

Activities for learners at a
post-primary school level

REGENERATION



Welcome to Science Week!

It's that time of year again and Research Ireland is inviting post-primary schools to take the leap and get involved in Science Week!

Science Week Fun!

November 10th – 17th, 2024

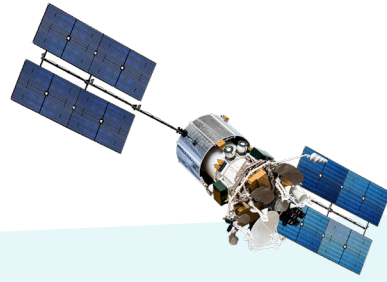
Get ready for an exciting Science Week where we'll dive into the theme of regeneration. The decisions we make today will affect our future so it's important that we use what've learned from the past - from protecting our natural world, being more sustainable in how we use energy and materials, embracing technological advancements and discovering smart solutions for health and healing.

We've planned some fun activities for you to join in and explore the idea of regeneration. Let's reimagine our world together and celebrate our amazing strengths!

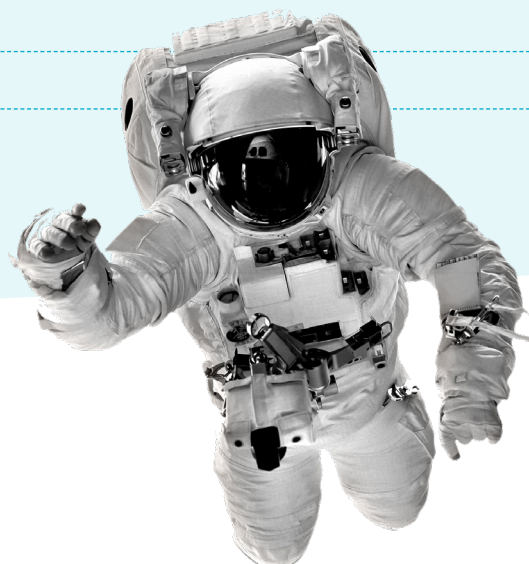
Join the conversation, see what's happening and share your Science Week celebrations using #ScienceWeek or tag @ESERO_ie



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What's in this pack?

To support teachers in bringing Science Week into their busy classrooms we've put together this pack that gives you lots of ideas to spark learners' curiosity and details of Science Week events and activities taking place all across Ireland.

Ways to get involved

- ▶ **Use the activities in this pack** to spark curiosity and discussion about science in everyday life.
- ▶ **Attend a free live-stream Science Week Careers Chats.**
- ▶ **Invite a speaker into your classroom** in person or online to bring science to life for your learners and give them the opportunity to meet people who use STEM in their jobs.

You could consider asking parents to volunteer, or contact:

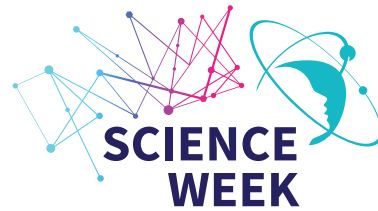
[I'm a scientist, get me out of here!](#) connects learners with people working in a diverse range of roles in STEM through energetic real-time text-based chats, where they get to ask those burning questions!

Lots of the Discover Centres offer outreach visits to schools. Find your nearest Centre [here](#).

Check out the Science Week events happening in your area at www.sfi.ie/events/.



What's on this Science Week?



"Careers Chats" with Shanice Griffin in DreamSpace at Microsoft

Join us online for a LIVE virtual event for Secondary School Students on Tuesday 12th November 10-10.40am.

This free live-streamed careers guidance event is perfect for classrooms across Ireland to get involved in an interactive discussion with digital creator Shanice Griffin and special-guests working within the fast-emerging Irish Space Sector. Join us to find out more about the journey and inspiration leading to their studies and careers.

#ScienceWeek #ESEROIreland @ESERO_ie @itshanice @researchireland

Solaris Project – A star is born!



Solaris is a giant motorised expandable sphere which takes the audience on a journey from the birth of a star to its explosive transformation into a pulsar.

The structure has thousands of individually mappable LEDs that create mesmerising visual images. The installation is being developed through consultation with researchers and a team of lighting/visual designers and creatives. The show follows the star as it forms, then swells into a red giant, finally exploding into a supernova before forming a pulsar.

This free installation will take place in Marina Market in Cork City opening for its world premiere on Sunday 10th November until 12th November and then in Saint Nicholas' Church in Galway 14th – 17th November. **No booking required!**



Tour of the Solar System

Bring the excitement of space science to your students with **The Space Show**, a dynamic, interactive experience at the National Museum of Ireland – Country Life.

The tour will engage Junior Cycle and Transition Year students with fun, hands-on activities exploring the wonders of space, astronomy, and the latest in space exploration.

Tour of the Solar System will take place during Science Week on Thursday 14th or Friday 15th November 2024 at the National Museum of Ireland – Country Life, Turlough Park, Castlebar, Co Mayo. Email the Bookings Office at BookingsCountryLife@museum.ie or telephone (094) 90 31751.

Futureville: Exploring Ireland's Future Towns



Tune into **Futureville**, a new science series filmed in Athlone. This show explores how today's scientific advancements could shape Ireland's towns 25 years from now.

Futureville will air on RTÉ 1 at 7pm on Tuesday, Wednesday, and Thursday during Science Week. To build on the themes presented, consider discussing town planning and sustainable communities with students using these resources:

SEAI Schools Energy Resources: Help students explore Ireland's energy targets at <https://www.seai.ie/plan-your-energy-journey/schools/post-primary-school/energy-in-ireland>.

National Challenge Fund on Sustainable Communities: Introduce research initiatives supporting future community development at https://www.sfi.ie/challenges/?query=&page=1&cat_status=&cat_name=1685602851-6&cat_theme=&cat_phase=&cat_type=&cat_partner=.

Climate Change and Habitat Loss

Climate change and biodiversity are central themes for Science Week, with a variety of events and media coverage focused on these critical issues.

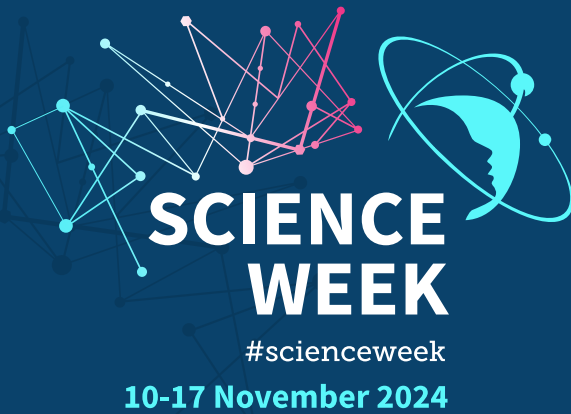
From discussing the impact of habitat loss to exploring conservation efforts, this theme encourages students to consider how they can make a positive difference in preserving biodiversity.

For follow-up activities, explore these resources:

- **Biodiversity Resources:** Discover interactive learning materials on biodiversity at [Biodiversity Ireland](#).
- **UN Sustainable Development Goals:** Use the UN's SDGs to introduce global targets on life below water and life on land at <https://sdgs.un.org/goals>.
- **Wildlife Conservation Resources from National Geographic:** Engage students with conservation stories and resources at <https://www.nationalgeographic.com/environment>.

These events and resources are a great way to spark discussions about sustainability, future planning, and environmental stewardship this Science Week.





Science Week events are taking place right across the country.

Find out more on ScienceWeek.ie

1. CAVAN

Cavan Monaghan Science Festival

2. CLARE

'Be a Marine Biologist' and 'Can we speak whale?'

3. CORK

- ▶ Science at the Marina
- ▶ SpaceFest 2024
- ▶ Ballyhoura Science Week Festival

4. DONEGAL

Inishowen Rural Science Festival

5. DUBLIN

- ▶ Foram / Forum - Giving voice to underrepresented groups in Climate Action
- ▶ BIAS - Inequality in Women's Health and Research

- ▶ Smart Cities Urban Quest: Adventure in the Docklands
- ▶ Science Week at The Ark 2024
- ▶ Irish Sign Language and Artificial Intelligence, a performance
- ▶ Smalltalk- Big Ideas: Supporting local communities turn ideas into actions
- ▶ Dublin Book Festival 2024 (DBF2024)
- ▶ Reimagining The Irish Food System (Creating Sustainable Cities and Communities)
- ▶ How It's Made: Demystifying IOT in Transportation
- ▶ The Bigger Picture: Engaging with Creative Perceptions of AI
- ▶ The Science of Theatre - The Light Box & Sound Machine

- ▶ Beta Festival 2024 - A critical inquiry in art and technology
- ▶ C'mere Til I Tell Ye - Dublin Science Festival

6. DUBLIN/OFFALY

The Blossoming: Cancer Has No Borders

7. KERRY

Kerry Science Festival 2024

8. KILKENNY

Kilkenny Science Festival 2024

9. LIMERICK

Limerick Festival of Science

10. LOUTH

Louth Libraries Science Festival 2024

11. MAYO

- ▶ Re-Generation: Sustainable Food for the Ages
- ▶ Circus Science by the Sea Festival

12. MIDLANDS

Midlands Science Festival

13. SLIGO

Sligo Science Festival

14. TIPPERARY

Tipperary Festival of Science

15. WATERFORD

South East Science Festival

16. WESTMEATH

RegenHERate: Supporting Female Health and Performance

17. WEXFORD

Wexford Science Festival

STEM – it's not just for Science Week!

Engage Your Students with Real-World STEM Projects

Bring STEM learning to life in your classroom with these exciting, hands-on projects that inspire curiosity, problem-solving, and innovation. Each of these initiatives offers students the opportunity to engage with real-world science and technology challenges, fostering inquiry-based learning and developing 21st-century skills. Whether it's coding for the International Space Station, designing a lunar habitat, or investigating local climate issues, these projects will captivate your students and provide valuable cross-curricular learning experiences. Below are details on each project, complete with resources and instructions on how to get your class involved.

CanSat: Let Your Students Build and Launch Their Own Satellite

Introduce your students to the exciting world of aerospace engineering with the **CanSat** project. This **European Space Agency competition** challenges students to design, build, and launch a **mini-satellite—a CanSat**—that fits into the size of a drinks can. It's a hands-on experience that brings space technology and engineering to life. Here's what your students will do:

- ▶ **Design and Build a CanSat:** Students will create an Arduino-based satellite, complete with sensors to measure variables like temperature and pressure.
- ▶ **Launch and Collect Data:** The CanSat will be launched to around 1 km altitude, and students will collect and transmit real-time data during its descent.
- ▶ **Analyse and Present Data:** After the launch, students will analyse the collected data and present their findings, enhancing their scientific communication skills.

The CanSat project is perfect for students interested in electronics, coding, and engineering, providing a practical introduction to space missions.

How to get started: Learn more and register your teams at **CanSat Europe:** <https://www.esa.int/Education/CanSat> or at **ESERO Ireland:** <https://esero.ie/activities/cansat/>

*CanSat Ireland 2024
Finals winning team
from Mercy Mounthawk,
Tralee, Co. Kerry.*



Astro Pi Challenge: Engage Your Students with Real Coding in Space!

The Astro Pi Challenge, created by the European Space Agency (ESA) and the Raspberry Pi Foundation, offers an incredible opportunity for your students to send their code to the International Space Station (ISS). This project helps students learn hands-on programming using Raspberry Pi and the Sense HAT—an add-on board with sensors that can measure temperature, humidity, and pressure.

Students will:

- ▶ Assemble a **Raspberry Pi** and program it using Python.
- ▶ Control an **LED matrix** and collect data using **Sense HAT sensors**, simulating the environment on the ISS.

- ▶ Participate in the **European Astro Pi Challenge**, where their code will run in space, allowing them to compare data from space and Earth.

This project is ideal for introducing coding, data analysis, and space science in an engaging and practical way. Teachers can access lesson plans and activity guides to integrate the challenge into their classroom.

How to get started: Teacher and student guides for setting up and coding at: <https://astro-pi.org/resources/getting-started/>

For registration and additional information, visit the **Astro Pi** website at: <https://astro-pi.org>

Climate Detectives: Investigate Climate Change with Your Students

Empower your students to tackle real-world climate issues with the Climate Detectives project by the European Space Agency (ESA). This initiative allows students to become young climate scientists, identifying local climate-related problems, gathering data, and proposing actionable solutions. It's a fantastic opportunity to develop scientific inquiry and critical thinking skills.

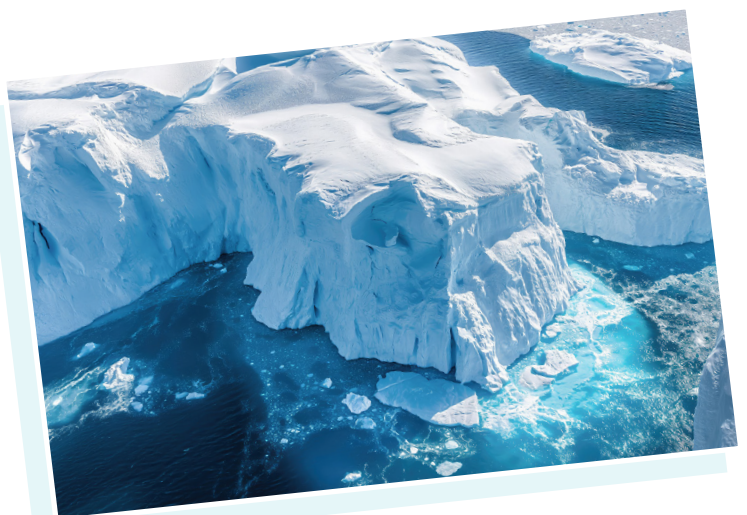
The project is divided into three phases:

- ▶ **Identify a Climate Problem:** Help students choose a local climate issue such as air quality or deforestation. They will submit an investigation plan detailing the problem.
- ▶ **Investigate the Climate Problem:** Students will collect data through Earth observation satellite imagery, historical climate records, or their own measurements.

- ▶ **Make a Difference:** Students will present their findings and propose ways to address or raise awareness of the issue.

This project not only develops students' scientific literacy and problem-solving skills, but it also helps them make meaningful contributions to climate action.

How to get started: Visit the **Climate Detectives** website for guides, resources, and registration information at: https://www.esa.int/Education/Climate_Detectives



Moon Camp Challenge: Help Your Students Design Lunar Habitats

Get your students thinking about space exploration with the **Moon Camp Challenge**, a project run by the **European Space Agency (ESA)** and the **Airbus Foundation**. In this challenge, students will design a **lunar base** capable of sustaining human life on the **Moon**. They will explore the challenges of living in extreme environments, and then create a model of their solution.

The **Moon Camp Challenge** offers different levels based on your students' experience:

- ▶ **Moon Camp Discovery:** For beginner students, who will design a simple lunar base using Tinkercad.
- ▶ **Moon Camp Explorers:** More advanced teams will design a fully detailed base that can sustain human life on the Moon.

- ▶ **Moon Camp Pioneers:** In this open category, students can push their designs even further, considering space settlements beyond the Moon.

This project encourages creativity and problem-solving while teaching students about space technology and sustainability. All participating teams will receive certificates, and the most innovative designs will be showcased in an online event with an ESA astronaut and space experts.

How to get started: Visit the **Moon Camp Challenge** website for resources, tutorials, and registration at: <https://mooncampchallenge.org>



Explore More STEM Projects and Resources with ESERO Ireland



Looking for even more ways to spark curiosity and excitement in your classroom? Head over to **ESERO Ireland** at www.esero.ie to find a treasure trove of space-themed STEM projects, resources, and updates designed specifically for teachers.

What is ESERO Ireland?

ESERO (European Space Education Resource Office) Ireland, in partnership with the **European Space Agency (ESA)**, is your go-to resource for bringing space science into the classroom. Whether you're teaching coding, engineering, climate science, or maths, ESERO provides high-quality, curriculum-aligned materials that make learning interactive and fun. With space as the hook, you'll engage your students in STEM subjects in ways that resonate beyond the classroom.

How Can ESERO Help You?

- ▶ **Classroom-Ready Resources:** ESERO offers a huge variety of lesson plans, activities, and projects, all aligned with the curriculum and designed to integrate seamlessly into your teaching.



- ▶ **Professional Development:** ESERO runs hands-on teacher workshops, giving you the tools and confidence to deliver inspiring, inquiry-based STEM lessons.
- ▶ **Continuous Support:** ESERO keeps you connected with the latest in space education through updates, events, and project deadlines—helping you stay ahead with fresh content for your classroom.

To keep up with the latest STEM project ideas, stay informed about upcoming competitions like **CanSat** and **Astro Pi**, or simply browse through exciting new resources, visit www.esero.ie. Let ESERO Ireland support you in creating an unforgettable STEM learning experience for your students!

Join us for the ESERO Ireland Space Education Confluence which will take place on 30th November 2024.

All second level teachers (and teachers in training) are invited to join us for a morning of online workshops to explore Earth Observation and Climate Change resources suitable for second level classes.

Book online for the Space Education Confluence on 30th November: www.spaceweek.ie/events/esero-ireland-space-education-confluence-2024/

The annual ESERO Ireland Space Education Confluence is supported by: OIDE: www.oide.ie
MTU Blackrock Castle Observatory: <http://www.bco.ie>

Keep an eye on [esero.ie](http://www.esero.ie) for further details.



5*S Space, Surveyors and Students

This STEM programme enables teachers and students to deploy cutting-edge satellite technology in the classroom free of charge via the ArcGIS platform. Students from first to fourth year can use an augmented reality app, SatelliteSkill5, for a unique educational experience focused on mapping, satellite technology and data literacy. With the UN Sustainable Development Goals as a central theme, 5*S explores practical solutions to address global challenges like climate change and sustainability, empowering young people with relevant knowledge and skills.

This is a three-workshop programme, delivered in person, at times that suit the school calendar/timetable. Find out more at <https://5sdiscover.maynoothuniversity.ie/>.



TY Weeks at DIAS Dunsink Observatory

The TY Week at DIAS Dunsink Observatory in Dublin is a programme for transition year students running twice during the school year, usually in late October and late January. The TY Week gives participants an opportunity to explore a variety of space science themes like solar physics, planetary science, meteors and more. As well as that the students get the chance to see what it's like to work in the observatory!

Students apply on an individual basis. More information is available at <https://dias.ie/dunsinktyweek>.



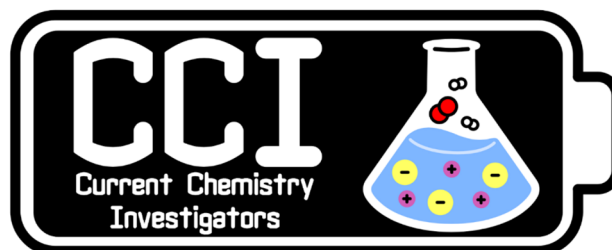
Current Chemistry Investigators Workshops

The CCI workshop is based on “Electro-Analytical Chemistry” where the topic of electrochemistry is subtly introduced through familiar chemical analysis techniques, linking with the current and future LC chemistry course. TY/LC students can figure out what happened to a fictional battery that went on fire by analysing the electrolyte with a conductivity meter.

The workshop contains plenty of lab skills like making standards, using pipettes, drawing a calibration graph, and working out the unknown. It covers theory like qualitative and quantitative analysis, ions in solution, electrolytes, and ion-exchange.

Workshops are run by CCI's trained researchers from partner institutions around Ireland, and the team will bring everything needed for the workshop with them.

Find out more at <https://currentchemistryinvestigators.com/>.



Busting Gender Bias in Computer Science and Cyber Security

This initiative is dedicated to breaking down gender barriers in the fields of computer science and cyber security. Through an innovative blend of science, arts, and humanities, this project has gathered a suite of resources including posters, multimedia, book recommendations and an inquiry stimulus framework.

For more resources to inspire young women to pursue careers in these vital areas, visit <https://cyberwise.ie/busting-gender-bias/>.



STEM Careers



STEM Careers: Exploring Opportunities in the Space Sector

The Space Industry offers a wide variety of careers and opportunities - you might be surprised at the variety of opportunities across subject areas including maths, physics, chemistry, engineering and computing.

Help your students see the vast possibilities of a career in STEM by introducing them to young professionals already working in the space industry. These three career profiles will show your students how subjects they study today can lead to exciting, real-world applications in space science and technology. Highlight these success stories to inspire your students to reach for the stars!

Career Profile: Cuán de Barra



Position: PhD Student, University College Dublin (UCD)

Current Projects: PhD Research on Gamma Radiation from Black Holes and EIRSAT-1 Spacecraft Operator

Cuán's journey into space science began with a love of maths and physics in secondary school. Taking subjects like Applied Maths, Physics, Chemistry, and Economics for the Leaving Certificate helped him build a strong foundation for studying Physics with Space Science & Astronomy at University College Dublin (UCD).

Cuán's interest in space deepened when he took part in UCD's EIRSAT-1 project, Ireland's first satellite, where he learned to work with satellite technology. During his undergraduate studies, he completed a project at the Calar Alto Observatory in Spain, studying pulsating stars called Cepheids.

He went on to pursue a Master's in Space Science & Technology, where hands-on experiences like designing a satellite and

launching it on a balloon from Northern Ireland, and an internship with the European Space Agency (ESA) in Madrid, gave him real-world experience in space missions.

Now working towards his PhD, Cuán is developing a detector that will be launched on a satellite to study gamma radiation from black holes. Alongside his research, Cuán is also a spacecraft operator for EIRSAT-1, where he communicates with the satellite and monitors its health as it orbits Earth. Cuán also collaborates with NASA on the Fermi mission to study gamma rays.

What's next for Cuán? He's keeping his options open but plans to continue working with satellites and gamma-ray research, whether in academia or industry.

Key takeaway for students: Cuán's career shows how an interest in physics and astronomy can evolve into hands-on experience working on satellites, collaborating with NASA, and studying black holes.

See Cuán's full profile at esero.ie/profile/cuan-de-barra/

Career Profile: Mark Kennedy



Position: Lecturer,
University College Cork
(UCC)

Specialisation: Astrophysics
and Black Hole Research

Mark Kennedy is a lecturer in astrophysics at University College Cork, where he studies some of the most fascinating objects in the universe—black holes and neutron stars. Mark’s journey into astrophysics started with his passion for physics during the Leaving Certificate, where he also studied chemistry, French, and accounting. This led him to pursue Physics & Astrophysics at UCC, where he also completed his PhD.

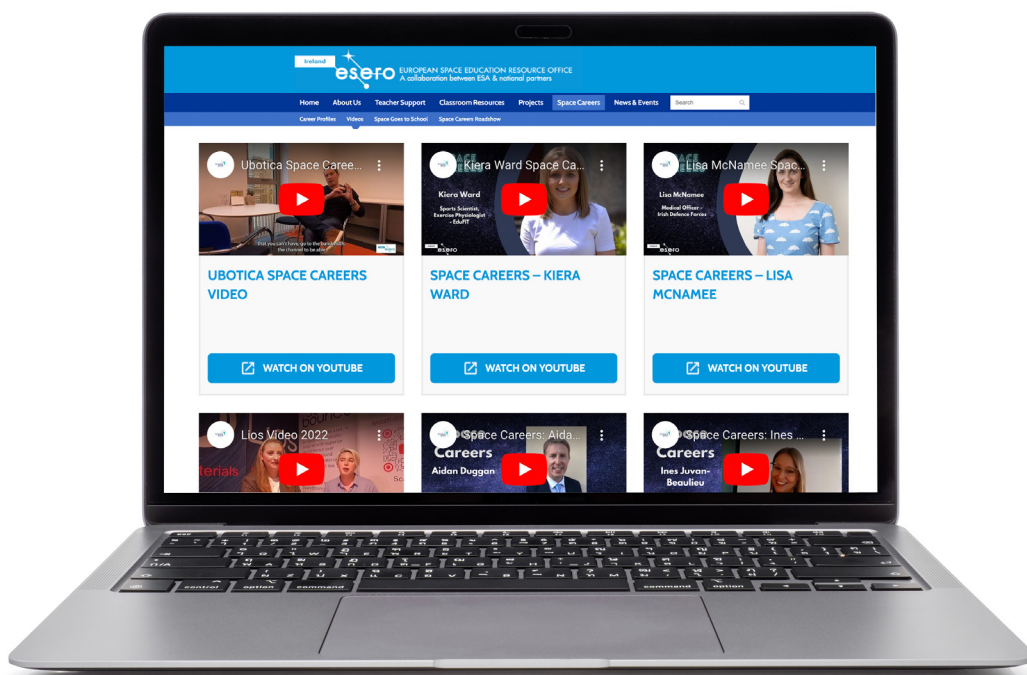
Mark’s career took him to Manchester, where he worked in astrophysics research for three years before returning to Ireland. He secured a Government of Ireland postdoctoral fellowship to study black holes in the Milky Way at UCC, and soon after, he was offered a lecturing position.

His typical day involves working with the GOTO collaboration (Global Relay of Observatories Watching Transients Happen), which maps the night sky, searching for new celestial events like supernovae or neutron star mergers. He also lectures students and works on research projects, which often involve analysing data and coding in Python.

Mark loves the thrill of discovery—being the first person to see new data and uncover the mysteries of the universe. However, he also acknowledges the challenges of academic life, particularly the constant need to apply for funding to support his research.

Key takeaway for students: Mark’s career highlights how studying physics can lead to a career exploring the universe, using cutting-edge space telescopes and collaborating on international space missions.

See Mark’s full profile at esero.ie/profile/mark-kennedy/



esero.ie/videos/

Career Profile: Rita Malosti



Position: Research and Development Manager, MBRYONICS Ltd

Specialisation: Free Space Optical Communications and Photonics

Rita Malosti works at the cutting edge of space technology as a Research and Development Manager at MBRYONICS Ltd, a global leader in free space optical communications. These technologies are used for high-speed, secure communication between satellites, spacecraft, and ground stations. MBRYONICS is involved in everything from designing telescopes and satellite optical systems to developing Earth observation systems and photonic integrated circuits.

Rita's background in physics and maths gave her the analytical skills necessary for her role, where she leads projects that push the boundaries of communication technology. Her journey into MBRYONICS started through

networking. She reached out to the company long before joining, expressing interest in their work. Over the years, they stayed in touch, and when the time was right, Rita joined the team.

No two days are the same for Rita. Whether she's writing proposals, managing budgets, attending industry events, or overseeing technical projects, her role is dynamic and challenging. The most rewarding part of her job is knowing that the technologies she works on will one day be in space, contributing to critical missions.

Key takeaway for students: Rita's career shows that physics and maths can lead to leadership roles in cutting-edge industries like space communications, where the work you do today can have a global impact tomorrow.

See Rita's full profile at esero.ie/profile/rita-malosti/



Explore More STEM Career Opportunities

These are just a few of the inspiring career stories that show the wide range of opportunities available in the space sector. To discover even more career profiles, visit the **ESERO Ireland** website at www.esero.ie. There, you will find additional profiles showcasing professionals from various fields, giving your students insight into how their interests in STEM can lead to exciting careers.

While you're on the website, don't miss the series of videos featuring people from Ireland who are making an impact in the space industry. These videos offer a fantastic way to engage your students and show them the real-world possibilities that STEM careers offer.

See esero.ie/videos

Professional Development and Support

Here are some great STEM professional development and support resources for post-primary teachers.

ESERO Ireland

ESERO provides a comprehensive range of resources and supports to help you as a teacher to integrate space as a theme in your classroom. We organise workshops throughout the year for teachers at both primary and post primary. Check in here for information on current and upcoming CPD opportunities.

Visit: esero.ie/teacher-support

Oide: Professional Learning for Teachers

Oide offers a wide range of CPD opportunities for teachers across all subject areas, including STEM. Their courses cover everything from STEM integration into everyday teaching to digital technologies and inquiry-based learning strategies. Oide also offers a variety of resources and workshops to enhance teaching practices, specifically aimed at supporting teachers in fostering a STEM culture in their classrooms.

Visit: www.oide.ie

STEM Teacher Internship (STInt)

The STInt programme, based in Dublin City University, offers post-primary STEM teachers a fantastic opportunity to gain real-world industry experience through paid summer internships with top STEM companies across Ireland. These internships typically last 12 weeks during the summer months, providing teachers with fresh perspectives to integrate into their teaching, making STEM subjects more engaging and relevant.

Visit: stemteacherinternships.ie

EPI-STEM – National Centre for STEM Education

EPI-STEM, based at the University of Limerick, provides high-quality CPD for STEM teachers. It focuses on mathematics and science education, offering a wide array of professional development courses, workshops, and resources. EPI-STEM helps post-primary teachers stay updated with the latest educational research and innovative teaching strategies to inspire their students in STEM subjects.

Visit: www.epistem.ie

Curious Minds: STEM Resources for Teachers

Curious Minds, supported by Research Ireland, provides teachers with a wealth of STEM resources and activities for engaging students in hands-on, inquiry-based learning. From lesson plans to classroom resources and CPD opportunities, Curious Minds supports teachers in bringing STEM to life in their classrooms, fostering creativity and problem-solving skills in students.

Visit: www.curiousminds.ie

ESCI – Education Support Centres Ireland

ESCI brings together a network of Education Centres that offer professional learning and CPD courses for teachers across Ireland. They offer a range of STEM-related workshops and online courses that cater specifically to post-primary teachers. These include courses on coding, digital tools for the classroom, and inquiry-based STEM learning methods. Education Centres across the country run local STEM events and workshops for teachers, making it easy to access practical support and guidance.

Visit: www.esci.ie

Science Week Classroom Activities

These Space Week activities offer engaging ways for students to explore concepts from the Junior Cycle Science Earth and Space strand. These activities are designed to engage students with real-world challenges faced by astronauts and space scientists using the Curious Minds Framework for Inquiry approach.

Each activity involves hands-on investigations, from modelling star life cycles and designing water filtration systems to testing plant growth under artificial lighting. These activities encourage students to investigate, question, and apply what they learn about space science.

You can find additional resources and ideas for space-related STEM activities on **ESERO Ireland's** website (esero.ie), where a wide range of materials is available to support Science Week and beyond.



Life of Stars

The **Life of Stars** activity guides Junior Cycle students through the stages of stellar evolution and the critical role stars play in creating and recycling elements.

This lesson uses interactive resources to help students understand how stars, including our Sun, change over time and contribute to the formation of elements throughout the universe.

This activity encourages students to explore the role of stars in the universe, the formation of elements, and the processes that shape galaxies and planetary systems.

Engage:

Engage students by prompting questions like “How does a star’s size determine its life cycle?” and “What would the universe look like without supernovae?” Use the **Life Cycle of Stars** diagrams for context: access the [handout version](#) and the [colour version](#). The **ESA Kids Stars and Galaxies** page (https://www.esa.int/kids/en/learn/Our_Universe/Stars_and_galaxies/Stars) provides background on star types and stages, which works well as an introduction.

Investigate:

Have students investigate nuclear fusion and element creation within stars. Use the **Make Your Own Sun** activity (https://www.esa.int/kids/en/learn/Our_Universe/Stars_and_galaxies/Stars) to model the Sun’s layers.

Guide them to compare the life cycles of smaller stars (like the Sun) and massive stars that may end in supernovae. The **Universe Without Supernova** activity (<https://nightsky.jpl.nasa.gov/documents/840/SNUniverseWo.pdf>) can help students understand the significance of supernovae in spreading elements across space.

Take the Next Step:

Extend learning by exploring the idea that “we are all made of stardust.” Encourage students to illustrate or describe how elements from stars reach planets, helping them connect stellar life cycles to the formation of new matter in the universe. This step reinforces the cosmic impact of stellar evolution and our connection to the stars.



Water Recycling Aboard the ISS

This Water Recycling Aboard the ISS activity introduces students to the importance of re-using and recycling resources in space.

On the **International Space Station (ISS)**, astronauts recycle water from sweat, wastewater and even urine to sustain long missions. Students will learn about water conservation, filtration technologies, and the practical challenges of resource management in space through the exploration of how this system works.

This activity encourages students to think creatively about sustainability, resource management, and technology solutions essential for long-term space exploration.

Engage:

Begin by showing European astronaut Andreas Mogensen on water recycling aboard the ISS (<https://youtu.be/FdLBlxoh2c?si=2schuma-hhLk1rx9>) to highlight the significance of recycling water in space. Have students consider questions like, “Why is it essential to recycle water in space?” and “What other resources might need recycling on long missions?”

For context on real-world applications, discuss the **Morocco water recycling project** inspired by space technology (https://www.esa.int/kids/en/learn/Technology/Space_spinoffs/Space_technology_delivers_clean_water_in_Morocco_and_Antarctica).

Investigate:

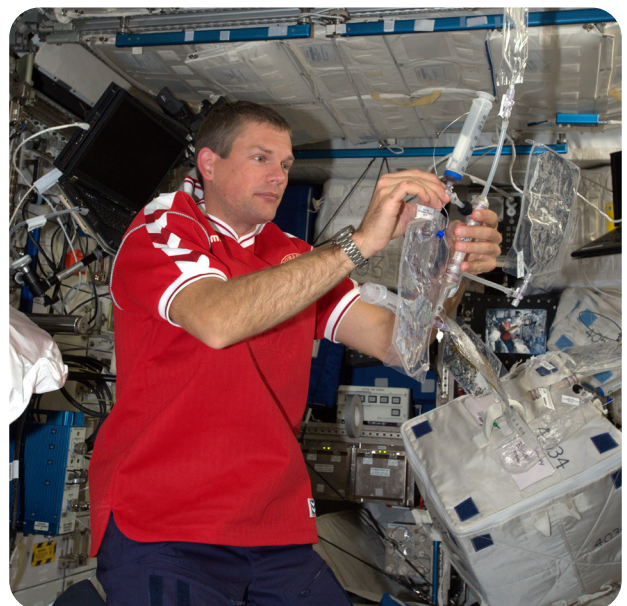
Challenge students to design and test their own water filtration and distillation system to purify a contaminated water sample, simulating what astronauts use on the ISS. Provide guidance by referencing filtration techniques used in space technology (see ESA’s Mars resources for filtration basics: https://esero.ie/wp-content/uploads/2015/01/63_Can-you-live-on-Mars.pdf).

Students can brainstorm solutions, make predictions, and compare their filtration results to see which methods work best.

Take the Next Step:

Encourage students to apply their learning by exploring future water recycling needs on the Moon. Discuss the discovery of frozen water on the lunar surface (https://esamultimedia.esa.int/docs/edu/PR33_Water_on_the_Moon.pdf) and possible extraction methods, such as heating lunar soil (<https://www.independent.co.uk/space/moon-water-lunar-soil-regolith-b2601809.html>).

Have students consider questions like “What uses might lunar settlers have for water?” and “Why is it too costly to bring water from Earth?” (For more on launch costs, see the Heavy Lifting Rockets activity www.spaceweek.ie/wp-content/uploads/2023/09/SpaceWeek_2023_HeavyLifters-1.pdf).



ESA astronaut Andreas Mogensen on the International Space Station ©ESA/NASA.

Plant Growth Aboard the ISS

The Plant Growth Aboard the ISS activity introduces students to the challenges and innovations in growing food in space.

With limited access to fresh produce, astronauts have experimented with growing plants on the **International Space Station (ISS)** to supplement their diet. This lesson invites students to explore how factors like lighting affect plant growth in space and to consider which plants could be suitable for future space missions.

This activity enables students to experiment with key plant growth factors and apply their findings to real-world scenarios in space exploration.



Space lettuce for dinner on board the International Space Station ©ESA/NASA.

Engage:

Begin by discussing the challenges astronauts face in accessing fresh food on the ISS, where most food is freeze-dried, canned, or pre-packaged. Show the video of astronaut Paolo Nespoli's experiment with plant growth (<http://wsn.spaceflight.esa.int/?pg=mm&id=315>), which ended due to fungal growth. Introduce **Veggie**, the ISS "space garden," where astronauts successfully grew lettuce, Chinese cabbage, and kale using artificial lighting. Ask students to think about the conditions plants need to grow and the challenges of creating these conditions in space.

Investigate:

Have students investigate how different colours of light impact plant growth, simulating the artificial lighting used on the ISS. Discuss which plants they would choose to grow in space and why, using the **AstroFood Plant Annex** for ideas (https://esamultimedia.esa.int/docs/edu/PR41_AstroFood.pdf).

Guide students in designing an experiment to test their predictions, encouraging them to consider key factors like water, soil, and light.

Because the plants are grown inside the ISS they must have artificial lighting. Students can investigate how different colour or intensity of light affect the growth of plants. Suitable plants should be quick growing, such as radish or cress. Pondweed might be used, with rate of bubbles used as a proxy for photosynthesis. Different colour lights can be sourced from grow lamps or desk lamps with filters, and learners might vary their intensity (by changing distance) as well as their colour. Light intensity can be measured with the Phyphox phone app, see <https://phyphox.org/> (used in line with your school smartphone policy).

Take the Next Step:

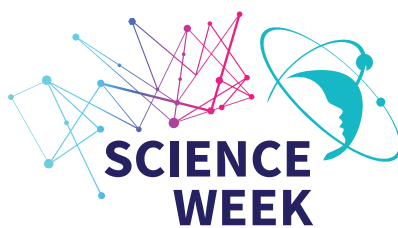
Extend learning by discussing the potential for future off-Earth agriculture. Have students explore how projects like **AstroPlant** (<https://www.astroplant.io>) are developing open-source plant growth systems for space. Introduce them to ESA's **AstroFarmer** resources (https://esamultimedia.esa.int/docs/edu/PR42_AstroFarmer.pdf which has a detailed teacher video support at https://www.esa.int/ESA_Multimedia/Sets/ESA_Teach_with_Space/) to help students think creatively about how space farming could support future lunar or Martian habitats.



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