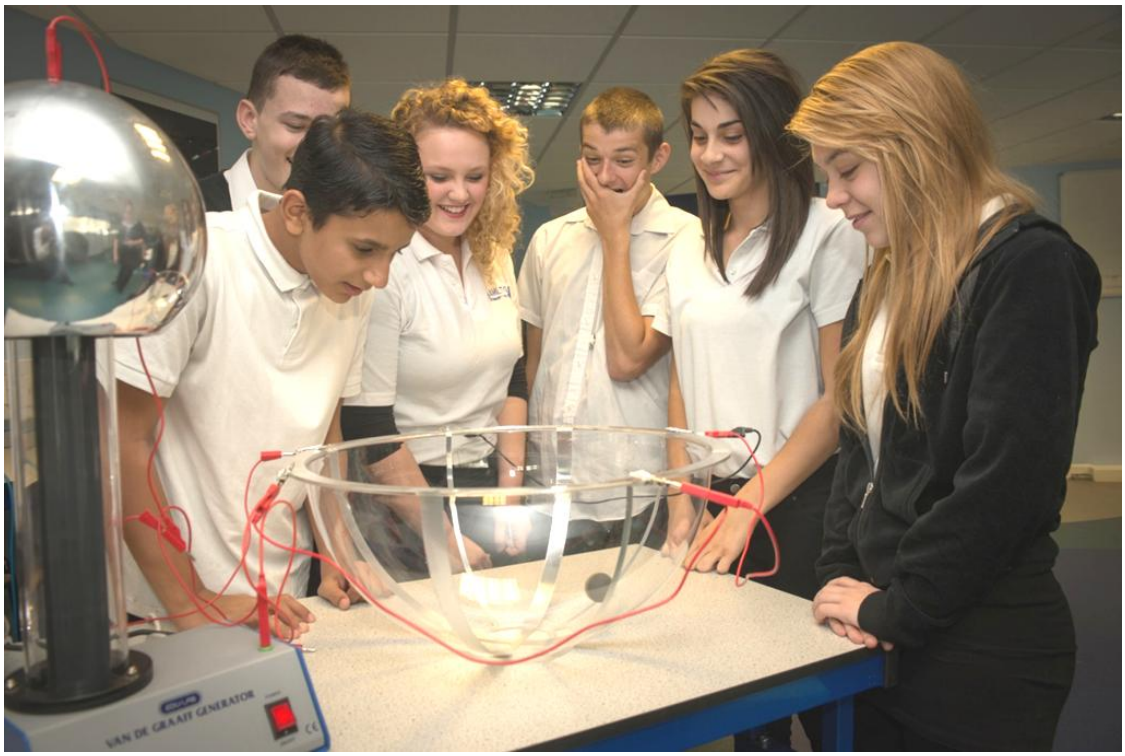
Final Project Report

By Dr Penny Fidler and Dr Michaela Livingstone



January 20 2014

UK Association for Science and Discovery Centres

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Foreword

It gives me great pleasure to introduce this report summarising the 'Explore Your Universe' national strategic programme.

Science is at its heart a hands-on, ever-changing, investigative pursuit and this project really brings this alive. If we want our nation's young people to be inspired and motivated by science and to consider it as a career for their future, we need to give them opportunities like these so they can see how astounding and enlivening the techniques and questions of real science are.

With this in mind, the vision for this national strategic project was to 'inspire a new sense of excitement amongst young people around the physical sciences by sharing the amazing stories and technologies of STFC'.

This fast-paced project trained, equipped and supported ten partner science and discovery centres, and two STFC facilities to run a host of specially developed cutting-edge 'Explore Your Universe' schools workshops, family shows, activities and scientist-led events. The programme was fully evaluated by academics, making it also the UK's largest multi-centre study of the impact of informal science learning.

In just one year these ten centres engaged and involved over 122,546 children and adults with the project's exceptional hands-on activities, experiments, schools workshops, public shows and meet the expert events. Indeed, the number of participants rises to 156,880 if we include all the other events and programmes that have come about directly because of the ASDC-STFC Explore Your Universe partnership.

To be clear, in none of these numbers are we talking about fleeting interactions with the science. All the children and adults we have included have taken part in whole curriculum-linked workshop or a family show or other event and discussion for between 20 minutes and two hours.

As with all ASDC national programmes, a key to their success is that they are modular, flexible and adaptable to enable the widest variety of science centres and science museums to embrace and embed them in their future programmes creating a considerable legacy. What is reported here we hope is just the beginning of the story…

The project has also created the beginnings of a national network of science engagement professionals with specialist expertise in the physical sciences and STFC-related science. It is our hope that they will continue to support one another and innovate together for many years to come.

I am delighted with the outcomes of this project and the exceptional enthusiasm, dedication and collaborative approach shown by all of the ten partner science centres, each of whom has jumped at the opportunity to set up and run these high-level workshops and family shows in their centres. I pay tribute to the professionalism of all the staff who are now delivering these workshops. In addition I would like to both thank, and celebrate the outstanding work of Dr Michaela Livingstone, the project manager, and the other exceptional members of the project team from the National Space Centre and Jodrell Bank Discovery Centre, whose passion and dedication has made this project come alive. I would also like to thank the over 70 scientists who have shared their expertise and of course STFC who have made this project possible.

Dr Penny Fidler; Project Director and CEO of UK Association for Science and Discovery Centres

Executive Summary

> *'The participating scientists, the science centres and the project team should feel proud of their contribution to what has clearly been a unique, highly engaging, enjoyable and mind-changing experience. The Explore Your Universe programme met its aims of enabling a broad audience to engage with contemporary science, and also supported the capacity-building efforts and skill development of the individuals and institutions involved.'*
>
> **King's College London evaluation report**

'Explore Your Universe: from Atoms to Astrophysics' was a cutting-edge national strategic science engagement programme developed and delivered by The Association for Science and Discovery Centres (ASDC) in partnership with the Science and Technology Facilities Council (STFC) and other experts.

The vision of this two-year programme was to inspire a new sense of excitement among young people around the physical sciences by sharing the amazing stories and technologies of STFC. The academic evaluation by experts at King's College London confirmed that the programme had indeed been highly engaging and had met its aims.

Explore Your Universe is part of a wider strategic partnership between ASDC and STFC that brings together some of the most fascinating and diverse cutting-edge science in the country with the talents and infrastructure of the nation's largest network of dedicated science engagement organisations who together attract 20 million visitors every year.

To develop the programme, ASDC worked in partnership with engagement experts in this area from The National Space Centre and Jodrell Bank Discovery Centre as well over 70 scientists and engineers working in the physical sciences and STFC-related science. To deliver the programme, ten UK partner science centres and museums were selected, trained, equipped and supported to run the activities with their school and family visitors.

As a central part of the programme, ASDC and partners developed a bespoke, high-quality, modular set of equipment, which included over 50 items ranging from a solar telescope, thermal imaging camera and 'a particle accelerator in a salad bowl' to meteorites, a cloud chamber, a pre-loaded iPad and a piece of the particle detector at CERN. Each of the ten science centres and two STFC facilities received the equipment along with a full training and on-going support programme.

The training programme included a two-day residential training academy for staff of the ten science centres where they learned to use all the equipment and to run the Explore Your Universe curriculum-linked schools workshops for 10 – 13 year olds, the bespoke masterclass for 14 – 16 year olds, the family show and meet the expert events. They were also given marketing resources, evaluation resources, all the powerpoints and images for workshops and marketing and a full training handbook with all these resources within. ASDC also set up a bespoke website (www.exploreyouruniverse.org) and social media streams to enhance collaborations. In addition, over 50 scientists and engineers working on STFC science were trained at one-day public engagement academies and linked up with the science centres for meet the expert events.

In their first year of delivery, the ten partner science centres engaged over 122,546 children and adults in exceptional hands-on activities, experiments, schools workshops, public shows, meet the expert sessions

and a variety of other events at UK science centres. As part of this, 45,852 people met an expert engineer or scientist, 59,236 took part in the half-hour family show in a science centre, and 9,400 school students aged 10-13 took part in a one hour workshop. In addition, 3,174 school students aged 14-16 spent two hours exploring the latest science in the schools masterclasses, 1,225 teachers and 3,659 young people joined activities with brownies, guides, cubs, scouts.

In addition (and not included in the numbers above), 7,866 people took part in Explore Your Universe activities at two STFC facilities and 26,468 people took part in the Stargazing and World Space Week Programmes administered by ASDC as part of this partnership - bringing the overall project total to 156,880 people.

Explore Your Universe was fully evaluated by academics at King's College London and the programme was shown to be highly engaging and hugely successful. Overall, the evaluation programme involved 4,895 people including 3,883 students and 369 teachers making it the UK's largest multi-centre study of the impact of informal science learning.

The in-depth evaluation results are in a separate independent report authored by King's College London available on the ASDC website. The highlights are included in this report including quotes they gave from the qualitative analysis. In addition the evaluation confirmed the programme exceeded the target number of participants by 53% and that elements of Explore Your Universe are now embedded in the activities and workshops at science centres across the UK who will continue to celebrate STFC science into the future.

Evaluation results from students aged 14-16 after a workshop

- 81% said they would recommend this masterclass to other people their age
- 78% said that they had never used or rarely use this type of equipment at their school
- 60% said that they thought their experience in the masterclass would help them with their school science classes
- 43% said that the masterclass made them feel more interested in studying science

Their teachers said...

- 96% rated the workshop very good or good
- 74% said they would talk about the workshop with students when back at school
- 90% said they would recommend the workshop to other teachers

Quotes from Teachers, Students and Families

What teachers said about the schools workshop:

"It definitely stimulated many in the class. The children were speaking about electrons and 'invisible light' on Monday morning. So it should be a positive long-term effect."

"[I couldn't do this at school due to] lack of equipment and resources and safety implications."

"Increased motivation for physics – they can envisage their career paths when they know what others are doing with physics."

And on the stories from STFC:

"Fascinating – was unaware of STFC although aware of the research they are involved in."

What students said about the schools workshop:

"[I would recommend it] because it is really good experience and it is interesting. I really liked it."

"We don't have the equipment [at school], so it is less hands on and more boring."

"[I will remember] how much involvement Oxfordshire has with physics."

"[This will help me at school] because when we do space in science, I will have a headstart."

What teachers said about the masterclass:

"Many students will now have a greater appreciation of the range of scientific careers."

"Also good that we had women physicists talk to the girls."

What students said about the masterclass:

"It was fun so it is nailed into my head."

"It is different [from science in school] as it is much more practical than note taking in class."

"It was clear and funny and I learnt a lot. It made everything previously not understood clear and easier to understand."

"[It will help me back at school] because we learnt stuff that I can recall during lessons."

What people said about the Family Show:

"I'll tell Dad about the cool experiments." Child at a family show

"Will use parts of it to show my son how physics is relevant in everyday life." Father at a family show

"I've learnt so much more and that will help in school." Child at a family show

What people said about Meet the Expert events:

"[I will remember] that I shook hands with a scientist who studies really far away galaxies." Child at a Meet the Expert Event

"They just seem like ordinary people but are younger than I thought they would be, I thought all scientists were old - like my parents." Child at a Meet the Expert event

"I've never met a scientist before! Was good to see Science in action!" Child at a meet the expert

A highlight of the project from a science centre professional:

"Getting high quality physics equipment and building close relationships with STFC-funded researchers."

A Summary of Results from School Students and Teachers

Evaluation of the schools workshop for 10-13 year olds

The students aged 10-13 said...

- 80.2% said they would recommend this workshop to other people their age
- 82.4% said that they had never used or rarely use this type of equipment at their school
- 56.9% said that they thought their experience in the workshop would help them with their school science classes
- 55.6% said that the workshop made them feel more interested in studying science
- 40.8% said that the workshop had made them feel more likely to consider a career in science

n=2,222

Their teachers said...

- 94.5% rated the workshop very good or good
- 72% said they would talk about the workshop with students when back at school
- 85.2% said they would recommend the workshop to other teachers like themselves
- 79.7% said the workshop was good value for money (17% couldn't say)*

n=236

Evaluation of the masterclass for 14-16 year olds

The students aged 14-16 said...

- 80.8% said they would recommend this masterclass to other people their age
- 78.3% said that they had never used or rarely use this type of equipment at their school
- 59.5% said that they thought their experience in the masterclass would help them with their school science classes
- 43.3% said that the masterclass made them feel more interested in studying science
- 36.6% said that the masterclass had made them feel more likely to consider a career in science

n=1,616

Their teachers said...

- 96.2% rated the workshop very good or good
- 74.4% said they would talk about the workshop with students when back at school
- 90.2% said they would recommend the workshop to other teachers like themselves
- 81.2% said the workshop was good value for money (15.8% couldn't say)*

n=133

Please note: ASDC collated and undertook a simple analysis of these quantitative results. King's is currently consulting with a statistician to examine whether there are any internal inconsistencies within the answers of individual teachers and students to fully validate all results. Also of note is that it seems a number of those who filled in the teacher responses were not the class teacher and therefore abstained from answering questions on value for money or if they would talk about this back in school. Further analysis here is needed.

The Association for Science and Discovery Centres Network

The Explore Your Universe Network

www.sciencecentres.org.uk

UK Association for Science and Discovery Centres

An Overview of Explore Your Universe

Background and the Strategic Partnership

In 2011, The UK Association for Science and Discovery Centres (ASDC) and the Science and Technology Facilities Council (STFC) began an exciting strategic partnership which brought together some of the most fascinating and diverse cutting-edge science in the UK with the talents and infrastructure of the nation's largest professional network of dedicated science engagement organisations.

Together, the 60 ASDC-member science and discovery centres engage 20 million adults and children each year and this pioneering partnership, for the first time, leveraged that reach and impact to share the amazing stories and science of a UK research council.

Explore Your Universe: The National Programme

Explore Your Universe: from Atoms to Astrophysics was a two-year national strategic programme directed and delivered by ASDC in partnership with STFC. It began in January 2012 and completed in January 2014 and had over 150,000 participants. One of the key features of the project was its considerable legacy and every element of the project's structure and design was created with this in mind.

The vision of Explore Your Universe was to 'Inspire a new sense of excitement amongst young people around the physical sciences by sharing the amazing stories and technologies of STFC'.

To achieve this vision, ASDC created and delivered high-quality training along with an exceptional set of equipment, and a host of resources (including workshops, shows, activities, a marketing pack, on-going support and a website) to ten partner science and discovery centres.

The entire programme was developed in partnership with two science centres with considerable expertise in this area; The National Space Centre in Leicester and Jodrell Bank Discovery Centre in Cheshire as well as a Science and Engagement Advisory Panel and experts who participated in the Charette at the start of the project.

In the original proposal, the following Goals, key audiences, programme outputs and targets were set out. All of these have been delivered.

The Goals of 'Explore Your Universe'

The 5 key goals for this national programme, in order of importance, were as follows.

1. To inspire and involve the key audiences with the physical sciences - from particle physics to astronomy
2. To help people of all ages and all backgrounds explore the physical sciences
3. To increase the visibility and approachability of STFC scientists and STFC facilities to the target audiences
4. To increase the public engagement skills and opportunities of STFC staff and STFC-related university researchers

5. To train science engagement professionals embedded in ASDC member organisations across the UK to engage the public with the latest in physical sciences, so they can continue to engage their 20 million visitors with STFC science and scientists into the future

The Key Audiences

The key audiences for this national programme were:

1. School students aged 10-16 in formal curriculum-linked activities and their teachers
2. Young people aged 8-13 enjoying learning about the physical sciences in informal contexts with their families
3. STFC staff and science centre staff to ensure these workshops and relationships are embedded as a legacy for the future

The Outputs of 'Explore Your Universe'

This project set out to deliver the following:

- An exceptional set of adaptable hands-on equipment for each centre
- A high-end master class for 14-16 year olds
- A schools workshop for 10-13 year olds
- A family show for 8-13 year olds and their parents for use across the UK
- A meet the expert session for family and schools audiences and introductions to STFC scientists and engineers
- A national training academy to train science centre staff from 10 centres across the UK to enable them to run the entire programme into the future
- A national training programme to train 50 STFC staff and related university researchers to work with this programme
- An in-depth academic evaluation of the Explore Your Universe involving responses from over 4500 school children and families. This makes it the UK's largest multi-centre evaluation programme of the informal science learning that takes place in science centres and museums

Considerably more was delivered and this is outlined below.

Overall Targets for the Project

The project aimed to reach 79,900 people and significantly over-delivered, reaching 122,546 people through the Science and discovery centres and 156,880 people overall. The original targets were as follows:

- **6,000 10-13 year old students**
- **3,000 14-16 year old students**
- **900 teachers**
- **20,000 families**
- **50,000 people in meet the expert events**

Further details on all elements of the project can be found in Annex 1: Details of the National Programme.

The Project Partners

ASDC led the project, with expert input from the National Space Centre, and Jodrell Bank Discovery Centre. Both these science centres have considerable expertise in engaging people of all ages and backgrounds with the physical sciences.

Selecting the Partner Science and Discovery Centres

The 10 organisations to be trained and equipped as part of the project were selected through an open tender process managed by ASDC. To achieve this, the full project information and an invitation to participate, along with criteria for selection was sent out widely by ASDC. Ensuring at this early stage that all applicants had enough information to fully understand what they and their organisations would be committing to if their application were successful was absolutely key to the success of the overall project. Further details are in the detailed project information section.

Both the invitation to participate and the application form can be found at **www.sciencecentres.org.uk/projects/explore**.

The Ten Selected Partner Science Centres were:

1. At-Bristol
2. Catalyst in Cheshire
3. Dundee Science Centre
4. Glasgow Science Centre
5. Observatory Science Centre in East Sussex
6. Our Dynamic Earth in Edinburgh
7. Royal Observatory Greenwich
8. Satrosphere in Aberdeen
9. Science Oxford
10. Winchester Science Centre (formerly Intech)

In addition ASDC also provided two STFC facilities with the full set of equipment and training:

11. Rutherford Appleton Laboratory in Oxfordshire
12. Daresbury Laboratory in Cheshire

Working closely with the two expert partner science centres on the project team

13. National Space Centre (and National Space Academy)
14. Jodrell Bank Discovery Centre

What Each Science Centre Was Given

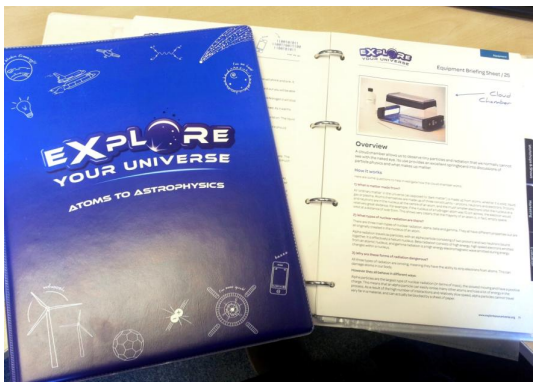
ASDC understands that all ASDC members are different; they have different strengths and existing partnerships, different audiences and unique relationships. We know that every centre will want to play to their strengths and run slightly different activities and events, and will want full freedom over how they choose to run these with their visitors. We always fully endorse this approach and indeed designed the project to maximise this flexibility. We wanted the ten selected centres to have the freedom to evolve and

adapt these workshops if they wished, to take advantage of their expertise and existing relationships with universities to enhance the way their audiences engage with the physical sciences.

The Science Centre Training Academy was held at the National Space Centre

The 10 selected science centres were given the following:

- An exceptional set of adaptable hands-on equipment
- A £5000 Grant to assist with running the programme
- Full and detailed training on how to use all the equipment, the types of hands-on experiments each piece can be used for, and all the related science.
- Places for two staff at the two-day residential training academy. Their travel, food and accommodation were paid for by the project
- A masterclass for 14-16 year olds
- A schools workshop for 10-13 year olds
- A family show for 8-13 year olds and their parents
- A 'meet the expert' format,
- A Training Handbook for all staff involved



- Details and introductions to scientists involved in the project's national training programme and other scientists and engineers related to STFC science
- A full marketing pack, including logos and branding material, sample press releases, professional photos of the workshops for marketing leaflets and curriculum links for teachers
- Evaluation forms and instructions for the project evaluation
- A website www.exploreyouruniverse.org for sharing of information between all those involved in Explore Your Universe and a social media feed with blogging opportunities and training.
- Two staff places for every centre at the National Meeting in mid-2013 to share knowledge and expertise with the other UK centres that are running similar activities
- Advice and on-the-phone support from ASDC and the project team throughout on any issue to maximise delivery, and to support staff working with new techniques and equipment

The full set of project materials is licensed under creative commons and is available to all on the ASDC website (**www.sciencecentres.org.uk**).

Over 50 Scientists took part in three 'scientist Training Academies' held in Jodrell Bank Discovery Centre, At-Bristol and Dundee Science Centre.

The Impact of Explore your Universe

The programme was evaluated by academics at King's College London. Their full report evaluating 4,895 children and adults involved in programmes at the ten centres is available via the ASDC website (**www.sciencecenters.org.uk**).

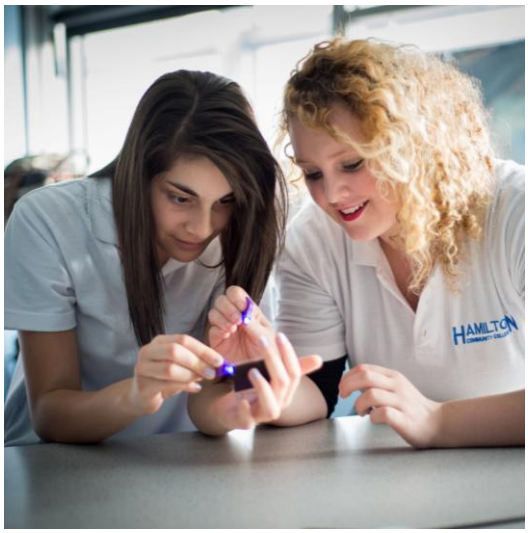
Numbers of School Children and Families Involved in Explore Your Universe

This programme has now been running for two years. In just one year (between February and November 2013), ten science and discovery centres engaged **122,546** children and adults who participated in exceptional hands-on activities, experiments, schools workshops, public shows, meet the expert sessions and a variety of other events. This includes **45,852** people who met an expert engineer or scientist, **59,236** who took part in the half-hour family show in a science centre, and **9,400** school students aged 10-13 who took part in a one hour workshop. Also participating were **3,174** school students aged 14-16 who spent two hours exploring the latest science in the masterclasses, **1,225** teachers and **3,659** young people in 'badged groups' (brownies, guides, cubs, scouts, etc).

In addition (and not included in these numbers), 7,866 people took part in Explore Your Universe activities at two STFC facilities RAL and Daresbury bringing the total to 130,412 people. These are counted separately as whilst they had been supplied with the equipment, handbook and resources and had been trained at the training academy, their staff time was already funded by STFC.

Finally, **26,468** people also took part in the Stargazing and World Space Week Programmes administered by ASDC and made possible through the Explore Your Universe partnership.

This brings the final total to 156,880 children and adults



Activity/audience	Proposed target	Numbers reached	Numbers including Daresbury and RAL
School workshop – students (10-13 years	6,000	9,400	12,588
School Workshop - teachers	600	960	1,148
Masterclass – students (14-16 years old)	3,000	3,174	3,174
Masterclass - teachers	300	265	265
Family show	20,000	59,236	59,236
Meet the expert	50,000	45,852	50,342
Badged Group		3,659	3,659
TOTAL	**79,900**	**122,546**	**130,412**

Additional People Engaged Through the World Space Week and Stargazing Programmes

Scheme	Number of Grants given	Numbers reached
Stargazing Grants	10	1,674
World Space Week 2012	8	13,024
World Space Week 2013	10	11,770
TOTAL	**28**	**26,468**
Explore Your Universe total		**130,412**
Grants added to Explore Your Universe total		**156,880**

Value for Money

The Explore Your Universe programme had a target of reaching 79,900 people over one year. The budget was £436,672 for the two-year programme, giving a cost per head of £5.47[1].

The Explore Your Universe programme exceeded this target and in fact reached 122,546 people who took part in a range of activities through the 10 participating science centres. Including the STFC facilities' numbers, this takes the total to 130,224 people reached.

This gives a cost per head of £3.35.

Because the project manager's time was fully covered, a number of additional programmes were also achieved, namely administering grants for ASDC members to run Stargazing events in 2012, and World Space Week events in both 2012 and 2013, supported by STFC. Together these grants schemes cost £48,990 and reached 26,468 people. The resulting combined cost per head for these schemes was £1.85.

When taken together the total programme cost (Explore Your Universe with facilities, plus grants) comes to £485,662 and reached a total of 156,702 people.

The resulting cost per head of the entire set of activities delivered as part of this partnership is £3.10.

The King's College London evaluation of the project stated that Explore Your Universe compared very favourably against other national initiatives related to STEM engagement.

> *"These figures compare favourably with the findings presented in the Frontier Economics report (2009) in which cost per participant for medium-sized science centres, national museums, CREST, and British Science Festival were found to be £9.00, £19.00, £13.00 and £16.10 respectively."*

[1] Note: the full project cost in the ASDC proposal was £458,662 which included the £21,990 of stargazing grants programme submitted as annex 1 of the ASDC proposal.

Academic Evaluation of Explore Your Universe

The programme was evaluated by academics at King's College London (King's). Their full report is available via the ASDC website (www.sciencecenters.org.uk). A summary of numbers of people evaluated and the instruments used is given below.

Numbers of people taking part in the Evaluation

Evaluation Activity/audience	Target	Numbers evaluated
School workshop – students (10-13 years old)	2250	2,203
School Workshop - teachers	300	232
Masterclass – students (14-16 years old)	2250	1,680
Masterclass - teachers	300	137
Family show	200	327
Meet the expert	200	316
TOTAL	**5500**	**4,895**

The Evaluation Programme for each science centre

A*	Evaluation form for 14-16 year olds **Students** in masterclass x 225	Two-page evaluation form*, administered by science centre
B*	Evaluation form for 10-13 year olds **Students** in schools workshop x 225	Two-page evaluation form*, administered by science centre
C*	Evaluation form for **Teachers** of 14-16 year olds in masterclass x 30	Two-page evaluation form*, administered by science centre
D*	Evaluation form for **Teachers** of 10-13 year olds in schools workshop x 30	Two-page evaluation form*, administered by science centre
E	Telephone interviews of a small sample of **Teachers**, six weeks after their workshop to give richer qualitative data	Administered by King's. Contacts supplied by the science centres and teachers
F*	Survey for a sample of **Families**, asking a small number of key questions. This would potentially be in addition to King's researchers working with selected centres to interview families after the event via follow-up phone calls. x 20 families from the family show x 20 families from the meet the expert	Survey*, and King's-led interviews** by arrangement, and ONLY where it will not interfere with the family's enjoyment and learning.
G	Evaluation of **scientists** following the training academy, and an email interview (with follow-up phone interview as necessary) with participating scientists following delivery of the activity	Two-page evaluation form developed by ASDC following the training, and email interview designed by King's.
H	Evaluation of **science centre staff** to understand how their confidence has increased and to explore the strengths of the delivery model.	1. Post-academy questionnaire (ASDC) 2. Post-delivery questionnaire (ASDC) 3. Post-delivery interview** by King's of a selected staff members
I	Interview with project team (NSC, JB & ASDC)	Interviews** will be conducted by King's

* Denotes the items where science centre assistants will need to input the answers into the form provided

** It is expected that interviews will take no longer than 45 minutes

Additional Outcomes and Added Value

World Space Week and Stargazing Grant Schemes

Because of the strategic partnership, ASDC and STFC were able to offer additional small grants to the ASDC network to support initiatives to engage the public and schools with space and space-related science. ASDC administered three additional grant schemes, which each offered up to £1,500 to 10 successful applicants:

Stargazing grants: aimed to support partnership between science centres and Dark Sky Discovery groups across the country to offer stargazing events in Spring 2012.

World Space Week 2012: these grants aimed to support centres to deliver events during World Space Week (4-10 October), to increase the celebration's visibility across the UK and within the sector, and to highlight space and space-related work being done in the UK and Europe.

World Space Week 2013: as above, with a focus on innovation and reaching new audiences, as well as fostering learning and sharing among organisations involved. ASDC also created a World Space Week booklet (paid for by savings made elsewhere in Explore Your Universe) highlighting contemporary space and space-related activities, collating top tips and example activities.

Full details of these grants, their selection processes and the centres involved can be found at the ASDC website (www.sciencecenters.org.uk).

High Profile Events and Activities

Additionally, ASDC has been able to showcase the project and share learning with the wider informal learning sector and with academics in the following ways:

- Presenting Explore Your Universe at international conferences including:
  - The Ecsite Annual Conference in Toulouse in 2012
  - The Ecsite Annual Conference in Gothenburg in 2013
  - The European Planetary Science Congress 2013
- Presenting Explore Your Universe at UK conferences including:
  - The 2012 ASDC Annual Conference at the National Space Centre in Leicester

- The 2013 ASDC Annual Conference at the Science Museum in London
- The 2012 Science Communication conference in London
- The STFC Public Engagement Symposium 2013 in Birmingham

In addition, ASDC have bought Explore Your Universe to the attention of David Willetts, Minster of State for Universities and Science, as well as members of the science and society department in BIS, the Government Office for Science and other research councils.

Science Minister David Willetts, with ASDC Chair Dr Teresa Anderson MBE and CEO Dr Penny Fidler, being shown the hands-on activities from Explore Your Universe at the 2013 ASDC National Conference in London

Reaching Wider Audiences and Other Opportunities

Explore Your Universe events and activities have been run at a host of outreach events, engaging with wider audiences than those who visit the science centres.

Green Man Festival 2013

ASDC, in partnership with Catalyst, the National Space Academy and Royal Observatory Greenwich took Explore Your Universe to the Green Man festival in Wales in the summer of 2013. The festival was an effective way of reaching an extremely diverse audience, especially young adults in a challenging but rewarding setting (in a tent with only renewable sources of electricity allowed).

Dr Suzie Sheehy, a particle physicist, presenting to a mixed audience at the Green Man Festival, Wales, August 2013

The delivery team at this festival also included scientists and over the five days of the festival the stall offered a set of themed activities that changed daily. All activities and experiments were based around 'The Big Questions' for example 'what makes us, the galaxies and everything?', 'is there life out there?' and 'how can we protect our planet?'. This stall reached over 1,000 people who fully engaged and many more who dipped in to see what was going on.

Feedback was very positive with 100% of those evaluated saying they enjoyed their experience 'Lots!'

Examples of other outreach activities

Below are some more examples of ways that science centres brought the physical sciences alive to wider audiences:

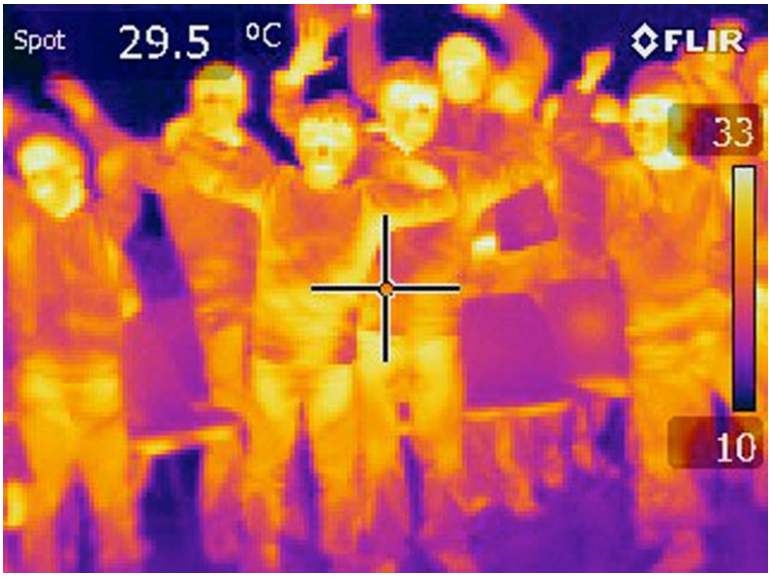
- At-Bristol had never been to a TeenTech event before – it was a positive experience for them and the scientists they took with them. They intend to take part again in the future.
- Catalyst delivered a stall at Car Fest North reaching many more families and over 500 young children by taking part in a play group over a week.
- The Observatory Science Centre noted that because many of the staff had been trained and engaged with the equipment, and because of the flexibility and utility of some of the equipment to be used in busking situations, staff were able to take many opportunities to engage their visitors in surprising ways. This even included running activities at a post-wedding celebration taking place in the centre
- Our Dynamic Earth got involved with delivering activities with community groups e.g. Dadswork.
- Satrosphere in Aberdeen used Explore Your Universe as part of their science communication training for science ambassadors from secondary schools. These ambassadors went to their feeder primary schools to engage pupils with science as part of an Aberdeen City Council initiative.

- Several centres are looking at ways of including Explore Your Universe stories and equipment in their Continuing Professional Development (CPD) programmes for teachers.
- Winchester Science Centre are trialling a new home educators programme utilising Explore Your Universe and have also used it for team building events.

Working with Badged Groups

ASDC developed relationships with the Guiding Association over the project. This resulted in ASDC writing about Explore Your Universe for the Guiding Magazine published in their Winter 2013 issue which has been sent to every guide leader in the county and includes science activities to do at guide meetings.

The science centres together engaged **3,659** guides, brownies, cubs and scouts in a multitude of activities and events, including special workshops to support badges and sleepovers. The discussions are on-going and we hope to encourage the Guiding Association to put more science in their badges. Currently the boys are offered a wide range of sciences and the girls opportunities are rather limited.



Developing New Relationships

The Explore Your Universe programme provided the opportunity and impetus for science centres to initiate and strengthen relationships with a number of different group and organisations. This included other science centres in the network, researchers, STFC staff, industry representatives, universities, astronomical societies, community groups, schools and more.

There was considerable development of the relationships between science centres and STFC facilities, notably RAL, Daresbury laboratories and the Royal Observatory Edinburgh/Astronomy Technology Centre who supported meet the expert and other events.

Below are some examples of how Explore Your Universe developed relationships:

- At-Bristol report they have developed a new relationship with Diamond Light Source.
- Dundee report they have strengthened and developed new relationships with a range of organisations, including academics, industry, community groups and schools.
- Catalyst has enhanced a relationship with the Royal Society of Chemistry and together they plan to host a linked event (delivered in London, streamed to Catalyst's Alchemy theatre with the opportunity for a linked Q&A session).
- Glasgow Science Centre has developed various relationships, including with the Astronomy Technology Centre in Edinburgh.
- Dr Paula Lingren from the University of Glasgow (an Explore Your Universe expert) wrote a blog for Glasgow Science Centre.
- Observatory Science Centre has made links with SEPnet and also with local universities directly.
- Our Dynamic Earth report the project encouraged them to work with a very broad range of experts, which has enhanced both staff development and the science they present.
- Royal Observatory Greenwich reports the relationships staff built with other science centres has been 'inspirational, problem-solving and moral boosting'.
- Royal Observatory Greenwich and Observatory Science Centre, who share a historical link, have hosted exchange visits between their centres.
- Satrosphere have built a strong relationship with an academic from the University of Aberdeen as a direct result of meeting them at one of the scientist training academies.
- Science Oxford already had a well-established relationship with RAL. They report Explore Your Universe has deepened this relationship, and developed other relationships with university groups.

Legacy of Explore Your Universe

'Explore Your Universe has provided a considerable legacy of resources and experienced staff to support current programming in science centres and act as a springboard for new ventures. In particular, Explore Your Universe has led to the forming of stronger relationships between science centres and schools and local scientists. These relationships should be valued and sustained.'

King's College London evaluation report

Embedding Activities

The science centres have now included elements of the Explore Your Universe programme into their on-going schools and public programmes. This ranges from running the whole suite of schools workshops to using the equipment and stories of STFC science in multiple workshops and family activities.

Some specific examples are listed below

- At Glasgow Science Centre the Explore Your Universe planetarium show they developed has been made a permanent fixture. The schools workshop will be delivered in the coming year, and the masterclass will be adapted and delivered to take into account curriculum changes in Scotland.
- Royal Observatory Greenwich has incoporated all the activities into their on-going programmes.
- At Catalyst, the vibrant SciBar will continue. The Explore Your Universe schools workshop will continue to be available throughout the year and the masterclass will be available as a targeted bi-

annual workshop. Catalyst is also developing a new family workshop on 'materials' which will include Explore Your Universe activities as well as a locally produced smart plastic.

- At-Bristol will embed the equipment and links to STFC science in their schools workshops and special theme days. Indeed they have already received a number of booKing's for the 'Explore Your Universe; Atoms to Astrophysics workshops in January to March 2013.
- Satrosphere in Aberdeen have embedded the schools workshop and masterclass into their permanent education programme, have developed a new workshop for younger students, developed teacher CPD, and are enhancing the family show. They are also including equipment and STFC stories in a range of other activities. The project has also inspired them to seek and secure funding for an inflatable planetarium.
- Dundee Science Centre have hosted a legacy meeting with education practitioners and experts and identified areas that could be further developed based on the equipment and resources. One suggestion is a loan resource for teachers.
- The Observatory Science Centre have embedded the schools workshops into their full programme and are engaging in discussions with various stakeholders to explore how they can utilise equipment and networking in wider ways.
- Science Oxford have embedded the activities developed for Explore Your Universe into their ongoing programming.

The feedback and evaluation we have received shows that although the variety of science centres have a broad range of needs, by creating a flexible and adaptable approach, and allowing them to re-name and re-use elements of the programme, we have managed to successfully enhance and enrich the capacity and capabilities of science centres and museums involved. They are now able to offer these exciting activities and share the stories and science of STFC and UK research programmes long into the future.

'I would like to be a scientist when I grow up because they do lots of different things and it sounds exciting.' – Child at a Meet the Expert event

Lessons Learned

Explore Your Universe successfully achieved its stated aims.

The following aspects of the project were highlighted by the evaluators as having contributed considerably to the overall success of the national multi-partner programme. ASDC, with experience of running multi-partner programmes had designed the programme from the start to include these.

- Creating a modular programme, and allowing considerable flexibility in terms of programming activities to work with the requirements of local audiences, allows providers to meet their aims most effectively.
- There is a definite need for committed, central and independent coordination of multiple-stakeholder projects. This was achieved by ASDC.
- It is important to set out expectations from the outset, as was in the invitation to participate.
- Teachers and students value the opportunity to experience novel equipment and to engage in hands-on activities. Such experiences are different from those offered in school, making them more memorable and more special.

The evaluators also noted several aspects to consider for future improvements as follows:

- Teachers and others noted they would like follow-up materials back at school/home.
- There is considerable scope to extend initiatives such as these to new audiences.
- A greater focus on the nature and breadth of science careers would be welcomed by teachers.
- Public engagement efforts on the part of scientists need to be supported and recognised by the scientist's institution (in terms of training, time allowed and recognition).

Summary and Conclusions

Explore Your Universe has been a huge success and has shared the inspirational stories and amazing technologies of STFC with a staggering 156,880 people across the UK. It has created a lasting legacy that will reach many more in years to come and has provided considerable value for money by using the well-linked, established and professional infrastructure of the UK Science and Discovery Centre network.

The Explore Your Universe programme has engaged over 150,000 people across the UK. Teachers and school students report that it has been fun, engaging and valuable and half the students have reported the workshop has inspired them to consider studying science. The current evaluation programme cannot ascertain if these cohorts do infact go onto study science in several years time, but certainly they noted they were invigorated by the day and the exceptional and varied opportunities a life in science can offer.

The programme also left a strong legacy for science centres. The training, resources and introductions given by Explore Your Universe have enriched the participating centres, and have had a big impact on the knowledge, skills and confidence of the individual staff members involved. The project has also provided an opportunity for centres to engage more with scientists and engineers resulting in fruitful partnerships for the future.

ASDC are delighted to report that the project has more than achieved its objectives and exceeded its goal of reaching 79,900 people by November 2013, all within the planned schedule and budget. We will conclude by sharing a quote from the formal academic evaluation report:

> *'All the stakeholders – the participating scientists, the science centres and the project team – should feel proud of their contribution to what has clearly been a unique, highly engaging, enjoyable and mind-changing experience. The Explore Your Universe programme met its aims of enabling a broad audience to engage with contemporary science, and also supported the capacity-building efforts and skill development of the individuals and institutions involved.'*
>
> **King's College London Evaluation Report**

We would like to whole-heartedly thank STFC for their support throughout this partnership, without which none of these wonderful programmes would have been possible.

Annex 1: Details of the National Programme

Project Research and the Charette

To inform the development of the Explore Your Universe resources ASDC undertook a research project right at the start of the project to ensure the project team had a full understanding of the scope and breadth of relevant engagement activities from across the informal learning sector. To achieve this we contacted our considerable network of science engagement professionals working in this area, as well as scientists, engineers, STFC-funded researchers and learned societies and asked them to contribute. We carried out phone interviews, and collected and collated information via an online form, from hundreds of sources.

This research sought to informally collate the vast wealth of expertise, knowledge and ideas in engaging people with the physical sciences from across the sector. This was used by the project team to inform the development of the equipment and project resources.

This research highlighted a handful of novel approaches and new intriguing demonstrations as well as revealing hundreds of experiments and demonstrations that the experts on the project team (from The National Space Centre and Jodrell Bank) had seen or used before.

In particular, the research pointed us towards those STFC scientists who had created excellent engagement activities and were willing to share them with the project. These expert were interviewed and invited to the Charette and asked to show their demonstrations. This included the 'particle accelerator in a salad bowl' from Dr Suzie Sheehy and a levitating magnets experiment from another researcher. This informal report is available on request to others.

The Charette was a one-day 'ideas event' held at Cosner's Hall in Oxfordshire with 30 invited guests. The day was facilitated by Dr Penny Fidler and everyone there had considerable expertise in the physical sciences and science engagement. The goal of the day was to come up with a perfect range of equipment that could be used with children aged 10-16 and families to inspire them with the physical sciences in general and STFC-research in particular. The Charette participants worked in groups on tables with hands on items to inspire them, interspersed by demonstrations by experts. This single day Charette of amazing ideas so generously contributed gave a breadth of view and ideas that was hugely instrumental in the development process. It also strengthened the ideas to focus on 'The Big Questions'.

The project team then took all the information from the Charette and the research project and combined this with what teachers want, what schools can't do and what the curriculum covers in all four countries. Added to this were other factors such as the

equipment budget alongside their considerable combined experience of what works well to engage families and students in informal settings.

This all fed in to the development process, along with additional expert advice from Scientists on the Science and Engagement Panel and the output eight months later was the Equipment boxes, the workshops, the training academies and the rest of the project resources.

Selecting the Partner Science and Discovery Centres

The 10 science centres to be trained and equipped as part of the project were selected through an open tender process managed by ASDC. To achieve this, the full project information and an invitation to participate, along with criteria for selection was sent out by ASDC to its wide network of contacts in the major public engagement organisations across the UK and published on the ASDC website.

Ensuring at this early stage that all applicants had enough information to fully understand what they and their organisations would be committing to if their application were successful was absolutely key to the success of the overall project. Therefore, in the 'Invitation to Participate' the expectations for each partner were clearly set out, including all key training academy dates, the project schedule, workshop delivery deadlines, as well as details of the large numbers of schools students and families they would be committing to engage in Year 1. In particular we outlined the considerable task involved to distribute, collect and then input the evaluation data and asked them how they would achieve this.

We also asked each applicant to highlight how the workshops and activities would be embedded in their future programmes. Finally, to ensure support for the staff from all levels of their organisation, we required the CEO or senior manager of each centre to tell us why their organisation would benefit from being involved.

We believe this has paid dividends in the energy and enthusiasm that the ten partners brought to the project. Both the invitation to participate and the application form can be found at **www.sciencecentres.org.uk/projects/explore**.

Development of the National Programme

The Activities Developed

The project team collaboratively developed the resources using information from the research project, ideas from the Charette and other sources combined with their own exceptional knowledge of techniques used to engage people of all backgrounds and ages with the physical sciences. This experience cannot be underestimated as it dramatically reduced the development cost and time. Together the project team had over 50 years of experience running science engagement programmes and activities in the physical sciences.

The project team developed scripts for the workshop, masterclass and family show. These were specifically designed around the equipment to highlight the breadth of research that is covered within STFC's portfolio, which ranges from atoms to astrophysics. Additionally, all the resources were designed to be flexible so each science centre could vary which demonstrations to include based on their specific preferences, scientist links and the needs of the audience that day.

The schools workshops and family shows were piloted with teachers and students and teachers also input earlier on to say what they wanted. Workshops and shows were all adapted in response to this feedback.

The workshop for 10-13 year old school students

This was a one-hour workshop that included looking at heat and temperature, electricity, magnetism, atoms and elements, astronomy and our universe. The powerpoint, script, curriculum links and all other resources are part of the Training handbook and also freely available to everyone on www.exploreyouruniverse.org

The masterclass for 14-16 year old school students

This was designed as a two-hour masterclass that could be split into two one-hour sessions on energy and the electromagnetic spectrum, and atoms and radiation.

Both school sessions were designed to link closely to the English and Scottish curriculum and to be relevant to others more broadly. The powerpoint, script, curriculum links and all other resources are part of the Training handbook and also freely available to everyone on www.exploreyouruniverse.org

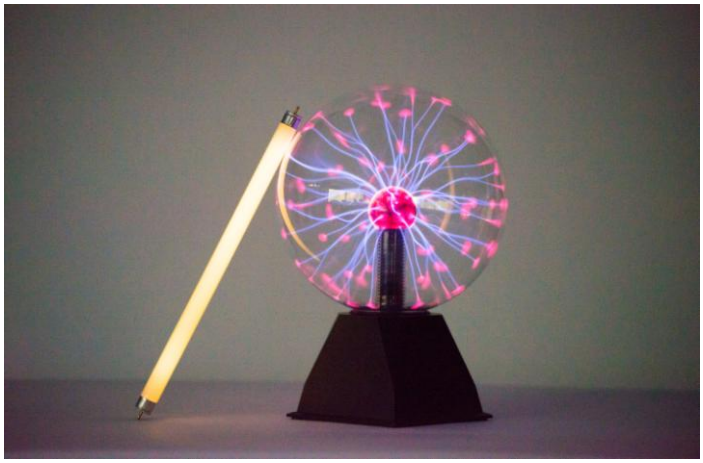
The Family show

This suggested show script was for a 30 minute show, suitable for families with children from 8 to 13, and again uses a range of equipment to highlight contemporary research related to STFC, from atoms to astrophysics. Again, the show was modular so could easily be adapted, and the powerpoint, script and all other resources are part of the Training Handbook and also freely available to everyone on www.exploreyouruniverse.org

Meet the Expert

Guidance was provided about the different formats a meet the expert session could take, as well as some practical tips on working with academics and industry. Introductions were then provided between scientists who had been trained at the Explore Your Universe Training Academies, and the science centre staff involved in the project

The Equipment



Following the research, a flexible set of equipment was put together by the project team that would allow centres (and scientists and engineers) to carry out a broad range of demonstrations and activities covering the physical sciences and that could be used to discuss and highlight the work and research of STFC. Below is the list of over 50 items of equipment that together makes up the set that was given to the ten science centres and two STFC facilities:

1. **Thermal imaging camera**
    a. Case
    b. Tripod adaptor
2. **Solar telescope**
    a. Case
    b. Tripod
    c. Video camera adaptor
3. **iPad (64Gb, WiFi only)**
    a. Camera connector kit
    b. VGA adaptor
    c. Case
    d. Pre-loaded apps
4. **The Optics box**
    a. Spectroscopes x7
    b. Discharge tubes and power supply
        i. H
        ii. He
        iii. N_2
        iv. O_2
        v. Hg
    c. UV lamp
    d. UV pens x10
    e. UV diode key chains x10
    f. IR source (remote control)
    g. Laser pointers
        i. Red
        ii. Green
    h. Fibre optic cable 1M
    i. S-shaped prism (total internal reflection demo)
    j. Laser optics kit (laser ray box, worksheets, Perspex blocks, prisms, mirrors)
    k. Large Prism
    l. White light source
        i. White LED
        ii. Accessories kit (several lenses, prism, slit plates)
    m. Diffraction grating slides x1
    n. Polarising filter slides x10
    o. Slinky spring
5. **The Materials box**
    a. Aerogel
    b. Meteorites
        a. Stony slices
        b. Iron
    c. Memory metal 1M
    d. Ferrofluid 50mL

e. Superconductivity kits
f. Ferro bar magnets x5
g. Iron Filing bubbles x15
h. Modern miracle materials
    i. CMS silicon detector module

6. Van de Graaff generator

7. 'Salad bowl' particle accelerator

a. Acrylic dome with aluminium tape
b. Cables
c. Crocodile clips
d. Nickel coated ping pong balls x4

8. Plasma ball

a. Fluorescent tubes x2

9. Liquid nitrogen dewar 25L for centres who did not own this kit

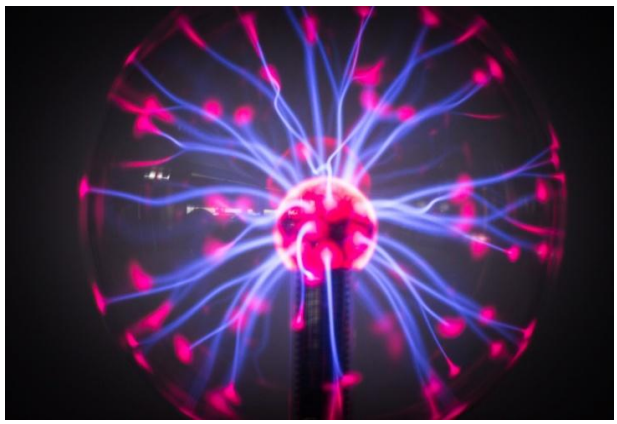
a. Cryo gloves
b. Roller base

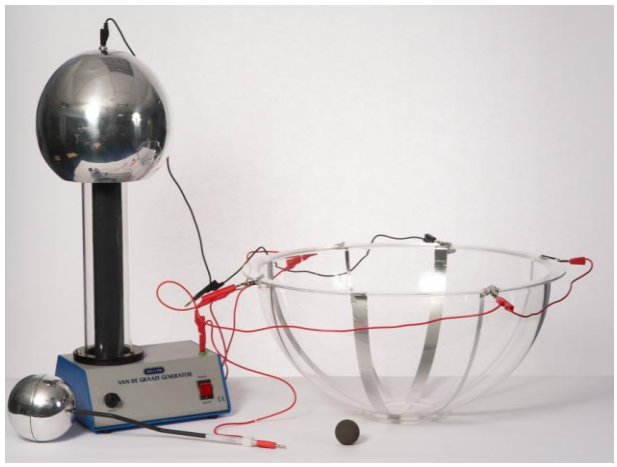
10. Liquid nitrogen flask 1L

11. Cloud chamber

a. fish tank
b. metal tray x2
c. sticky-backed black felt
d. thoriated rods x5

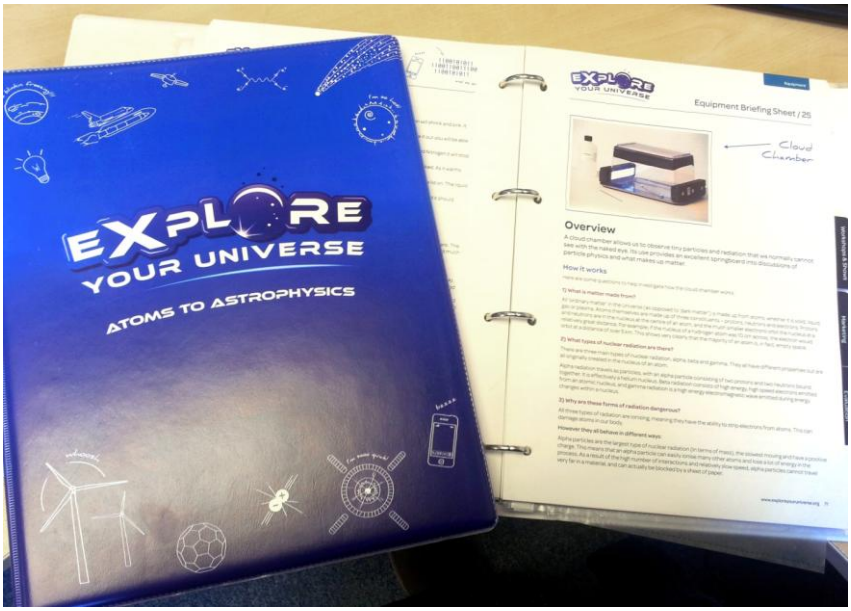
12. USB Web camera





The bespoke Optics Box and Materials Box designed to house delicate equipment

The Handbook



The project handbook was created to be the one-stop resource for the project and was designed primarily for science centre staff. IT was written by the project team and 100 copies were professionally produced. These have been in hot demand and were given to science centre staff at the Training Academy, Scientists and engineers at their Training Academies and the few remaining being requested by other organisations and individuals who had been instrumental in the project and who wanted to use the handbook to engage wider groups.

The handbook is 200 pages long, and set out as examples of activities and ideas to use each piece of equipment together with all the science behind each experiment and applications and links to real-world STFC-supported research. In addition the handbook also contains information about the project, scripts and PowerPoint presentations for all the shows and workshops, the marketing pack and details of the evaluation. Other items such as the evaluation forms were added to the handbook during the project.

A number of additional resources were also created during the project by the project team and partners, and these were shared via the project website.

The Website

To create a virtual home for the network, a website was designed and built that could host all of the materials and resources for the project. Specific to the design was that this website should be central to facilitate networking and sharing amongst peers in geographically distant science centres and research departments. The website can be found at **www.exploreyouruniverse.org**

As well as hosting all of the resources, the website has an events diary and a discussion forum which is populated by the participating centres, scientists and engineers. The ASDC project manager also

contributed information to the forum regularly, sharing interesting resources, STFC press releases and new opportunities, as well as regularly updating the Twitter feed.

The homepage is designed to highlight media, newsfeeds and social media streams to allow any visiting public to continue their journey should they visit.

Training for Science Centre Professionals

ASDC developed and delivered a two-day National Training Academy for 20 professional science engagement staff from the 10 partner science centres. The Academy took place in November 2012 at the National Space Centre. This provide staff with the technical knowledge, techniques and confidence required to run the suite of Explore Your Universe activities, as well as building up a community of practice and a national support network of staff working on this project.

The Training Academy programme was created by ASDC and provided:

- An introduction to background science
- Information on how to use all the equipment and resources
- Information on how to run the schools workshops
- Information on how to run the public events
- Advice and tips on marketing to schools and the public (and logos etc. in the marketing pack)
- Guidance on and details evaluation and reporting
- Opportunities for collaborations with STFC and their staff

Staff returned to their centres and then trained colleagues who also delivered the activities.

The evaluation of the academy was very positive. The academy was rated ‘Excellent’ by 95% of attendees, and every single aspect of the Academy was rated as ‘very successful’ or ‘successful’ by every participant.

Overall science centre professionals said that participating in the programme had provided them with both personal and professional development by:

- Providing new equipment that helped add value to their offers to the public and especially school groups
- Allowing the opportunity to increase knowledge about the physical sciences and knowledge of how to communicate the relevant topics
- Supporting stronger networks with other communication professionals and academics

The value of participating in a national strategic programme of this nature was also highlighted. Many noted a number of benefits for both themselves individually and for their organisation. We are delighted that the role of ASDC was both commended and seen as invaluable in providing leadership and coordination of the programme.

Many have noted the collegiate spirit within the network that has been created and fostered through this project, with mutual support, visits and ideas, enthusiasm and inspiration being shared. We hope that this will continue into the future, helping to foster new collaborations and support further progression of the sector within this area.

Training for Scientists and Engineers

As part of the vision to share the stories and technology of STFC we sought to increase links between those at the forefront of research and development (scientists and engineers) and science centres. To help raise awareness of the opportunities and support available to researchers and STFC staff, and to increase confidence and skills related to carrying out hands-on, interactive demonstrations with the public, ASDC arranged and delivered three one-day Training Academies hosted by science centres. These were:

- 29 Nov 2012 At-Bristol
- 7 Dec 2012 Jodrell Bank Discovery Centre
- 27 Feb 2013 Dundee Science Centre

The Training Academies for Scientists and Engineers were interactive in nature and provided participants with the opportunity to explore the hands-on focus of science centres, see the particular opportunities available through the Explore Your Universe project and have a brief introduction to the public engagement landscape and engagement skills. Participants were then able to practice and develop their skills in carrying out practical science engagement during 'The Challenge' part of the Academy.

Here, participants were given time to work as a group, facilitated by a member of the project team or hosting science centre, to plan and deliver to the group a short hands-on demo or presentation about something related to their research using the Explore Your Universe equipment. They were then given the

opportunity to reflect and discuss what they thought worked well, and what worked less well. This reinforced a lot of the basic principles covered earlier in the day, but also provided an invaluable opportunity to discuss best practice, hone skills and discuss useful practical tips.

Overall, the evaluation showed the following (based on 40 questionnaires):

- 80% of scientists and engineers rated the Academy as excellent or good overall
- The academies were rated very successful or successful for every aspect of the academy, such as increasing knowledge and skills of working with the public, increasing knowledge and skills of working with school groups, increasing knowledge and skills to celebrate their area of science, increasing awareness of how to seek out local science centres.
- 77.5% said it had increased their confidence. The remaining 22.5% said it was about the same, and further detail provided suggested this was from those who had a reasonable level of experience already.

Scientists were then allocated to science centres based on either their stated preference or geographical location and were all registered with the www.exploreyouruniverse.org blog so they could freely contribute to it.

The Marketing Pack

A full marketing pack was developed, including all the project logos and branding material, sample press releases, professional photos of the workshops for marketing leaflets and curriculum links for teachers (for schools marketing).
Additional materials were provided such as stickers to give to participants as a memento from shows and business cards so the public could go online after their visit.

A large banner was also created for 'the Big Questions' stall at Green Man and is now available to use at public events, festivals and conferences.

Press and PR


Science centre invites public to free stargazing

New show to explore our universe

Stargazing to live music

Free family stargazing event in Menzieshill

We worked closely with the STFC press office to provide press releases for science centres to use to publicise and celebrate the project at their centres. Many centres achieved good local press coverage.

We also shared timely media releases from STFC directly with the network so that they were always up-to-date with the

latest from STFC's exciting work, allowing centres to update their activities to relevant contemporary activities and discoveries. This also meant that staff at centres had up-to-date information to help them prepare for anything questions they may get from visitors. Science Centres said this was very useful. Press coverage has been achieved by all the partners in various ways and is part of the individual science centre's reports.

Delivery in Science Centres and On-Going Support

The science centres delivered Explore Your Universe activities between January 2013 and November 2013 and submitted these numbers and evaluation to ASDC and King's College London. They continue to deliver but are no longer reporting their delivery successes to ASDC.

Throughout the project all science centres were welcome to contact either the project manager and many did to get information and problem solving relating to equipment or to ask about collaborations and gtting in touch with other organisations. Each science centre was also assigned a 'buddy'. Buddies were members of the project team who offered support visits and more informal support over the phone when needed.

Additionally we held a number of conference calls throughout the project to support centres with the latest content or to discuss project issues such as evaluation and to give staff at geographically distributed centres the opportunity to discuss what they were delivering and how it was going with colleages in other parts of the UK running the same workshops.

The National Meeting

The goal of the National meeting was to bring together the staff from all the science centres and facilities involved in the project. To this end, we held a lively one-day national meeting at the Royal Observatory Greenwich in November 2013 with the theme of 'looking to the future'.

Around 25 people were at the national meeting and together they shared their innovations and new ways to use the equipment, new experiments to try and solutions to problems. Each project participant gave a presentation on what they had achieved and shared their ideas on how they would be taking the project forward into the future.

All of the presentations are available on YouTube (www.youtube.com/playlist?list=PLWb7i4B4POIfCeCNsn-V9EO7Xi2Ttnuvq).

Annex 2: Detailed Evaluation Results

Inspiring Students and Teachers

9,400 school students at workshops (12,588 including facilities)

3,174 school students at masterclasses

1,225 teachers (1,413 including facilities)

This project aimed to reach KS2-4 school children through engaging, interactive workshops and masterclasses, specifically designed to reinforce and enrich curriculum learning.

The project team collaboratively developed suggested scripts for the workshop, and masterclass. These were specifically designed around the equipment to highlight the breadth of research that is covered within STFC's portfolio, from atoms to astrophysics. The workshops were designed to be flexible in terms of demonstrations, delivery time and so on. Both school sessions were designed to link closely to the English curriculum but to also be relevant to other curricula more broadly.

Science centres then assimilated these activities and adapted them to fit the needs of their regional audiences.

Evidence from the evaluation highlighted some common aspects:

- The equipment used is not normally available to schools, and is valued highly
  Highlights: IR camera, plasma ball, Van de Graaff, dry ice and liquid nitrogen
- Hands-on experiences were valued and enjoyed
- Students are more receptive to hearing about real research and real-world applications; teachers also said this was invaluable
- Evaluation from both students and teachers suggested that the activities have the potential to support both core learning and revision experiences

The workshop for 10-13 year old school students

This was a generally a one-hour workshop that included looking at heat and temperature, electricity, magnetism, atoms and elements, astronomy and our universe. STFC's frontier research projects were highlighted with images and information, including examples of particle accelerators in the UK.

Evaluation was collected from 2,203 students participating in workshop activities in the ten centres.

The Students said:

- 80.2% said they would recommend this workshop to other people their age
- 82.4% said that they had never used or rarely use this type of equipment at their school
- 56.9% said that they thought their experience in the workshop would help them with their school science classes
- 55.6% said that the workshop made them feel more interested in studying science
- 40.8% said that the workshop had made them feel more likely to consider a career in science

'It was interesting and we were all involved in experiments.'

'[I will remember] how much involvement Oxfordshire has with physics.'

'We don't have the equipment, so its less hands on and more boring'

'At high school we will probably go over the full thing and if I get stuck I will remember this workshop.'

Their teachers said:

- 94.5% rated the workshop very good or good
- 72% said they would talk about the workshop with students when back at school
- 85.2% said they would recommend the workshop to other teachers like themselves
- 79.7% said the workshop was good value for money (17% couldn't say)

'[I couldn't do this at school due to] lack of equipment and resources and safety implications.'

The masterclass for 14-16 year old school students

This was designed as a two-hour masterclass that could be split into two one-hour sessions on energy and the electromagnetic spectrum, and atoms and radiation. As with the workshop, the masterclass highlighted with images and discussions some of STFC frontier research from the Large Hadron Collider to the James Webb Space Telescope.

'Students enjoyed and valued the Masterclasses, with the most common descriptors being: 'Interesting', 'informative' and 'easy to understand'.' – King's report

The students said:

- 80.8% said they would recommend this masterclass to other people their age
- 78.3% said that they had never used or rarely use this type of equipment at their school
- 59.5% said that they thought their experience in the masterclass would help them with their school science classes
- 43.3% said that the masterclass made them feel more interested in studying science
- 36.6% said that the masterclass had made them feel more likely to consider a career in science

'I learnt a lot about things I otherwise wouldn't in an interactive way.'

'It is different as it is much more practical than note taking in class.'

'Because we learnt stuff that I can recall during lessons.

Their teachers said:

- 96.2% rated the workshop very good or good
- 74.4% said they would talk about the workshop with students when back at school
- 90.2% said they would recommend the workshop to other teachers like themselves
- 81.2% said the workshop was good value for money (15.8% couldn't say)

'It was a very positive influence on their view of physics as a modern technological subject.'

'Idea that science learned in school has practical application.'

'Opportunity for pupils to have a different learning experience.'

'Some equipment and contexts we can't / don't use in school.'

'Also good that we had a women physicist to talk to the girls.'

'Many students will now have a greater appreciation of the range of scientific careers.'

Inspiring Family Audiences

> ***"Families clearly enjoyed the shows and recalled both key facts and processes." – King's Report***

During January – November 2013 the science centres reached **59,236** people who took part in a family show. This was typically a 20-45 minute experience in a theatre-style show that included demonstrations and the opportunity to take part in interactive experiences. In some instances this was shorter, delivered at festivals for example, and still involved hands-on activities.

The project provided a suggested family show script, using a range of demonstrations and highlighting a number of contemporary research stories, but again this was left flexible in terms of demonstrations used, duration and adaptability for centres to use their own approaches and techniques to best suit their centre and their audiences.

Whilst there was a great deal of variation between centres, a number of aspects were highlighted by the King's evaluation:

- The equipment allowed centres to provide high quality activities that inspired visitors
- Centres tackled a higher level of science than they normally do in their shows, and this was appreciated by older visitors in particular
- The chance for visitors to learn about the applications of science happening on their 'door-step' provided an inspiring surprise for visitors

Participants said:

> *'I've learnt so much more and that will help in school.' Child at a family show*
>
> *'I think we'll buy a telescope.' Parent at a family show*

Engaging Experiences with Scientists and Engineers

45,852 people met an expert at a science centre as part of Explore Your universe (50,342 if we include the STFC facilities). This included a range of activities, ranging from 'fairs' within a centre or at festivals where a number of experts were available for demonstrations and one-on-one conversations with visitors, to small

groups having the opportunity to engage an expert over 90 minutes. Both family and school audiences met with experts.

Training for Scientists and Engineers

To help raise awareness of the opportunities and support available to researchers and STFC staff, and to increase confidence and skills related to carrying out hands-on, interactive demonstrations three, one-day training academies were hosted in science centres:

- 29 November 2012 - At-Bristol
- 7 December 2012 - Jodrell Bank Discovery Centre
- 27 February 2013 - Dundee Science Centre

51 scientists and engineers who work in the physical sciences were trained and allocated to a science centre to take part in meet the expert sessions should they wish. Science centres were also welcome to utilise any appropriate partnerships they already had in place.

The training provided to scientists and engineers included:

- An introduction to science centres and the project
- A brief introduction to science communication and engagement
- An overview of the variety of ways to use the Explore Your Universe equipment
- Guidance on adapting activities to suit different audiences
- The opportunity to practice engagement skills with feedback from engagement professionals

The academies were rated very positively by participants (n=40):

- 80% rated the day as excellent or good overall
- Each aspect of the academies were rated successful or very successful, including 'increasing knowledge and skills of working with the public',' increasing knowledge and skills of working with school groups', 'increasing knowledge and skills to celebrate their area of science' and 'increasing awareness of how to seek out local science centres'.
- 77.5% said it had increased their confidence. The remaining 22.5% said it was about the same, and further detail provided suggested this was from those who had a reasonable level of experience already.

Whilst there was no obligation for scientists and researchers who came to the training to take part in activities back at centres, a proportion participated in a number of meet the expert programmes at centres.

The scientists who participated in events and activities at science centres came from a variety of backgrounds at all levels. However the evaluation did show that the majority of those involved were PhD students or at junior researcher level, and the majority worked in astronomy/astrophysics.

Scientists also reported enjoying and valuing their experiences and many noted the benefits of working with, and having the support of, expert science communication organisations.

Evaluation from meet the expert events

> *'Respondents welcomed the opportunity to engage personally with a scientist. They appreciated the chance to hear about contemporary science first-hand from scientists involved. Many appeared to be highly enthusiastic about their new knowledge and their experience.' – King's evaluation report*

'I would like to be a scientist when I grow up because they do lots of different things and it sounds exciting.'

'I've never met a scientist before! Was good to see Science in Action!'

'They just seem like ordinary people but are younger than I thought they would be, I thought all scientists were old - like my parents.'

Our grateful thanks to STFC for their vision in supporting Explore Your Universe.

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January 2014