

National Schools' Observatory
Strategy 2017-2022

Access to the Universe for All



@SchoolsObs



LIVERPOOL
JOHN MOORES
UNIVERSITY





“Tell me and I forget.
Teach me and I remember.
Involve me and I learn.”
– Benjamin Franklin

What is the NSO?

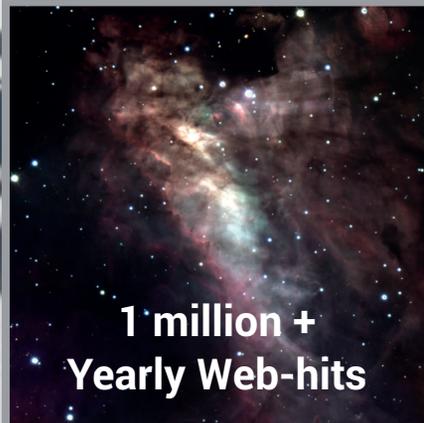
The National Schools' Observatory (NSO) uses astronomy to support and promote STEM education, utilising privileged access to the world's largest robotic telescope

One of the largest astronomy education projects in the world, the NSO currently has over 9000 users, our website attracts well over 1 million hits every year, and there have been over 140,000 telescope observations requested by teachers and pupils since our inception in 2004.

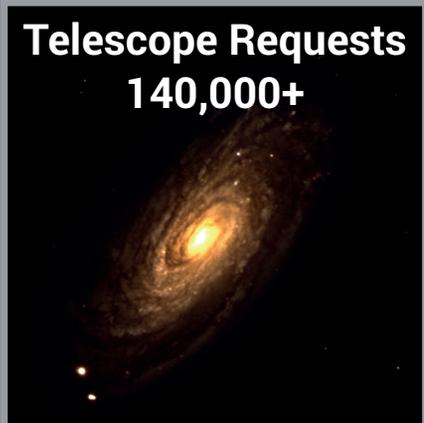
We feel strongly that astronomy creates a sense of excitement and wonder in people of all ages and we tap into that interest to expand our users knowledge of science and mathematics. At the same time developing their computer literacy and communications skills, strengthening critical thinking and giving experience of the real-world application of science and technology.



1,500
Registered Teachers



1 million +
Yearly Web-hits



Telescope Requests
140,000+

Access to the Universe for all

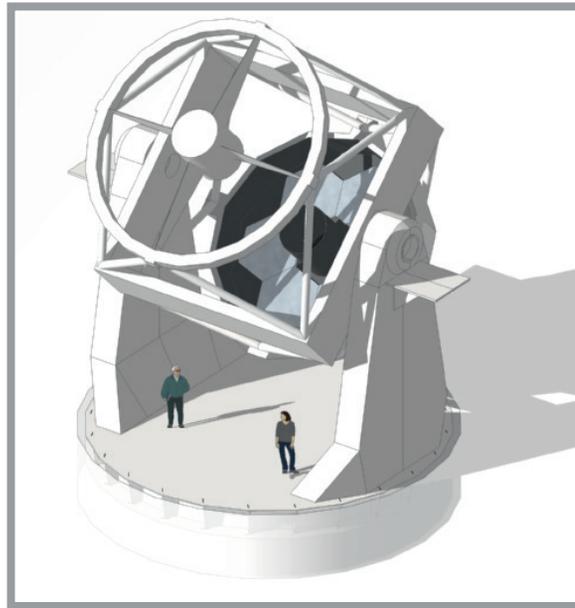
Core to the NSO is the Liverpool Telescope (LT). Owned and operated by Liverpool John Moores University (LJMU), the LT is the **world's largest robotic telescope**. It is used by professional astronomers around the globe for world-leading research and located at a top international observatory on La Palma in the Canary Islands. Its autonomous nature and ongoing programme of instrument development allows for the most efficient scheduling programme and fast response to transient astronomical events, leading to cutting-edge research.

LJMU generously dedicates 10% of this unique telescope's time to UK and Irish schools, giving the next generation of Science, Technology, Engineering and Maths (STEM) professionals an unequalled opportunity to engage with the global scientific community.

In the future, this opportunity will become even more exciting. Building on the success of the LT, LJMU are planning an even bigger, more advanced robotic telescope. As we move into the 2020s, this new telescope will be **a leap forward for observational astronomy** in a new era of large automated surveys and "big data" challenges and, again, education will be a key component.

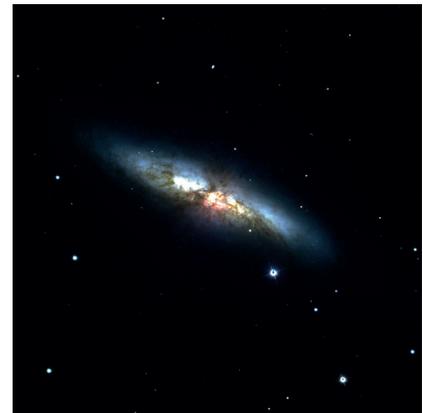


As well as having a significant impact on teaching and learning within schools, the NSO is also **committed to providing outstanding public engagement**. Working with LJMU's Astrophysics Research Institute, we organise and deliver a wide range of events for the wider public from public talks to street theatre. Collaborating with a diverse range of people and institutions from artists and film makers, to garden designers and festivals allows us to **bring the wonders of the Universe to a whole new audience**.



Large Robotic Telescope

- 4 Metre Mirror
- Rapid Response
- Innovative Design



The Liverpool Telescope

- 2 Metre Mirror
- Unparalleled Flexibility
- Fully Autonomous



STEM Education and the role of Astronomy

Astronomy not only excites and motivates pupils, it also links together many STEM areas. Science is at the root of astronomy, but it also depends upon cutting-edge technology, advanced mathematics, and high-tech engineering.

The NSO provides its students with a broad set of STEM skills and enables teachers to bring current research into the classroom. Astronomy is a particularly powerful tool for this – it has been seen that **students' achievement within GCSE Astronomy has led to a "higher degree of knowledge in other science courses"** (Jeffes, 2012).

In 2013, the NSO commissioned an independent evaluation from the Centre of Science Education at Sheffield Hallam University. They concluded that; **"In our view, [the NSO] has unprecedented reach, and is one of the most significant educational initiatives in the STEM field linked to an Higher Education Institution"**.

"In a world in which the UK's competitive advantage will depend increasingly on innovation and high-value products and services, it is essential that we raise the level of our STEM skills."

The Race to the Top by Lord Sainsbury (2007)





Our Vision: To become a recognised world-leading resource for the enrichment of STEM subjects.

Student Skills

Independence: Student-led projects and open-ended investigations promote independent working and exploration.

Interaction: Collaborative working is key to modern science and is explored through group projects, discussion groups etc.

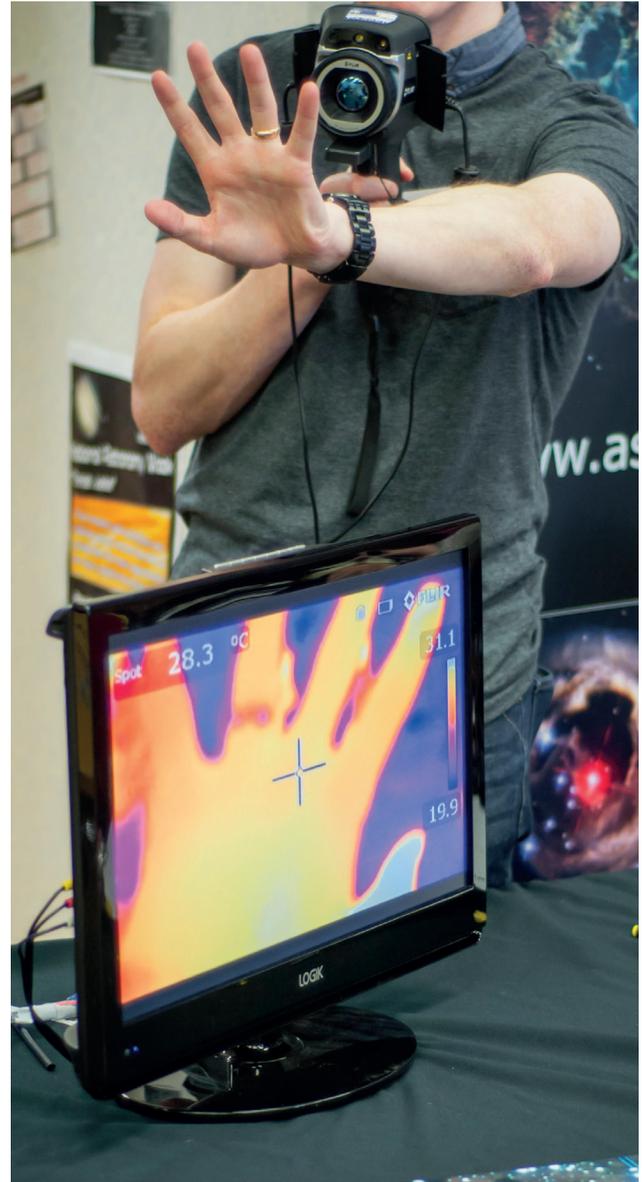
Experience: Working alongside professional astronomers, engineers and software developers gives important insights.

Inspiration: Astronomy and space are sources of endless inspiration and wonder, which are harnessed and focused by the NSO.

Knowledge: As well as increased understanding of the Universe, the NSO allows students to explore the science and technology that underlines our understanding.

“[I feel] like you are doing something in physics instead of experiments where everybody already knows the answer.”

NSO Student



Numeracy: Astronomy and maths work side by side and by exploring how the Universe works we introduce students to maths in a novel way.

Computing: Observations taken require students to use dedicated software to manipulate and analyse the data in order to understand the objects they view.

Curiosity: The NSO aims to allow students to explore science, to experiment and to promote asking questions.

Organisation: Student log-ins allow pupils to maintain their own observation requests and make decisions about the compromises needed to obtain data.

Research: A modern and developing suite of student-led, independent projects allow every student to become a real scientist and contribute to research.

nsO NATIONAL SCHOOLS' OBSERVATORY

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LIVERPOOL JOHN MOORES UNIVERSITY

LEARN ALL ABOUT THE LIVERPOOL TELESCOPE

Register with us now to get access to the world's largest fully-robotic telescope, Liverpool Telescope and learn all about the Universe with our extensive web resources.

IMAGE OF THE MONTH: NOVEMBER 2017

FREE access to the world's largest robotic telescope **The Liverpool Telescope**

Run by professional astronomers, find out what the **NSO** can do for you.

Part of Liverpool John Moores University

Case Study: Niamh Fearon, Work Experience

What do you do?

I am currently a third year student at the University of Manchester studying for a Masters in Physics with Astrophysics. I chose to study at Manchester because of its highly ranked physics department and also for its wealth of astrophysics research opportunities which includes the Jodrell Bank site where the Lovell Telescope is located.

What got you interested in astronomy?

I have been interested in astronomy since I was a child. I used to go to the planetarium at the weekend to watch the shows about the Solar System and all the planets within it. Ever since my love for science and maths has grown and I always had the most interest in these subjects at school. I enjoy keeping up to date with the latest physics and astronomy news and the astronomy society at my university hosts weekly lectures which I attended. I recently attended a lecture from a specialist who is working on gravitational waves with the LIGO VIRGO collaboration, members of which who have just been awarded the Nobel prize.

When did you come across the NSO?

I applied for the NSO work experience week in 2012 but was unsuccessful in gaining one of the limited places but applied again the next year and attended the week in summer 2013.

How has the NSO helped you?

During the week we listened to lectures from the academics at the ARI and also worked on a group project. The project we were assigned was to study variable stars and research the nature of them. I really enjoyed my week at JMU and it influenced my A-level choices and also the course I wanted to study at university. In summer 2017, I was given the chance to come back to the ARI and help supervise the students who were attending work experience week. It was a great opportunity to show off how the NSO has helped me to study astrophysics and that it is an interesting and rewarding field of science.





“Cutting-edge astronomical research
inspiring the next generation of scientists.”

- University Alliance

Core Aims

To realise our vision, we have identified four core aims to guide our development over the period 2017-2022

1. To increase the scope and recognition of the NSO as a resource for all STEM education
2. To increase engagement with under-represented groups in STEM
3. To demonstrate the impact of the NSO
4. To ensure the long term success of the NSO



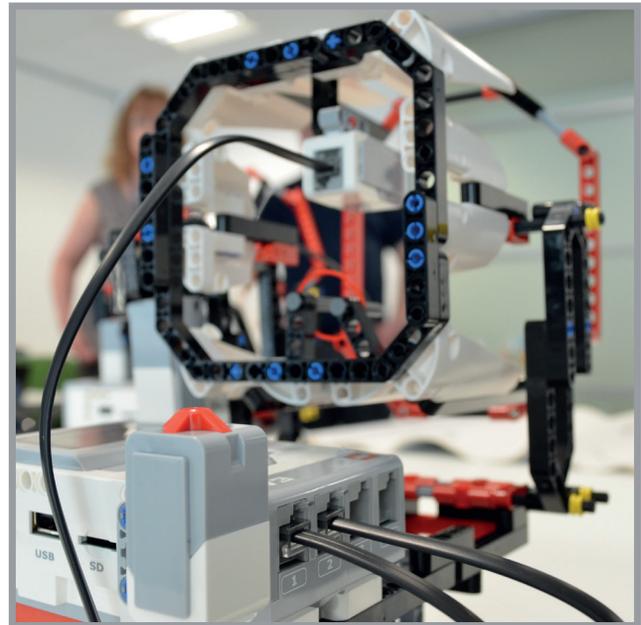
Aim 1: Increase Scope

The development of LJMU's newest telescope opens up new opportunities to go beyond the school science lab and into all STEM areas. Using cutting-edge engineering and innovative materials, the telescope will be a showcase for the excitement and challenges of the modern engineer. The next decade will also see a vast increase in the data available to astronomers using the telescope. If they are not to be swamped we need significant developments in both computing and the mathematical tools needed to sift through the flood of information. All these advances will have impacts far beyond astronomy, and the NSO will bring them to pupils and teachers as they develop.

Such advances are not just for older students. Research shows that pupils' attitudes to possible careers become fixed at a young age, and so showing younger children the range and scope of opportunities ahead of them is essential and, again, astronomy is an ideal tool for this, leveraging their interest in space.

Targets

- Broaden the scope of resources to ensure that each branch of STEM is well represented
- Increase the involvement of primary schools
- Double the number of users actively involved with the NSO
- Increase the visibility of the NSO outside of the UK and Ireland



Aim 2: Reach under-represented groups

A glance around any university science class shows that science careers are still dominated by a narrow range of gender, social and ethnic groups. The under-represented groups embody a vast wasted resource, as well as the individual loss to each person who never finds their ideal career, so finding ways to increase their engagement with science is essential. Again, astronomy has the power to break down the barriers and appeal to groups under-represented across STEM, and so we are adopting this as a core aim of the NSO.

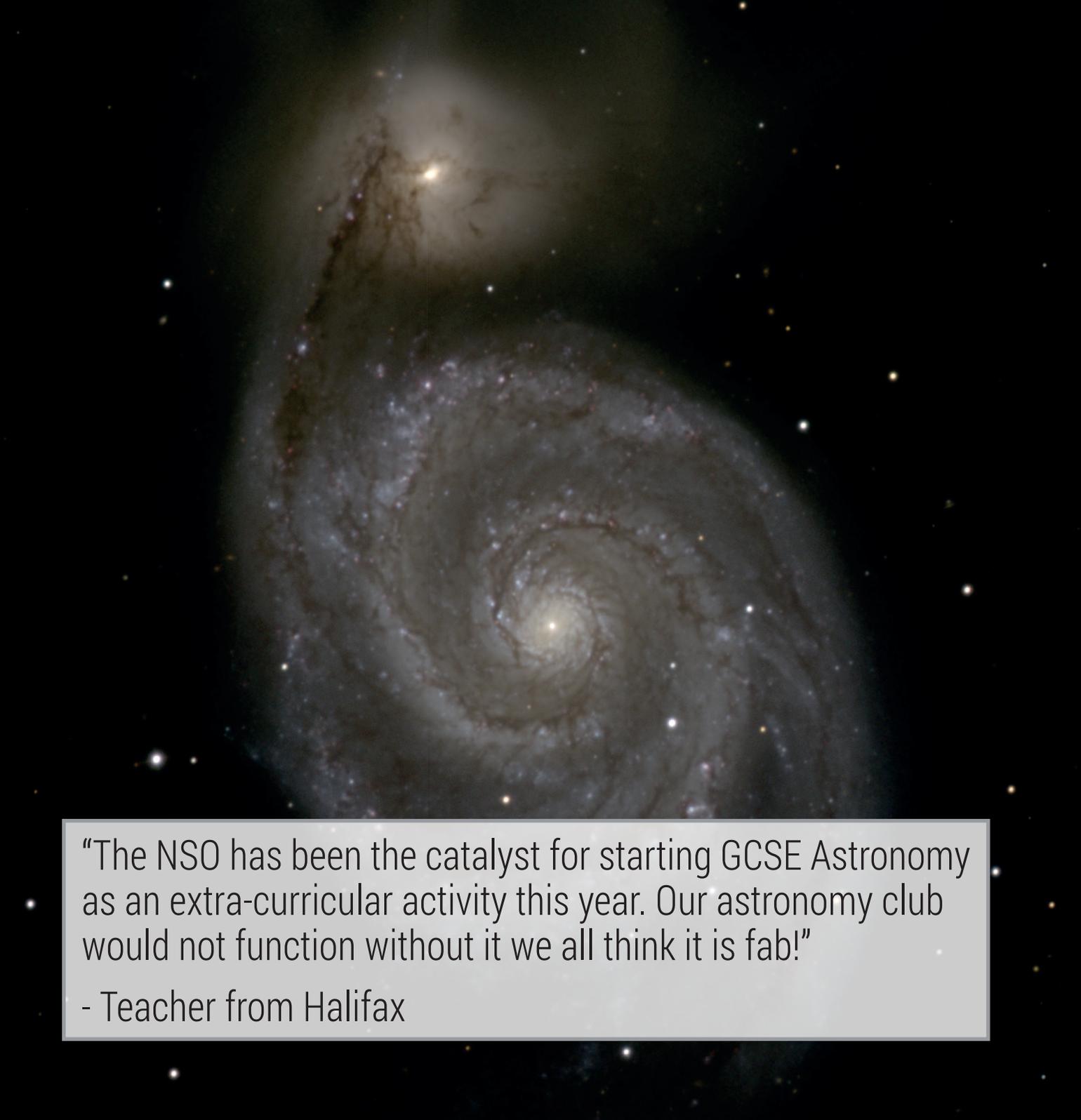


Targets

- Open access to individual users on the NSO, including the development of a suite of student-led activities and research projects
- Broaden the range of teachers registered on the NSO beyond specialist physics and astronomy teachers
- Engage with 3 defined under-represented communities to create more positive attitudes towards STEM. Specifically:
 - Poor socio-economic areas in the north of England
 - Geographically remote schools and their communities
 - Hearing-impaired users

“The one topic (amongst the sciences) that generated universal enthusiasm was any study of astronomy”

Pupils' and Parents' Views of the School Science Curriculum, Osbourne and Collins, 2000



“The NSO has been the catalyst for starting GCSE Astronomy as an extra-curricular activity this year. Our astronomy club would not function without it we all think it is fab!”

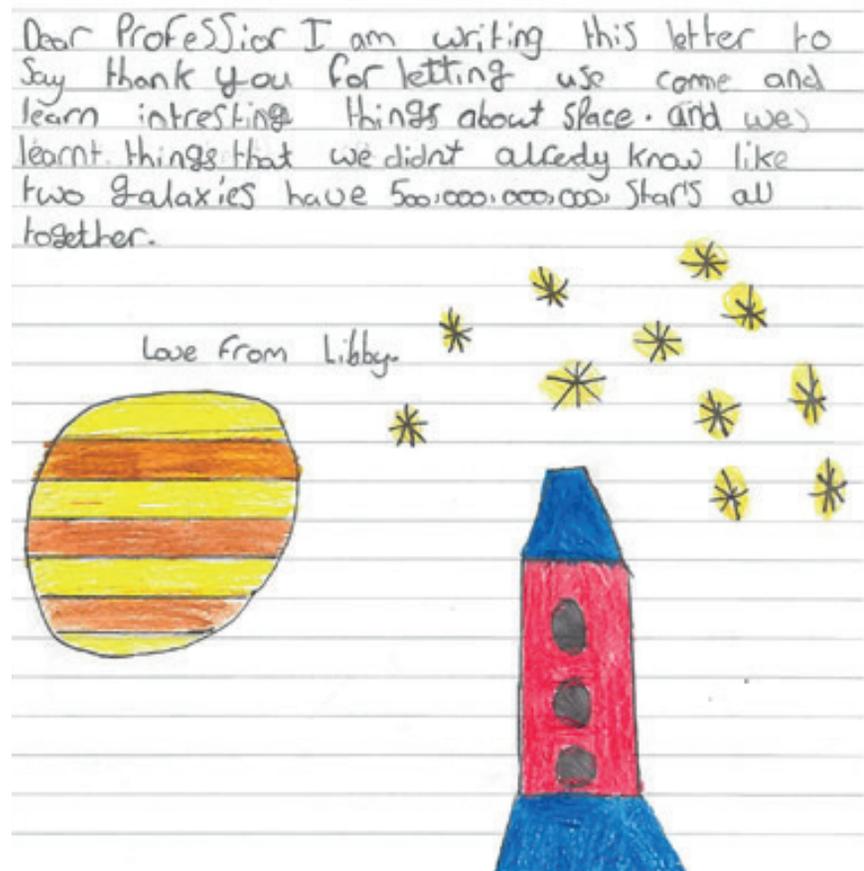
- Teacher from Halifax

Aim 3: Demonstrate our Impact

Feedback from teachers, pupils and an independent evaluation have shown that the NSO is already having an impact. This strategy document outlines significant planned developments for the NSO so it is vital that we continue to gather feedback to inform our choices and determine the impact we are having.

Given the wide range of audiences and stakeholders, this will involve a number of activities including user surveys, modern online communication tools, and website statistics analysis, all of which will be tied together by a long-term independent evaluation.

In this way we can not only demonstrate our impact, but ensure that every aspect of the NSO is fit for purpose and reaching the right audience.



“The great thing about incorporating the NSO activities into your lessons is that they engage pupils with real data to solve real problems in areas that continue to fascinate them, such as astronomy and space exploration - this really is how science works.” Teacher (Portsmouth)

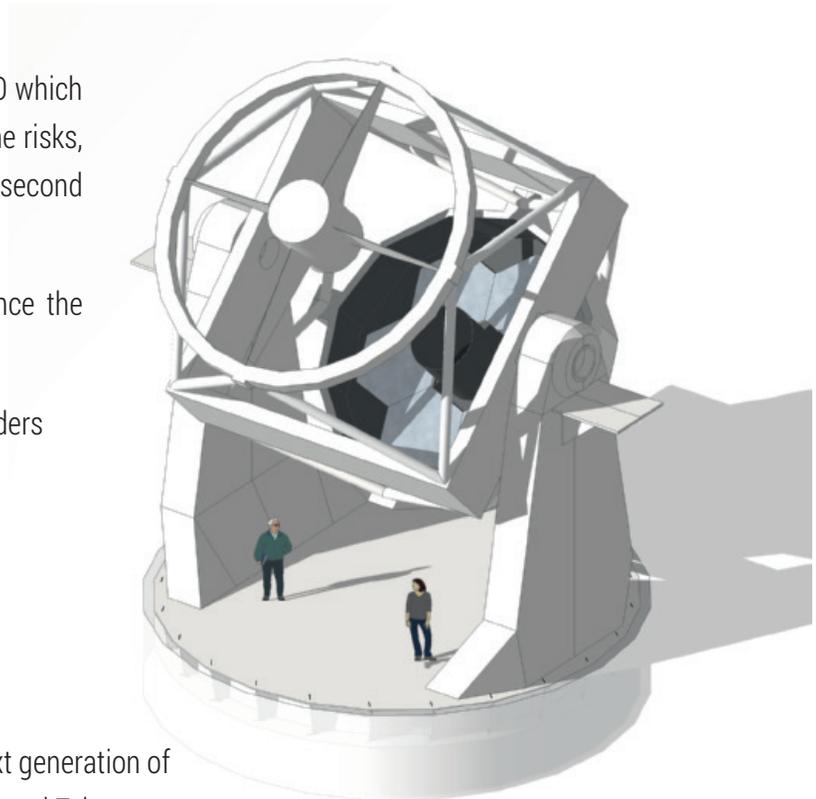
Aim 4: Long term success

The NSO has grown substantially since 2004, and under this strategic plan it will continue to expand. However, long term sustainability requires long term planning and resources. The future contains various risks as well as many exciting possibilities, and we need to ensure that we capitalise on the positives and neutralise the negatives well in advance.

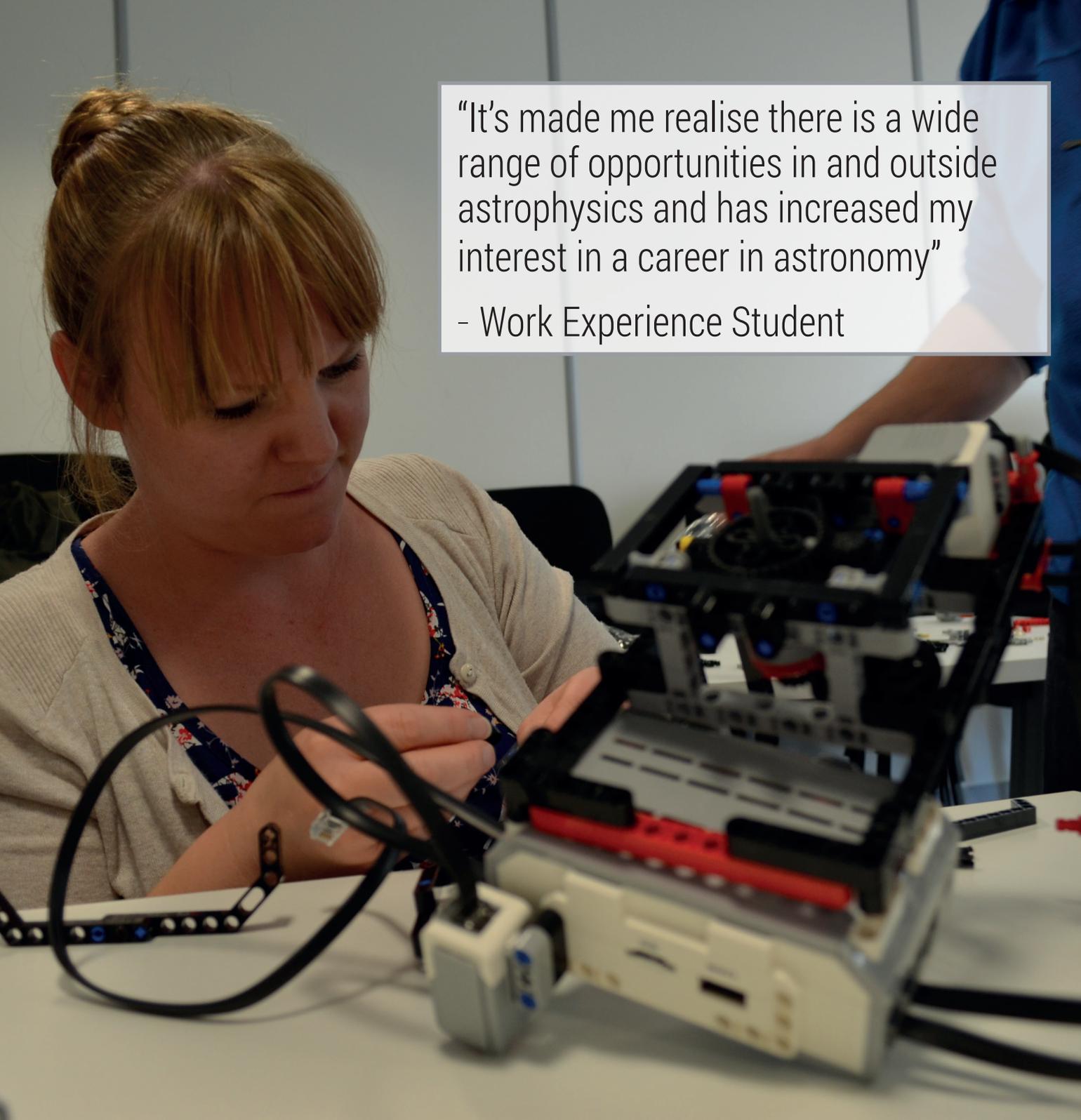
Guided by the NSO Board, who bring together expertise from astronomy, education, business and politics, we will continue to look ahead for both challenges and opportunities and make sure that we are always ready for them.

Targets

- Produce a robust plan for the future of the NSO which maximises the opportunities, and minimises the risks, of the development and operation of LJMU's second telescope
- Continue to attract external funding to enhance the scope and impact of the NSO
- Increase the visibility of the NSO with stakeholders



The next generation of
Liverpool Telescope



“It’s made me realise there is a wide range of opportunities in and outside astrophysics and has increased my interest in a career in astronomy”

- Work Experience Student

Case Study: Neil Mawson, Software Engineer

What do you do?

I am a Senior Software Developer; I work for a company designing and maintaining software for Further Education colleges. I have learnt a range of different computing languages to do this building on skills that I picked up during the course of my PhD in Astrophysics where I focussed on astronomy instrumentation and image analysis. Prior to this, I completed a masters degree in Astrophysics in Liverpool.

What got you interested in astronomy?

I think some of my early school science lessons covering space and astronomy got me interested in the subject. I was always fascinated in the objects we can see in the night sky and what is behind them, how they came to exist and what they might look like in the future. I also love photography, including taking images of the night sky, and was fortunate to buy a telescope as a teenager to further my interest in astrophotography.

When did you come across the NSO?

I came across the NSO when I was at Sixth Form College (Birkenhead). My tutor at the time knew of my interest in astronomy and suggested a side project using the resources available through the NSO. I did an investigation into the moons of Saturn, tracking their paths over the course of a few weeks and figuring out which moon was which. It was amazing to get the observations back from the telescope and compare them to what I could see from my back garden.

How has the NSO helped you?

The NSO helped cement my decision to do astronomy at university. It gave me a taste of what work goes into scientific investigations in astronomy, rather than just seeing the amazing views. It allowed me to carry out real science using data from a professional grade telescope, which at that stage in my life was an amazing opportunity.



Case Study: Sarah Llewellyn-Davies, Teacher

What do you do?

I am a teacher of chemistry and astronomy, along with general science at KS3, in a large secondary 11-18 comprehensive school in North East Wales. I have been teaching for almost 30 years and still adore my work, despite the increasingly hectic nature of the current teaching climate. I was humbled to have been awarded the RAS Patrick Moore Medal for Education in 2015 and I am currently one of the Lead Educators with the National Space Academy.



What got you interested in astronomy?

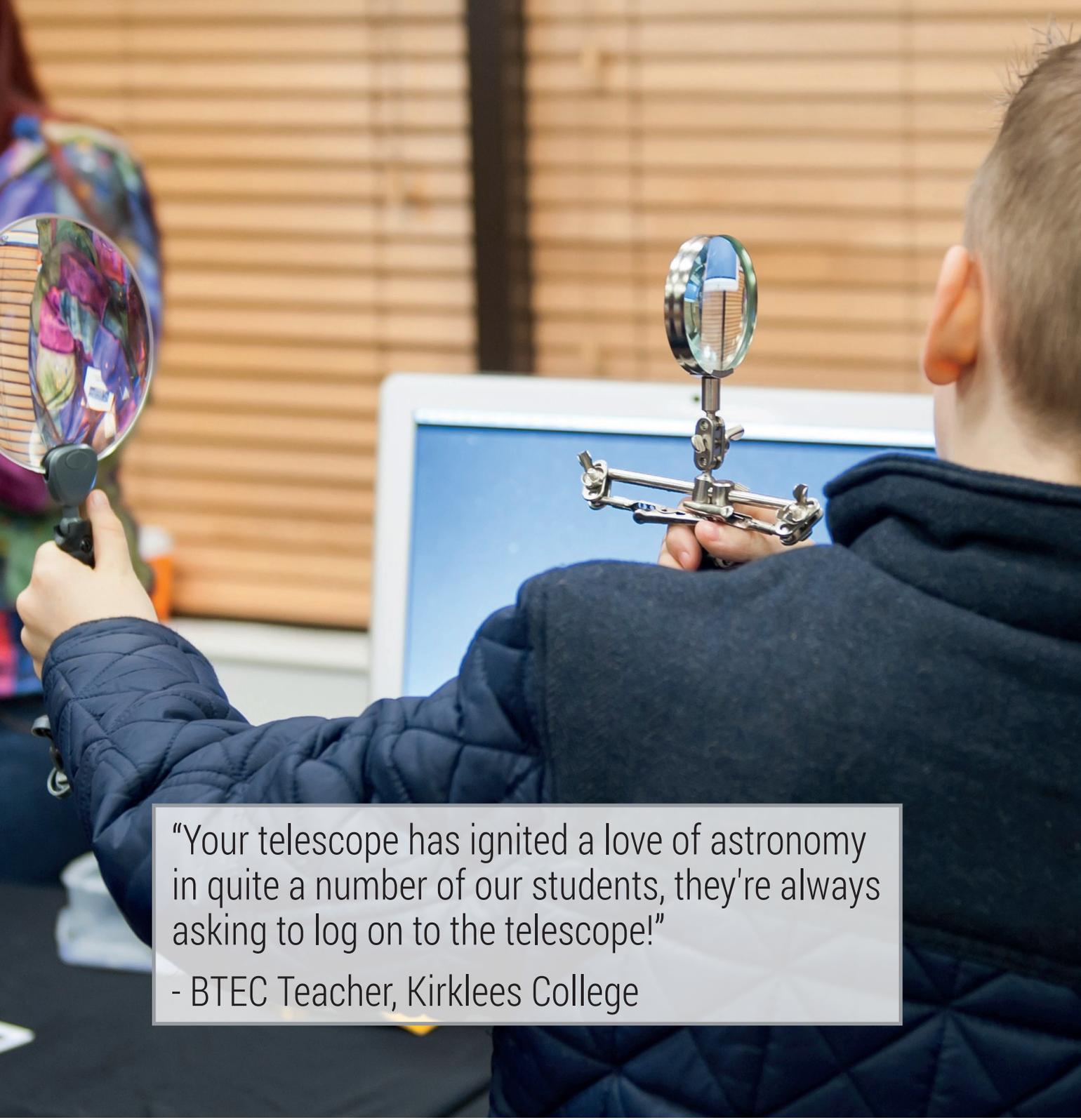
I first became interested in all things space when I was a little girl, when I would watch the Sky at Night with my father. I still have memories of the Moon landings even though I was too young to stay up to watch them. What could be more inspiring?

When did you come across the NSO?

In 2006, almost by chance, I attended an incredibly inspiring CPD event on the use of robotic telescopes, which led to me introducing the same to my equally fascinated students for the first time. Very shortly afterwards I discovered the NSO and was amazed by the educational facilities and information it offered to both students and teachers, especially as all of it was free to use. I then suggested delivering GCSE Astronomy and quickly gained the school Governors' approval. After bringing my first ever group of GCSE Astronomy students to the IOP lecture tour presented by Professor Andy Newsam in 2009, there was no looking back.

How has the NSO helped you?

The benefit of such an outstanding resource supported by its equally outstanding team of educationalists has been immeasurable. Every year since my Astronomy education journey began, at least one of my students has gone on to study astronomy and astrophysics at University. I owe a huge debt of gratitude to the NSO for enriching my teaching career and helping to inspire so many of my wonderful students to continue their study of STEM subjects at a higher level.



“Your telescope has ignited a love of astronomy in quite a number of our students, they're always asking to log on to the telescope!”

- BTEC Teacher, Kirklees College

Partners

Since the NSO's inception, we have been fortunate to work with many partners in order to develop as a project. Most importantly, we wish to thank the vast numbers of teachers who have engaged with this project along the years, and without whom we would not be able to inspire the next generation with STEM.

We are grateful to the following charities, organisations and funding bodies for supporting our work over the years; the **Science and Technology Facilities Council** (STFC) for funding several projects through Public Engagement Large Awards, **The Ogden Trust** for supporting the NSO staff through the Ogden Science Officers programme, the

Royal Astronomical Society for continued support and oversight through the NSO Advisory Board, the **Institute of Physics** for continued support and collaboration, the **Liverpool Telescope** Group, the **Instituto de Astrofísica de Canarias**, several programmes funded by the **European Commission**

under the auspices of the European Union, **Spaceport**, the **Faulkes Telescope Project**, **Pearson**, the **Royal Observatory Greenwich**, **The Observatory Science Centre**, the **European Space Education Resource Office – UK** for supporting NSO staff through the National Space Ambassador programme, the **National Astronomical Research**

Institute of Thailand for the collaborative work spreading the NSO into Thailand through an STFC Newton Fund grant, and the **World Museum** part of the National Museums Liverpool group.



Summary

The NSO is a world-leading educational initiative that uses the wonders of the Universe to inspire young people and teachers in science, technology, engineering and much more. It already has a significant reach and demonstrated impact, but through this strategic plan, we will be expanding both in size and scope: across multiple subject areas, into under-represented groups, and out of the classroom. Truly bringing access to the Universe to all.



Access to the Universe for All



National Schools' Observatory
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NSO teacher field trip to visit the
Liverpool Telescope on La Palma

