

# Science, Innovation and Technology Committee

Oral evidence: Public engagement, citizen science and UK astronomy and their role in increasing diversity and inclusion in STEM, HC 329

Wednesday 17 April 2024

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[Watch the meeting](#)

Members present: Greg Clark (Chair); Dawn Butler; Dame Tracey Crouch; Dr James Davies; Rebecca Long Bailey; Stephen Metcalfe; Carol Monaghan; Graham Stringer.

Questions 176 - 206

## Witnesses

I: Dr David Arditti, President, British Astronomical Association; and Professor Chris Lintott, Professor of Astrophysics and Citizen Science Lead at Physics Department, University of Oxford.

II: Dame Maggie Aderin-Pocock, Chancellor, University of Leicester and astronomy educator; and Chas Bishop, CEO, National Space Centre.

Written evidence from witnesses:

- [Dr David Arditti](#)

## Examination of witnesses

Witnesses: David Arditti and Professor Chris Lintott.

Q176 **Chair:** The Science, Innovation and Technology Committee continues its inquiry into UK astronomy.

We are very pleased to welcome our first pair of witnesses. Joining us in the room is David Arditti, who has been President of the British Astronomical Association since 2021. He chairs the Sir Patrick Moore Prize Committee, which awards prizes to promote amateur astronomy, and he is an accomplished composer of contemporary classical music in his spare time.

Joining us virtually is Professor Chris Lintott, Professor of Astrophysics and Citizen Science Lead, Department of Physics at the University of Oxford. He is an author and broadcaster for the BBC's "The Sky at Night" programme. He is a member of the collaboration that is building the Vera Rubin Observatory in Chile, which will be equipped with an 8.2 metre diameter mirror and a 3,200-megapixel camera to create the widest, deepest and first-ever 10-year movie of the night sky—something to look forward to. Thank you for joining us today.

We are very interested in talking about amateur astronomy and the contribution it makes. Starting with Mr Arditti—

**Dr Arditti:** Sorry, my correct title is Doctor.

**Chair:** Forgive me. I am glad that you corrected that.

Dr Arditti, I am told that there are 192 amateur astronomy societies across the UK. Tell us a bit about the contribution of amateur astronomy.

**Dr Arditti:** Amateur astronomy remains the only area of science in which amateurs make a really big, serious contribution that is important to the professional community. The reason is obvious: the sky is huge and professionals cannot monitor it all the time. They increasingly have capability to survey all the time, but only to a certain level of detail or depth. Amateurs can study objects that, for one reason or another, are neglected—they might not be particularly fashionable for the sources of research funding at the moment but might become more important later, so it is important to keep records going.

Amateurs take part in projects that professionals co-ordinate. An important part of the BAA's work is linking professionals with amateurs and co-ordinating projects on all kinds of different objects in the sky: solar system objects, objects further out in the universe, stars in our galaxy—variable stars in our galaxy—and more distant objects.

Amateurs can do very sophisticated work such as spectroscopy, which is the splitting of light from stars into its component colours and analysing it. They can detect planets around other stars. They can confirm



professional discoveries like supernovae—exploding stars in distant galaxies.

On a more local level, they collaborate with NASA and ESA in monitoring probes that they send to planets, which typically look at a small area of the planet and are there for only a short time. We can provide a longer-term context, because we have amateur observers all over the world and have been keeping records for a long time. We can tell them the long-term weather on Jupiter or Mars, which helps to put the more detailed discoveries from probes into context.

There has always been that interrelationship, and a lot of respect both ways. It has always surprised me how egalitarian astronomy is. There is little sense of separation.

The BAA arose when it was separated from the Royal Astronomical Society in the late 19th century. Astronomy started to become professionalised and there was a need for a society catering for amateurs.

We have always had a certain number of professional astronomers in our ranks. Many of our members, if not professional astronomers, may be professional scientists in other fields, so they know what they are doing.

Q177 **Chair:** You mentioned that certain fields are unfashionable for research funding. Will you give us examples of those that amateur astronomers pursue?

**Dr Arditti:** Meteors are small bodies of the solar system that frequently collide with the Earth. Amateurs monitor exactly where they are, what times of the year they occur and how they are changing. They are associated with comets, which, when they disintegrate, produce meteors.

They are fairly unpredictable phenomena. They are affected by subtle gravitational interactions between the solar system and all kinds of collision processes.

We keep track of these things and of comets. The orbits of comets constantly change, so amateur observations are important in knowing where these things, and some of the small asteroids, are.

Q178 **Chair:** Why don't professionals do that? Why is it the preserve of amateurs?

**Dr Arditti:** You do not need big equipment to observe these things. A lot of it can be done with the naked eye, with binoculars or with small telescopes. There is more funding for slightly more glamorous areas—looking at black holes or the expansion of the universe. Chris might comment or disagree on this, but I would say that there are certain areas that are fashionable at the moment, with other areas being less so.



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Noctilucent clouds are on the border of the Earth's atmosphere and outer space. We do not know what causes them but they have become much more common in recent years. They might be linked to climate change, to space debris, which might be linked to human activity, or to solar activity. Amateurs monitor that. There is some professional activity in that area now and a specific satellite has been looking at it from above, but it is not really on professional astronomers' radars. It falls in the cracks between atmospheric science and space science.

Q179 **Chair:** Professor Lintott, you are a professor at the University of Oxford. What is the interaction between amateur astronomers and people in your professional roles?

**Professor Lintott:** I can add to what David already said. The Royal Astronomical Society is a network across the country, as you mentioned at the beginning of your question. It does important work in engaging with the broader public. I spend a lot of my time talking to amateur astronomical societies about projects like the Vera Rubin Observatory, as an effective way of communicating broadly. We are very lucky in astronomy that this network of enthusiasts contribute to the science and are cheerleaders and our representatives in their communities. That is a valuable aspect of the amateur-professional crossover that should not be forgotten.

I grew up in a local astronomical society and owe my interest to the efforts of those running Torbay Astronomical Society several decades ago.

Q180 **Chair:** How old were you when you first took an interest, and how did you find your local society?

**Professor Lintott:** I was lucky that my school had access to an observatory and took the slightly crazy decision to give a bunch of 11-year-olds and 12-year-olds the keys to the observatory and to encourage us to make our own observations. I spent an awful lot of my evenings and most of the summer holidays working with people from the society to try to make observations—without too much success, I should say. It is not that we were doing groundbreaking research, but the thought that we might be able to do so was exciting. We counted meteors and observed a few distant galaxies.

The new aspect of this collaboration in the past 15 years is that the amount of data from mostly professional observatories has exploded, thanks to digital cameras and new technologies. There has become a need to enlist not just amateur astronomers but the general public—people who have not thought about astronomy before—in sorting through that data to identify unusual objects and to classify everything from galaxies to planets.

My main professional involvement has been in building and running a platform called the Zooniverse, which is UK-led in collaboration with lots



of partners in the US in particular, and in producing a website where people can log on and contribute to science in just a few minutes.

We have the traditional form of amateur astronomy, monitoring the sky, which is still important, but we now have the new form of what is often called citizen science, pioneered in this country by astronomical collaborations. We invite people to make use of the data that we collect from the cosmos, and that is becoming increasingly important.

**Q181 Chair:** Tell us where we and those tuning in to this hearing can find that website.

**Professor Lintott:** You can go to Zooniverse.org and pick a project. It has now expanded to about 200 projects well beyond astronomy. To give you some idea of the scale, over the 15 years or so we have been running the platform, we have had about 800 million contributions from about 2 million registered users, so this is an enormous amount of effort.

One thing that has been particularly important is that when you ask a member of the public to engage with a large dataset—to look at images of distant galaxies, for example—you find that not only are they excellent at the tasks that we imagined they might do, such as dividing galaxies into their various types, but they are wonderfully distractable. They find things that we were not expecting from the data and ask questions that we were not expecting.

This form of engagement provides not just useful scientific data but expands the range of things that we are looking at and discovering. It has been a great pleasure to, for example, use the Hubble space telescope to follow up on discoveries made by individual members of the public via our projects.

**Q182 Chair:** We shall go into a bit more detail with my colleagues, but first I shall ask the same question of Dr Arditti: how did you get into astronomy?

**Dr Arditti:** I read a book by Patrick Moore—the presenter of “The Sky at Night” on the BBC for many decades, on which Professor Lintott and Maggie have been presenters—in the school library. That is the classic route. Patrick Moore was so important in inspiring many people of my generation to get into amateur and professional astronomy.

My father had a business friend in the local astronomical society. He took me along to a stargazing session at the home of a member who, by the standards of the time, had a big, 12-inch diameter telescope, whereas now they are 6 feet long and a foot wide. He had it in a home-built observatory in his back garden. We looked at Saturn one April evening. I could see with amazing clarity all the satellites of Saturn and its rings. I had seen them through a small, 2-inch telescope, but I saw that with amazing clarity. We looked at other objects. The people were so open and keen to explain everything and share their knowledge, so I joined the society and the rest is history. I have been doing that ever since.



**Chair:** And now you are the president. That is a lovely story.

Q183 **Rebecca Long Bailey:** My constituency of Salford has its own astronomical society, and apparently the observatory was opened by Patrick Moore in the 1970s. It has been doing fantastic work in the community, ensuring that astronomy is accessible to everyone, as you and Professor Lintott described. How healthy is UK amateur astronomy, and how accessible is it to everyone in other parts of the country?

**Dr Arditti:** It is pretty healthy. The local astronomical societies are important. Many of them are in small, isolated communities. They organise meetings and get leading experts to speak to them. They are an interface between the professionals—the universities—and the grassroots, ordinary people. They organise lots of events and go into schools to show kids telescopes and how to make them and do simple observations. Youth groups such as the Scouts have an astronomy badge, and members of local societies will help with getting badges by doing simple things such as identifying the constellations.

That is really important. There certainly are problems of diversity in astronomy. That is established. The BAA is predominantly male and white, and during my term as president I have been keen to work out why that might be and to see what we can do. I am in the West of London Astronomical Society, a local society of about 200 people. It is in a racially diverse area of west London and it is more racially diverse than the BAA and much better balanced in men and women. However, it is still probably not completely representative of the community.

There is definitely an issue there. The Royal Astronomical Society studied this and spoke to young professional astronomers. It found that female astronomers still find considerable barriers to career progression. From that point of view, it is not the best example of diversity.

Q184 **Rebecca Long Bailey:** How do we compare with amateur astronomy networks in other countries for funding and access to facilities?

**Dr Arditti:** I have quite close contacts with societies in the United States, Germany and France. They all have their strengths and slightly different cultures. We are very strong. British amateur astronomy has always been very respected around the world. Our organisation has a lot of overseas members and our journal is distributed to libraries around the world. We allow amateurs from other organisations to contribute data; you do not have to be a member of the BAA to have your observation—your data—published. It is important that we do that, because we can get the largest amount of data and the biggest number of observers around the world involved, and we can publish better data.

How are we off for resources compared with other countries? We do not have much for public astronomy in Britain, apart from voluntary activity. There are not many planetaria and there are virtually no public



observatories in Britain, with only about three planetaria for the whole country.

In Germany, a lot more local observatories are funded by local or regional government. They certainly receive grants from somewhere and they are probably staffed mainly by amateurs. They are hubs for community participation in astronomy and getting people interested in science.

We do not really have that here. We have activities in schools and universities and the voluntary things are done on a shoestring by amateur societies. Some of them have their own observatories. They have bought or been given land and have built something. They usually open them to the public, to a certain extent.

It is all very shoestring. There is less involvement by local or regional government in the UK.

**Professor Lintott:** I should mention that I am honorary chair of the British Association of Planetaria. It has more than 50 members, so all scales of organisation are involved.

I know your Salford society well because it does an excellent job in engaging with the community and developing programmes with local education organisations. It is an example of what societies can do.

Interestingly, the international partnerships it has developed are with the US. It is partners with the Jet Propulsion Laboratory and uses materials developed by NASA for its purposes.

It is a slight source of regret that it is harder for us in this country to support the informal outreach we have been talking about from our own research programmes and from those of the European Space Agency. The funding that goes with our research programmes in professional astronomy and space science in this country rarely includes support to develop materials for partners in the informal education we have been talking about.

That is one serious difference between this country and, in particular, the US.

Q185 **Rebecca Long Bailey:** You mentioned that a lot of amateur astronomers in the UK are enlisted to sort through large swathes of data. Salford is doing some specific research. How is research organised in the amateur field, or do societies choose what they want to research as and when?

**Professor Lintott:** For people looking at the sky and using their own telescopes to make observations, there are international and national organisations such as the BAA that take on a co-ordinating role. As David mentioned, observations can be brought together.

The newer form of citizen science that I was talking about is mostly online projects, which people find in their lunch breaks and spare time.





We deliberately design the projects so that a contribution can be made quickly. Somebody who has not been interested in astronomy before can go to the website and try to discover a planet. That authentic engagement—saying to someone, not, “I am very clever and I’ve discovered a planet,” but, “Together, we can do this”—is transformative. It can be the spark that changes somebody’s attitude to science or encourages them to do more, including making their own observations. Those things are usually co-ordinated online by Zooniverse or various space agencies or observatories.

**Q186 Rebecca Long Bailey:** How structured is co-ordination between local societies and universities? Salford is lucky as it is next to Manchester University, Salford University and Manchester Metropolitan University—it has all that on its doorstep. Other societies will not be in the same position. Is that support co-ordinated for them?

**Professor Lintott:** No, that is all local and ad hoc. It is common to have the relationship you are talking about, but it depends on the resources that a university has to put into its engagement.

**Q187 Dr Davies:** I want to raise the impact of light pollution, both from space and from Earth, on amateur astronomy. Will you describe the nature and extent of light pollution from space, including from satellites?

**Chair:** We need to be on time. That is a big question, but please give a summary answer.

**Dr Arditti:** And these are two quite different subjects. Government and local authorities have the power to deal with light-based pollution, whereas satellites will require international agreement. It is an increasing problem because the sky will be full of small satellites put up for occasional purposes. There is already the Starlink system. Several thousand satellites have been put up recently, but with all the launches scheduled by Russia, China, India and Europe the projections are that there could be hundreds of thousands visible to the naked eye. The traditional sky as we know it, with constellations, would be almost obliterated by a tapestry of local lights moving back and forth constantly. We need urgent international action. We will not stop this, because there are powerful international drivers behind it, but we must moderate it. Professional astronomers are working hard through the International Astronomical Union to get this discussed by United Nations committees.

When this Committee writes its report, I would like it to emphasise the fact that in this country, there are lots of problems with the control of light pollution. It was brought under the Clean Neighbourhoods and Environment Act some years ago, whereby local authorities have some powers to regulate and take it into account under planning. There are, however, very large gaps in the legislation. For example, all sports facilities are completely exempt—they can do whatever they like. Anything to do with transport is completely exempt. Anything to do with defence is completely exempt.





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There are very large holes. A golf course or sports stadium can have as much lighting as it wants. We are not asking for all the lights to be turned off—let us be clear about that. We are asking for sensible lighting at the time and place it is needed and to make it efficient, eliminating the leakage into space as much as possible. Britain has a relatively poor record—

**Chair:** We need to be more concise, otherwise we shall not get through our questions.

Q188 **Dr Davies:** I will move to Professor Lintott for his perspective. Clwydian Range and Dee Valley has a dark skies initiative. How successful are such initiatives? We have heard about the need for an international agreement on satellite pollution. Are other countries doing things differently from us to achieve that?

**Professor Lintott:** The satellite issue is very difficult. International diplomacy is under way and is being led at the UN by the International Astronomical Union. I encourage everyone to look into the issues that must be solved internationally.

Your point about dark sky parks is interesting. Places from Dumfries and Galloway down to Exmoor, the Channel Islands and many places in between have found dark skies to be a way of promoting tourism and interest in an area. Community-supported efforts have been very effective, but the moment you introduce large numbers of lower satellites, you lose the joy of a dark sky. We should remember that for most people, the nearest wilderness is space—it is just above their heads. We have a right to enjoy a reasonably unfettered view of the night sky, which is transformative for many people. We risk losing that view forever in the next 10 years unless there is urgent action.

**Dr Davies:** It is a very big challenge. Thank you.

Q189 **Dame Tracey Crouch:** I have a brief question based on your replies to an earlier question. How much does it cost, on average, to be an amateur astronomer?

**Dr Arditti:** How long is a piece of string? You can do lots of useful work with the naked eye, monitoring meteor showers or looking at some of the brighter variable stars.

I would not say that it is the most expensive hobby. I am sure that racing yachts is much more expensive. Indeed, in a sense it has become cheaper because the equipment is mass manufactured, mainly in China. When I bought my first telescope in 1982—a 6-inch diameter telescope—it cost £150. Today, a 6-inch telescope costs £250—almost the same now, in absolute money, as then. It would be better today, too. You do not have to spend a tremendous amount.



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The BAA offers grants to amateurs if we think that they have a good idea for a research project and need the money to buy equipment—telescopes, cameras, filters and various things.

That is not the main problem with participation. I think that time is a bigger factor.

**Professor Lintott:** I add only that the advent of open data and the free sharing of images from space missions and observatories mean that it is easy to be an astronomy fan online. The projects that we put together are open to all to contribute. We have deliberately lowered the barriers to access images from missions to Mars and so on.

Q190 **Stephen Metcalfe:** Professor Lintott, you talked about the Zooniverse, which was helpful and interesting; thank you very much for enlightening us on that. Do citizens need any particular skills or expertise to take part in citizen science projects?

**Professor Lintott:** That is an excellent question. I threatened your Clerks that I had a three-and-a-half-hour lecture on it, but I shall spare you that.

The projects are often designed so that anyone can take part. You need a web browser and a few minutes' training. What is interesting is that we see many citizen scientists and volunteers—some with amateur astronomy backgrounds, and some coming in cold—developing skills over the course of these projects. I am thinking of, for example, a misbehaving star known as Boyajian's star, which was spotted by volunteers on our Planet Hunters project. It dimmed suddenly and unexpectedly and came back to full brightness. It then, completely unexpectedly, started blinking as if somebody was fiddling with a dimmer switch. This was a mysterious object, but before the professionals in the project could get to it, our volunteers online had developed their own model and hypothesis, involving a dust disc around the star blocking out the light.

It was publishable work, so we see that these projects provide opportunities for skill development. Indeed, we have some evidence that those who develop skills through these projects, such as programming or data analytic skills, go on to use them in their workplace. We see these projects as a way of contributing to upskilling the workforce and we are looking at developing programmes for schools and for informal education, where we can use the projects and the motivation that they provide for people to develop skills and pick up things that would be useful elsewhere.

Q176 **Stephen Metcalfe:** Brilliant. Thank you very much. Dr Arditti, you have talked about the important role of the BAA, and about your members and the contribution they make. Do they take part in citizen science projects?

**Dr Arditti:** Yes, many of them do. There are many types of citizen science projects, including the type that Chris has organised with his



Zooniverse project, where all the data comes from professional telescopes and amateurs sift through it. There are other types: there is a project called the ExoClock, which is to do with ESA; a satellite is going up to look at planets of other stars and measure their properties. Professionals need to keep their orbits under review and many of these orbits can be timed. The dimming of the star as the planet goes in front of it can be timed with small telescopes.

That is a citizen science project co-ordinated by professional astronomers in universities, which amateurs feed data into, gained from small telescopes or maybe bigger telescopes that they can hire from time to time. The BAA gives a lot of help and co-ordination with that. It is one of our main *raison d'être*. We are organised into sections for each area of astronomy. We have a variable star section and one that deals with the exoplanets. More experienced members will tutor the beginners in the techniques required.

**Q177 Stephen Metcalfe:** Excellent. I have touched on my next question, which is about whether your members in the BAA promote citizen science. Is there a role for you in that, and are you resourced enough to be able to carry it out?

**Dr Arditti:** I think we promote it to a certain extent, but we do not have to. We do not have to do what anybody else wants to do, because we are independent, so if our members want to do something else we do what they want; but, yes, we have a lot of meetings where people like Chris will talk to us and explain what they want to do, and we will try to find people who want to take part in those projects.

**Q178 Stephen Metcalfe:** Yesterday, my five-year-old granddaughter, Daisy, asked out of the blue, "How old are planets?" That is not actually the question. I happen to know that the Earth is about 4.5 billion years old; but I went to look for resources that you could provide to a key stage 1 student to help them to get enthusiastic about astronomy and understanding the universe. I wondered what role the BAA and you, Professor Lintott, have in providing resources that educators can use to make the subject accessible and get people excited about it, so that they become your members in the future, and professors of astrophysics in about 20 years' time. Do you think you have a role in that space, and, if so, how do you fulfil it?

**Dr Arditti:** I think we ought to. We have not done enough of it, and as president I have been keen to push that. We have just taken the decision to set up an education section. We have been taking part in the New Scientist Live show that takes place every year at the ExCeL in London, organised by *New Scientist* magazine. I think there were about 6,000 children through there on one day. They had a day entirely for children. We had our telescopes set up, and we had models of the planets suspended from distant parts of the hall. We showed the planets to hundreds of kids.



We do not have much published that is directly aimed at children. NASA has quite a lot that is suitable for the early learning stages. I think we need to do more.

**Professor Lintott:** This is very important, especially as we know that attitudes to science are set at an early age. If you wait until you are talking about careers with sixth formers, you have in some sense lost your audience already.

I think we are good at engaging through universities. The research councils, and particularly STFC, have an excellent scheme for public engagement, which focuses on exactly the early age groups that you are talking about, as well as under-served groups. The universities in the UK, many of which invest heavily in astronomy, are good at utilising that funding, so I think in any locality you would find local schemes.

What those schemes do not provide is central resources that could be used by anyone and picked up by people outside the university sector—our friends in planetaria and in local societies, and the informal network of astronomy educators.

An example would be our Vera Rubin Observatory, which is an international effort but is very well supported in the UK and funded by the research council as a programme of importance. We added, in our application, some modest funds for public engagement so that we could develop exactly this sort of central resource. That was de-scoped as not important to the project.

It was disappointing that the research council did not consider engaging the public with this research effort to be a core part of what we were trying to do. To me, the act of research goes hand in hand with communicating it. If we look at a system that used to exist—I am sorry always to be pointing to the US—NASA used to have a system where a tiny percentage of any grant had to go towards the provision of engagement, and that was a good way of ensuring that there were indeed resources online.

On that theme, NASA has a website called Space Place, and that is where I would point your inquisitive five-year-old.

**Stephen Metcalfe:** Thank you very much.

Q179 **Graham Stringer:** Can I take you back to your answers to Becky's questions? You mentioned public observatories. Can you give us a definition of a public observatory? Would it include Jodrell Bank, which is open to the public, for instance?

**Dr Arditti:** I would say so, yes. I would say it is any observatory that spends some time opening itself up and educating the public.

**Professor Lintott:** I can talk a little about Jodrell Bank, because I know that group well, and their recent elevation to UNESCO world heritage site



status has stimulated a huge amount of activity. The new visitor centre is a marvel. I encourage anyone who has not gone to see it to do so. It tells both the science and the history of the site brilliantly.

There are other large-scale efforts nationwide. I was just talking to the team behind the Sherwood Observatory, a £5-million development in Nottinghamshire that will include a planetarium and visitor centre; but there are informal places around the country where societies or other groups—universities—can open up their observatories to the public.

The most important thing, I think, is to get people to look through a telescope at Saturn or the moon. Those are the two things that really stun a first-time viewer. Those can be life-changing and inspiring events.

As David says, there is this tradition of a public observatory, but what we have, really, rather than a set of museums that do that, is a set of institutions that are willing, through volunteer support, to give that opportunity to people.

**Q180 Graham Stringer:** In our briefing notes, we have a couple of comments that a lot of citizen science is excellent—first rate—but that sometimes it falls down; there are breaks in the statistical analysis or observation. The Committee has looked at a lot of professional science and the problems of replication, and other issues. Scientists, like other parts of society, cheat. Is the quality of science from citizen scientists a problem, and what are the impacts of that? Are there any checks on it?

**Professor Lintott:** On our side, because in the Zooniverse project several people look at each image or data point, we are able to cross-check and validate. We have no problems with people submitting false data and so on, but of course, as with any carefully designed experiment, we go to great lengths to validate statistically.

On the observing side, David can say more, but, again, because we work in networks of amateur astronomers, the cross-checking that one is able to do produces data of high quality. Unlike in, for example, biological citizen science, where often people are out sampling their local river for water quality or monitoring the local environment, and it is harder to cross-check because they may be the only person doing those measurements, in many cases in astronomy—because the sky is open and can be observed from all over—we are able to escape the worst of the replication crisis.

**Dr Arditti:** Falsification of data is not unknown in amateur astronomy, as in any area, but there is not much incentive for it, really. There is informal and more formal checking. For example, I am working on, and constantly looking at, images of Jupiter produced by other amateurs, and taking images of Jupiter myself, so we know what it should look like and it is very easy to spot when someone has processed their images wrongly or exaggerated certain features in a way that is unrealistic. Informally, we know what good data looks like.



When stuff is published, it is peer reviewed in our journal, so either professionals or experienced amateurs look at it. This is accepted worldwide as authoritative. There has never been a major problem with this.

In any field, humans are fallible, but the checking is as good as it can be and if we find something is wrong, we will issue a correction later. It is important to realise that this vast amount of data is very largely correct, and even with observations of variable stars with the naked eye, you can get to accuracy of a 10th of a magnitude. That is accuracy of a few per cent in just estimating the brightness of stars with the naked eye—just by comparing the brightness of one star with another. Believe it or not, although that sounds like a subjective process, we have hundreds of observers around the world doing a similar process, and we plot them in a graph and can see where the outliers are, so we can compare that with the best professional electronic measurements and know what the errors are. I would say that the data is in general very robust.

**Graham Stringer:** I will just finish with a comment, following up on what Becky was saying about amateur astronomers in Salford. In my bit of Salford—we both represent Salford—is Crabtree's cottage, where he first measured the transit of Venus in 1639, which of course led to an improvement in Kepler's tables. Kepler's work led directly to Newton's "Principia", which is probably the most significant scientific treatise ever. It is a wonderful example of amateur science, going back a long time.

**Chair:** Without Salford, we would not have had—

**Graham Stringer:** Well, precisely.

Q181 **Dr Davies:** I think we have one or two minutes left for this panel, so, Professor Lintott, what opportunities does citizen science offer for people to move from the amateur stage up to something more significant?

**Professor Lintott:** We are seeing an increasing number of applicants, particularly for our PhD programmes, with citizen science experience, albeit often alongside a university degree—several excellent applicants have done Open University degrees later in life, for example. It provides an opportunity for skill development, as I have talked about.

We are also working hard to find opportunities for citizen scientists to publish their work, either in the main astronomical journals or in specialist publications, so that they have a track record. It is an opportunity for people to get a sense of research and to use that, perhaps, as a career step.

I would not want to suggest that most of our participants are interested in changing career. Most of them are interested in making a contribution with the time that they have available, but for those who want to do more it is clearly a useful step towards getting a sense of what being a professional astronomer, or a professional scientist, is like.





Q182 **Dr Davies:** Finally, do you think academic institutions other than your own could be doing more to assist that transition, where it is valuable?

**Professor Lintott:** Yes, there is clearly a need for something halfway between being a serious amateur astronomer, or having a serious interest, and having embarked on a full-time career. You see that in the demand for the kind of distance learning courses that many institutions provide, in astronomy in particular. I think there is an untapped demand and need, which universities could perhaps be better at responding to.

**Chair:** Thank you, Professor Lintott and Dr Arditti, for your evidence this morning.

## Examination of witnesses

Witnesses: Dame Maggie Aderin-Pocock and Chas Bishop.

Q183 **Chair:** I am very pleased to have with us Dame Maggie Aderin-Pocock, who is an honorary research associate at the University College London department of physics and astronomy. She has been the Chancellor of the University of Leicester since March, and since February 2014—over a decade—she has co-presented the long-running television programme “The Sky at Night”. In 2020, she was awarded the Institute of Physics William Thomson, Lord Kelvin medal and prize for public engagement in physics. Dame Maggie has also been president of the British Science Association.

Joining her is Chas Bishop, chief executive of the National Space Centre and a trustee of the Association for Science and Discovery Centres.

Thank you both very much for coming.

You have caught a bit of the previous discussion. Dame Maggie, you present, and followed in a very important tradition of broadcasting, on astronomy. How important is that outreach—on television, in your case—in generating the interest in citizen science that we have heard about?

**Dame Maggie Aderin-Pocock:** Can I just make a correction? I do not actually work at UCL. I run my own company, Science Innovation Ltd, and I do extensive outreach through that. Over the last 20 years, I have spoken to 500,000 people directly, so I do lots of outreach.

**Chair:** I beg your pardon.

**Dame Maggie Aderin-Pocock:** I think television and direct contact are critical in getting aspiration. I like to call it the desire to aspire. One of the challenges we face is that whereas we were talking about science communication and citizen science, and things like that, sometimes it is to the usual audience. It was mentioned previously that people go to things like New Scientist Live, but they attract a certain audience who already have an interest in the subject. Television and outreach in schools transcend that by speaking to everyone.





I have been very lucky. I do "The Sky at Night", but I have done a number of programmes like CBeebies "Stargazing", which is stargazing for five to seven-year-olds. We sit in a cold field in Derbyshire and say, "Imagine what you would see if the clouds weren't there." I have met many kids who say, "You are Dr Maggie, and I have seen you on TV." It is an introduction—and it is a powerful one, because kids just love space and astronomy. I write children's books and I would love to write one about space and dinosaurs, because then I would have the market. They are the things kids are fascinated by. That is why television especially is critical for this. It reaches a very general audience, and not a pre-selected audience, which is often the problem we have otherwise.

**Q184 Chair:** Did you cause the children's programmes to be commissioned—did you suggest it—or did the BBC wisely think that it would be a good thing to commission and broadcast?

**Dame Maggie Aderin-Pocock:** I was approached for the children's programmes and I have tried to lob ideas in there in the past. Children's television is an interesting area. I would say it is underfunded, so getting new children's programmes commissioned is quite challenging. During lockdown, my daughter and I did a programme called "Out of this World" from our kitchen, with a very large green screen, but again I was approached for that. Getting ideas out there can be challenging.

**Q185 Chair:** You say you were approached. Was that by the BBC or an independent production company?

**Dame Maggie Aderin-Pocock:** I think that CBeebies "Stargazing" was internal BBC. With "Out of this World", an external company asked whether I would participate in the layout of the programme, and that was then put to the BBC and commissioned.

**Q186 Dame Tracey Crouch:** Well, Dr Maggie, I have seen you on TV, too. I have an eight-year-old. As an aside, he goes to a church school and had a very difficult question relating to God, space and dinosaurs—so you could do the whole thing.

I want to follow on from my colleague's question about his granddaughter. There is a saying in sport, which is my background, that if you get a kid interested in PE at primary school, you will have them interested in sport for the rest of their life. The same is true for science, so my question, starting with you, Mr Bishop, is about what role you play in engaging schoolchildren in astronomy. How does that role raise an interest in STEM more generally?

**Chas Bishop:** There is a network of about 60 science and discovery centres across the UK, so access is really important. They are in cities and rural areas. It is really important that people feel as if they have somewhere local to them. Transport and access remain a problem, so most science centres will have a community programme or an outreach programme to make sure they can get beyond their natural catchment.



Science and discovery centres are really good at taking a difficult subject such as astronomy and presenting it to audiences in a way that they can understand and appreciate. We are talking about audiences with, at one end, no understanding whatever of the subject—that is often the parents, not necessarily the children—and the experts at the other end.

The majority of our audiences are made up of families with children aged up to 13. To answer the previous points that have been raised, pre-school is critical, so we make sure there is a lot of provision for that. We tend to aim a lot of our programming towards 11, 12 and 13-year-olds, on the basis that younger children want to be 11, 12 or 13, but 13-year-olds do not necessarily want to be younger. Having really exciting and engaging content for that age group is critical.

In addition, most science centres—certainly the National Space Centre in Leicester—will have a schools programme that supports the curriculum being taught in schools. For the younger children, you are looking to get them excited and to engage them in a topic. They have to have fun—there is no question about that. As they move up through the age range to upper primary and lower secondary, you might start to try to help with their confidence in the classroom and their attainment. There are some science centres with the resources to look at older children and pathways into further and higher education and the world of work, which I can talk about a bit more.

**Q187 Dame Tracey Crouch:** It is really interesting, but that requires a school to come to the centre. It is very much that the educators come to the experts. I am interested to learn how you get the experts shaping the curriculum in that easy bitesize way for the educators to deliver, to develop that thirst and interest to come to the centre.

To reshape the question—Dame Maggie, please feel free to come in—what role are you playing in shaping the curriculum, particularly for key stage 1 and 2 children, not just relying on a teacher with an interest to book a coach, get 30 kids on it, and come to you for three hours to learn about it?

**Chas Bishop:** The relationship between the expertise that we have, academia nationwide, and teachers is critical. Teachers are on the whole brilliant at driving the agenda and inviting us to go and see them. We have a lot of teacher panels on a lot of our curriculum subjects where we talk to them about what they want of a science centre or the National Space Centre, and how we can help in the way you suggest.

As you say, access is really challenging at the moment for a lot of schools. The coach journey is far more expensive than entry to the National Space Centre, so we do a lot of community engagement programmes where we will go out to the school or to community venues, such as libraries or social or sports clubs. We go to areas where people might not have the means, transport or confidence to come and see us. We take our stuff to them, and it is really powerful and impactful.



As to evaluating all the programmes that we do, and working with teachers, yes, getting feedback from the students is great, but the teacher feedback is pretty reliable because they will tell us very honestly what does or does not work and how we can help, with our expertise, to influence the curriculum and introduce astronomy and space more generally as a teaching context for science subjects. As Maggie says, it is space and dinosaurs, but there are others. You just want a touchstone—something inspiring to get them interested and introduce scientific subjects. Space is a fantastic way of doing that.

**Dame Maggie Aderin-Pocock:** You mentioned the curriculum and taking kids to venues. I mentioned that I spend a lot of time going out to schools and speaking to kids. As Chas says, it is trying to find the right hooks. A few weeks ago, I was making space ice cream on “Blue Peter”. It didn’t have much to do with space, but they really liked the idea of the ice cream, and then that led on. It is about getting those hooks and windows.

One of the other things that I have been involved in, as quite a few universities are, is training our scientists and researchers to be effective when they go out to schools. When I first started going out and doing science communication, I was told, “Be careful, because the last time a physicist came out, the number who wanted to take up physics went down.” I do not think it is a good idea just to send researchers out into the crowd. I worked with the Royal Society doing media training, and training for scientists, so that when they get into a school or are being interviewed on the “Today” programme, they are more effective.

On top of that, I have in the past been involved with CPD—training teachers, leading them and giving them resources so that they can access things that the European Space Agency and NASA are doing. There is a wealth of information out there, but if you are not familiar with the field, it might be quite hard to find it. There are better resources, so that when you are doing a school topic on, say, forces, the NASA and ESA sites are relevant.

An interesting thing at the moment is that it is not just about TV and going out. I have a 14-year-old daughter and we watch TikTok together. TikTok is lots of kittens and things like that, but there are quite a few resources there where people rap and talk about all sorts. My daughter knows pi to I don’t know how many digits because of a song she learned on TikTok; so there are quite a few resources there. Because that is what that age group is watching, it makes sense to utilise it. I am Chancellor of the University of Leicester, and we post things on TikTok quite a bit, because we know that that’s where it’s at.

**Q188 Dame Tracey Crouch:** You briefly mentioned something that in a way answers the next question. How do we gauge and evaluate the success of communication and engagement in astronomy, especially its ability to inspire future astronomers? Clearly, it does not necessarily mean sending



out physicists, but how do we gauge the success of communication?

**Dame Maggie Aderin-Pocock:** I started my career in communication about 20 years ago with some funding from STFC. I think it was then PPARC; it has gone through a number of iterations. One of the things we were very keen on was doing evaluations. Often, before I did a session in a school, we would do questionnaires just to get an idea of their feelings about science, scientists and things like that, and then maybe a week after the talk, we would do another evaluation. A few times, we have tried to do vertical or longitudinal ones over longer periods, but they become very challenging.

Most of the science communication is done through organisations under the auspices of UKRI and its sister organisations beneath that. That is part of getting the funding, but, generally speaking, it is quite hard. For instance, I go to lots of literature festivals and give talks, but there is no evaluation, apart from anecdotally during book signings and things like that, so it is quite hard to measure. Chas, I do not know whether it is easier for you because you have the people there, so you can do before and after.

**Q189 Dame Tracey Crouch:** What tools do you use to assess its impact?

**Chas Bishop:** As Maggie said, before students start the programme, immediately afterwards and three and six months afterwards you are trying to ascertain whether the knowledge or confidence in the classroom has stuck, or whether their attainment in the classroom has improved. Teacher feedback is possibly more reliable sometimes than the children who are responding to the enjoyment of the occasion. Teachers are able to give really good feedback. If we have teacher panels, that influences how the programmes evolve over time, because they will say what works and what does not work.

A longitudinal study is brilliant if you can do it. I give you the example of the work of the National Space Academy, which runs a space engineering course with Loughborough College. It is a post-16 course where we take children with no family history of higher education who are probably more confident in their vocational skills than academic skills. We take them for A-levels in maths and physics and BTEC level 3 in engineering, so it is tough. Their expectation of academic success is not particularly high, but we track them through the course and they graduate and move on to wherever they want.

The success rate of putting those students into higher education, whether it is a degree course or degree apprenticeship course, is 90% compared with 86% in public schools, and I think the comprehensive number is 81% or 82%. Therefore, it works.

We track them through university into the world of work. We now have 10 years' worth of data to show what has happened. They are going on to Rolls-Royce, Airbus and BAE Systems. Some high-quality people are



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coming through. Then you are looking back to see where the influences might be.

It is well worth getting to know some of the data that the Space Skills Alliance is putting out. It has just done a study showing that 42% of people were influenced by a careers conference that they had back in their school days. That has really influenced what we do with our careers conferences, space camps and multiple interventions. What Maggie was hinting at is that, if you see students half a dozen times or more, you build up knowledge of them and then you can start influencing career thoughts and give them a pathway that might be suitable for them.

**Q190 Dawn Butler:** Dame Maggie, I think you are incredible. The first time I saw you on television, I thought you really brought the subject to life. It was so engaging and infectious. The UK always likes to say it is world leading. How do we compare with how other countries engage?

**Dame Maggie Aderin-Pocock:** It is quite interesting. We do a good job on engagement. As Chris said in the previous session, there are resources, but it is about getting access to them. We are talking about telescopes. America has a number of telescopes and observatories, many as a result of philanthropic ventures—for example, establishing a telescope or planetarium.

I do not think we are quite there in that respect, but we are pretty good in trying to get our scientists out into schools. There are a number of different organisations with STEM ambassadors and researchers going out to schools. It is more effective if you train the researchers before they go out.

Of course, I would like to see more. Anecdotally, we need more role models. I know that we will go into diversity in a little bit, but we need more role models out there. Sometimes, people come up to me and say, “We’ve named our school lab after you.” I think it is wonderful and I am so touched, but we need more people to name labs after.

It is about encouraging scientists to think they can go out to a school. At first, it is quite terrifying—I remember it—but getting more people to do that makes it more effective. We are pretty good, but we need a better and more joined-up infrastructure. Other countries do that better.

To me, it is also a bit of a PR problem. This is astronomy and STEM, but, if you take somewhere like Germany, when they speak about an engineer they think of someone as a professional, whereas in the UK, an engineer is thought of as somebody grabbing a spanner and wearing overalls. This is a perception we are still trying to tackle, but I do not think we are there yet. Getting people to realise what engineers do would be a big step in that direction.

**Q191 Dawn Butler:** Chas, do you agree? What three things should the Committee tell the Government to give us?



**Chas Bishop:** I would complement that answer by talking about France and the success of the space cluster at Toulouse. It is a very successful, huge campus with lots of organisations there, but with public access at its heart. Sometimes, we need to work harder at celebrating some of these clusters. Leicester is being influenced quite heavily by Cité de l'espace, which is the public angle to Toulouse. It is now called Space City, the part of the world where I sit. Maggie is my next door neighbour at Space Park. Space City has the National Space Centre at its heart, with the University of Leicester's new space camp to the north and the city council's innovation and grow-on space to the south.

One of the original reasons—there is consistency between Toulouse and Leicester—was the regeneration of brownfield sites that could not be used for anything else. It is an old sewage works. The Space Centre is in the middle, and there are now 100 space and science-related organisations around it. Think of the inspiration of having public access there, with people coming on to the site—pre-school to postdoc is a trope we use—and having sight of where their career might take them in the future, if they take an interest and we can introduce them to role models. We have exhibit A here. Maggie has talked on a number of occasions on stage at the National Space Centre, as Chris and others have. It is fantastic when you put role models on stage and introduce them to students on that pathway. They say, "These are the sorts of things you might do at school; these are the sorts of experiences you might have through further and higher education; and these are the sorts of places where you might work." Toulouse is a very good example and it is heavily influencing what we are doing in Leicester.

**Dame Maggie Aderin-Pocock:** Awareness is critical. Many people are not aware that we do space in the UK. When they think of space and astronomy, they think of NASA. Therefore, the fact we are doing many missions means we are punching above our weight in the UK. It appears on the news sometimes. For instance, on the way here, someone from the "Today" programme said, "Can you do an interview?" I said, "No. I'm doing a Select Committee." It is nice to get it out on the news, but kids are not really getting that. Therefore, celebrating the successes as well the failures, because it is all part of the scientific process, and letting them know we are doing it here is so critical, and finding ways, by a PR campaign or whatever, of getting it out there would really help.

Q192 **Dawn Butler:** What would be the initial amount? How much extra would you need?

**Chas Bishop:** I could put a figure on the amount that the science centre network would very much like to have to do something that you are not asking me to do, which is to talk about the ageing of our buildings. We were hit very hard by the pandemic; it wiped out our reserves. Those reserves were being used to do the very charitable aspects of what we do. Free provision for those from disadvantaged communities in the halo of the National Space Centre in Leicester and all the other science centres





around the country has been squeezed a little bit, because we have had to come back from the pandemic with the nuts and bolts of maintaining buildings and doing the commercial stuff, which is making us sustainable.

The figure is about £50 million—that would be lovely, thank you. That allows us to mend the roof while we are investing in these community engagement programmes. We are investing between £125,000 and £250,000 in those programmes, depending on how good the year is, on free provision for those who do not have the means or confidence to come and see us. As I said earlier, we go and see them with kit.

In terms of the success that Maggie was talking about, we have 330,000 visitors at the moment and we are capping numbers daily because we cannot cope. On the one hand, that is great—it means that the National Space Centre experience is great fun, engaging and what have you—but that is an indication of how exciting space is at the moment. It is a lovely story to tell because it keeps evolving; there are always new stories to tell and new researchers to come and talk to us or put on stage. We are talking about astronomy here today. I would say that our gateway topic into the subject is human space flight, but then astronomy tends to proliferate when we are talking about curriculum-focused study, because that is more relevant as a context for teaching science. Human space flight is a really important part of this.

**Q193 Carol Monaghan:** Dame Maggie, you are inspiring us even as we sit here; two of us are trying to work out pi to 20 digits. We will try to focus on astronomy.

We are taking evidence that tells us that astronomy, like many areas of STEM, is not particularly diverse. You have talked about the importance of going into schools and how that can have an impact, but are there other things that you would choose to prioritise if you were in charge and had the funding Dawn was talking about?

**Dame Maggie Aderin-Pocock:** I see the challenge as a two-way trend. In the past, there have been external forces—for example, “People like you don’t do space and astronomy,” and things like that. We have made progress in gender, ethnicity and a whole range of things. There has been progress, but society is still dictating the internal pressure where you do not see yourself as that. You need to see it to be it. If they do not see themselves in certain roles, they do not aspire to do those roles. It is about trying to break down those stereotypes wherever possible. That is why I am always harking on about a PR campaign, but it is a way of getting exposure.

It is about trying to show the diversity of things that you can do with a career in space and astronomy. I was born here, but my father was from Nigeria. I remember when growing up that it was quite a tough day when I had to tell him I was going to study physics rather than going into medicine, law and things like that, because that was the pipe dream—that is what you do. Physics is the study of everything in the universe,





from the tiniest particles to the cosmos. What are you going to do with that?

It is showing what you can do with these soft subjects. For instance, as a space scientist and astronomer, most of the work I have done has been building satellites to look at climate change. Kids latch on to that. Through my work I can make a difference.

Q194 **Carol Monaghan:** The problem is that there is only one of you, unless we can clone you and put you everywhere.

**Dame Maggie Aderin-Pocock:** One Maggie is definitely enough.

Q195 **Carol Monaghan:** That is a serious issue. This morning, we have talked about role models and the importance of being able to reach out to children when they are very young. It is very difficult for you to do all of that. How do we reach some of these communities that are possibly not on CBeebies, are not going to the Space Centre and are not being taken to New Scientist Live? Is there a difficulty there?

**Dame Maggie Aderin-Pocock:** Yes, and that is why I see it more as a PR campaign, with things like TikTok—where kids go. It is lovely that we do science festivals and things like that, but they are for people who are already that way inclined.

Q196 **Carol Monaghan:** Do the Government have a role in that? Should they be putting stuff out on TikTok?

**Dame Maggie Aderin-Pocock:** I think they could.

Q197 **Carol Monaghan:** We are not allowed to use TikTok.

**Dame Maggie Aderin-Pocock:** We should be encouraging universities to do TikTok so it is naturally getting out there, but it is more than that. A few years ago, I had the crazy idea that on something like "EastEnders" you would have a group of scientists or astronomers move in, so it becomes everyday. At the moment, it is siloed: "Those scientists are out there. They are not like us."

Q198 **Carol Monaghan:** It still seems quite elitist. My daughter is 16; she is very bright and scientific. She likes astronomy. She said to me, "Do you think I could possibly make it as an astronomer?" It was a negative; it was almost unattainable. That is someone who has been brought up in a physicist's household, and it is perpetuating. I found that quite depressing. I thought, "How could we make that any better?" Maybe it needs something that makes it more normal.

**Dame Maggie Aderin-Pocock:** I think so. At the moment, there is still a belief that only special people, or people with a brain the size of a small planet, do this. No: if you have an interest and passion, you can do this too. Of course, you need a certain aptitude for it, but there is also the idea that to work on astronomy or in space you need degrees and PhDs. There are apprenticeships; there are all sorts of ways of doing this, but



people do not know about them. They do not know that there is a space industry and careers in astronomy, and they do not know what they need to work in these careers. Career officers in schools are meant to cover everything, but they cannot cover everything.

Q199 **Carol Monaghan:** They do not have the specialist knowledge.

**Dame Maggie Aderin-Pocock:** Yes. So if we make it part of the *de rigueur* and the everyday, people will think that being a space scientist is not something weird and special; it is something that normal people—relatively normal people—do.

Q200 **Carol Monaghan:** Chas, I have been to the National Space Centre and I very much enjoyed it. I planned to spend an hour there when my son was young. We ended up spending the entire day there. It is very good, and I would highly recommend it. What initiatives are you using to appeal to hard-to-reach communities? We hear about all sorts of initiatives, but how are you measuring their impact and success?

**Chas Bishop:** How do we define “hard to reach”? We go into prisons. We have a programme at the moment funded by the Esmée Fairbairn Foundation for alternative provision for excluded children. I will answer some of your questions in instalments because you are talking about investment.

There is a huge role here for universities to play. We agree that there is only one Maggie, but there are lots of other role models who are coming through the university system. We employ them during weekends and holidays and in the community as science explainers and communicators. We take them out into these communities. They might be coming from first or second-year science or space-related courses. It is really relevant to students who are a few years younger because they can talk about their very recent experience.

Some fantastic people across the science and discovery network are working in science centres but are from universities and further education colleges. They are not Maggie, but they are brilliant and do the job of standing on stage, or work one to one with students. They are brilliant teachers who are getting to know students. As often as not, it is about the cultural references they have. Is space science and astronomy being talked about in the family set-up, for example? How can we bring in the adults, parents or guardians? They might have very little confidence in their own ability, but you want them to help to push. You might get teachers or community leaders who are brilliant at encouraging the kids when we are not there to turn up.

As to how we measure success, if you are in a community and someone comes back half a dozen times, you tend to give incentives. If you come once a week for six weeks, you get a ticket to the National Space Centre where you can show off the work you have done in those six weeks to your parents, who come along as well. There are prizes and all sorts of



things. We now have 26 students who have been more than 20 times to one of our current community initiatives. They come every week and they are so keen. Then you can say, "What do you think about course options at school? What do you think about a space engineering programme?" We have a science course going on in parallel with an immersive design course at Leicester College offering this breath of provision, which is not the frightening academic route necessarily but keeps them in the engaging context of space, science and astronomy and allows them to express themselves through it.

Interestingly, we talked earlier about sport and dance. We have used sport in physics; we have used dance in physics. There is a lot of provision when we talk about the hard to reach for those who might have hearing, sight and physical impairment. Neurodiversity is a big thing—accessible afternoons, closing the place to everybody else and making sure it is nice and quiet for a small number of people.

There are all sorts of different requirements out there, but I would come back to role models. Maggie is at the top of the iceberg, but I promise you that there are lots of others. There is also a huge female bias in astronomy.

**Q201 Carol Monaghan:** You said something quite important: you referred to getting to know the young people you are working with. I was a physics teacher. People would come in and out of schools, but often it was a one-off. A one-off does not have impact; building relationships has an impact, but often the organisations doing that were not taking the time and effort; it was a tick box to say, "Yes, we have done school engagement." My question would be, "Yes, but is there any impact?"

You have talked about the local area. I visited Leicester; I was really impressed. How do you widen that across the UK to make sure it is not just young people in Leicester who are benefiting from the National Space Centre?

**Chas Bishop:** You ask for three bits of funding. The third is a continuation of the UK Space Agency's space for all fund. It is run over five terms at the moment with 45,000 children in disadvantaged communities across the UK. The UK Space Agency pays us to run the National Space Academy's space to learn programme. We pay schools across the country to release about 36 teachers for 25 days a year to go into schools in their territories and deliver intensive programmes at GCSE level—actually, it starts a bit younger at this stage; it starts at 13. It works through, it is intensive and tries to get the repeat, because if you get to them, that makes it easier. There was a top-up fund to cover travel and meals, which was dissuading some from coming. If you are talking about barriers, you can provide free provision, but they may not be able to get to the venue. The venue sometimes is in schools; sometimes the network goes to the Glasgow Science Centre; in Edinburgh, it is Dynamic Earth; in Aberdeen, it is the science centre



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where we have a space camp; and the careers conference is coming up in the summer.

We go to those places and do everything we possibly can to break down the barriers with meals, free transport and free provision. It is a £1.8 million fund from the UK Space Agency for 45,000 students. It finishes in May 2025. It is our dearest wish that that continues, because it is oversubscribed. If there was not public funding for it, we would either have to charge or find some other funding.

It is working so well at the moment that I would love it to continue and grow, because 36 teachers can become 72 teachers and so many more. Wherever the model works, we have delivered it: in flats in Cape Town; in China; and in the UAE, where there are fewer financial problems than in the flats in Cape Town. It has been absolutely fantastic over three years. The programme simply works. The curriculum was based on the UK, but to change it does not require much of a tweak.

**Carol Monaghan:** I am aware we are a bit tight for time, but I am sure that appeal has been heard loud and clear.

Q202 **Chair:** In the previous Parliament, this Committee, on which Carol, Stephen and Graham sat, was critical of the STFC's outreach activities. The Committee found that it had withdrawn some funding for outreach and public engagement to concentrate on research, narrowly defined. Given the importance of building a pipeline of future talent, is that still the case? Can you update us? Do you have concerns about that?

**Dame Maggie Aderin-Pocock:** Yes. I should declare that I sat on the STFC for a number of years. On my understanding, in the past, one critical thing was that, when a grant was given, a certain amount was allocated—this was what Chris Lintott was speaking about—for science communications. Having sat on the STFC and seen the flat rate and the challenges it faced in juggling what science to fund, I can understand where the challenges are coming from. There has been a reduction in outreach work, mainly because of these challenges, but they do some and they are very effective. In fact, when I go out to schools, I direct them to funding available from the STFC for space, astronomy and the other things they cover, but there is a pinch point.

Over the years, I have worked with the STFC and PPARC in its many different guises and received money from them in terms of media fellowships, but I have also sat on the council. You see the squeezing and juggling. It will say, "We will concentrate our research here and let some other research go."

It is not surprising that science communication has been pinched, but that is a challenge for all of us in the future. If we do not have that pipeline and the next generation coming through, we are all stuck. I understand where the challenges are coming from, but it definitely needs to be addressed.



Q203 **Chair:** Reflecting on your experience in the three related sectors in which you have made a huge impact, one is obviously academia itself. Secondly, as you have said, you have launched a company and spun it out; and thirdly, there is the media. Looking at those three fields in which you have been active and thinking about diversity and inclusion, which do you think does it better?

**Dame Maggie Aderin-Pocock:** In terms of outreach?

Q204 **Chair:** I guess in terms of success in empowering and bringing in people from a wider background than has been the case traditionally in all these areas.

**Dame Maggie Aderin-Pocock:** Working with the media has the greatest reach. That is one of the reasons I like working with the media—television, radio, books, TikTok and other things—because you are reaching audiences you would not otherwise reach. Through the science communication, I fund my schools outreach by doing commercial outreach. I speak to bankers, lawyers and people like that and then I am able to go to most schools for free. That is quite an effective scenario. In going out to schools, I have seen 500,000 people and I am knackered, but the range is limited.

CPD is very powerful, as you were just saying. It empowers teachers to go out.

As for my vision of a PR campaign, I think the media is the way to do it in many different guises. As to the messages we send, we want to talk about diversity and be more inclusive.

One thing I like to get across is that when I was growing up, I thought astronomy was done by white guys in togas: it was the Greeks and Romans. That was all I ever heard about. It is about telling a different tale where astronomy is done by people across the world. Every culture has looked up at the night sky and wondered. Getting that message out there is very empowering for people to think, "Well, my ancestors did it. Why can't I do it?", because at the moment it is the white guys in togas who are winning and people think, "That's just not for me."

Q205 **Chair:** On the internal culture within astronomy, I was a little surprised in the written evidence we have taken by reports of bullying and harassment being particularly prevalent in astronomy. A report by Professor Wyn Evans, Professor of Astrophysics at the University of Cambridge, said that in a survey of 650 astronomers, "44%...had suffered bullying and harassment in the workplace within the preceding 12 months". He said that, "bullies in astronomy are a feature, not a bug." That was rather surprising to me. It would not have occurred to me that this was an environment where you would expect bullying to be rife. Do you recognise that? Is that your experience from your career in astronomy?



**Dame Maggie Aderin-Pocock:** From my experience, no. I am surprised. I would like to see that report in more detail. Academia is cut-throat and very competitive and that leads to the sort of environment where there is bullying. That is unfortunate and should not be the case, but pushing against the envelope can lead to that. Personally, I would have thought astronomy was less inclined to that, so that does surprise me. I would like to compare it with other areas.

Q206 **Chair:** Why do you think astronomy would be less subject to it?

**Dame Maggie Aderin-Pocock:** I do not know. I am making generalisations here; I am going off-piste. In astronomy, when you look up at the night sky, it gives you a slightly different perspective. This is anecdotal and probably would not stand up to peer review. Working as an astronomer, working on "The Sky at Night", speaking to many different astronomers and going to universities across the UK and abroad as well, my feeling is that astronomers generally like to support one another. I am an optimist; I see things through rose-tinted spectacles, so perhaps that is the perspective coming through. That is why I would like to compare it with other areas of STEM, because I would have thought astronomy was better than most.

**Chair:** That is a very sensible steer. We will do that when we carry out the research for our report. I thank Dame Maggie and Mr Bishop, as well as the other witnesses, for their evidence today.