)
- Recycle, play, discover alternative to expensive toys (BULGARIA)
- U03 Using a smartphone as an IR spectrometer (BELGIUM)
- The Periodic Table of the Smartphone (PORTUGAL)
- Vou're Fired! A Dramatic Approach to Primary Science (UNITED KINGDOM)
- Verification of the physical model in computer games by motion analysis (GERMANY)

- V01 STEAM for STEM (ITALY)
- V02 Embodied simulations (NETHERLANDS)
- V03 Top model (POLAND)
- Tannin tan for leather, ink or medicine (SLOVENIA)
- V05 What does the Umami Taste? (SPAIN)
- V06 Physics out of the Pocket (UKRAINE)

- (01) Simple spectrophotometer (SWITZERLAND)
- Y02 Funny Labyrinth (TURKEY)



# **SCIENCE ON STAGE EUROPE**

# SCIENCE ON STAGE

# The European Science teachers' network

Science on Stage Europe believes that the best way to improve science education and to encourage more schoolchildren to consider a career in science or engineering is to motivate and inform their teachers. Therefore, Science on Stage Europe brings together passionate science teachers from over 30 countries, to exchange best practice teaching ideas and concepts. This non-profit organisation was founded in 2000 and reaches 100,000 teachers Europe-wide.

#### **Activities**

# **Science on Stage Festival**

Every two years Science on Stage Europe organises Europe's biggest science education festival. Teachers from all over Europe exchange their ideas, projects and methods at stands, in workshops and on stage. These ideas are afterwards disseminated throughout Europe via follow-up activities:

# **Teacher Trainings**

To spread these best practice teaching concepts Europe-wide, Science on Stage countries organise teacher training events involving an international project and a national festival project.

# **Travel Scholarships and International Projects**

Teachers from different countries, who participated in the festival, can meet again to continue their work and to develop new joint projects together.

# **Teaching Materials**

Working groups of international teachers develop materials for their colleagues in Europe. Science on Stage publishes and spreads these concepts as teaching materials in different languages, which can be ordered or downloaded for free

Science on Stage Europe is mainly supported by the Federation of German Employers' Associations in the Metal and Electrical Engineering Industries (GESAMTMETALL) with its initiative think ING.

Stay in touch for future opportunities to get involved.

# ADDRESS Science on Stage Europe e.V.

Am Borsigturm 15, D-13507 Berlin PHONE +49 30 400067-40 EMAIL info@science-on-stage.eu

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# **SCIENCE ON STAGE NETWORK**

# **NUCLIO**

# **NUCLIO**

#### Núcleo Interactivo de Astronomia

NUCLIO is a non-profit organisation that brings together researchers and teachers from the fields of science and education, with the aim of promoting innovation in education. NUCLIO coordinates the Galileo Teacher Training Program (GTTP), one of the largest in the world involving over 100 countries. Since its establishment, the organisation has reached directly over 10,000 students and 3,000 teachers at a national level.

# **NUCLIO Projects**

NUCLIO coordinates and participates as a partner in several national and international projects, such as: Astronomers Without Borders, Dark Sky Rangers, Open Schools for Open Societies, Global Science Opera, Our Space Our Future, Islands Diversity for Science Education, Digital Schools, Frontiers, Go-Lab, GO-GA (Go-Lab Goes Africa), IASC (International Astronomical Search Collaboration), Inspiring Science Education, PLATON, PLOAD (Portuguese Language Office of Astronomy for Development), Stories of Tomorrow and Science on Stage.



















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#### **NUCLIO Activities**

The organisation offers accredited teacher training courses in the framework of its projects.

NUCLIO also promotes scientific outreach actions in partnership with the Municipality of Cascais, such as night sky observations and talks with scientists, taking place regularly at the Environmental Center of Pedra do Sal. Cascais.

NUCLIO represents Science on Stage in Portugal, organising the national pre-selection events for the international festivals. In 2019. NUCLIO has the pleasure to be the host of Science on Stage Festival (#SonS2019), with the support of the Municipality of Cascais.

# **NUCLIO Goals**

- · Inspiring new generations to acquire fundamental skills, such as: critical thinking, creativity, communication, collaboration, tolerance, empathy, respect and other important values.
- Promoting innovation and development in education, in a studentcentred approach that follows the evolution of society and motivates students in the search for knowledge.
- Highlighting interdisciplinarity, inquiry-based learning and integration of ICT in the school culture as a whole.
- Believing that schools should be open to community, acting as open ecosystems of learning and meeting local needs.









#### ADDRESS - NUCLIO - Núcleo Interactivo de Astronomia

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# Science on Stage Portugal

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#### WEBSITES

NUCLIO https://nuclio.org/ SonS PORTUGAL https://scienceonstage.pt/ FESTIVAL SonS2019 https://sons2019.eu/

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