Outreach across the School of Physical Sciences

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Some quick definitions

Outreach → Working with those under the age of 18

Public Engagement → Working with the general public. This could be town halls, mixed audience events, museum exhibits etc etc

These definitions are **very loose** and regularly interchangeable… even regularly debated!

Where I feel like something is both, or too similar to call, I shall simply use **OPE** to stand for Outreach and Public Engagement

Widening Participation → Also referred to as WP. Our commitment to make higher education accessible to all, regardless of background, culture, gender or sexuality

Outreach -

The activity of an organization in making contact and fostering relations with people unconnected with it, esp. for the purpose of support or education and for increasing awareness of the organization's aims or message; the fact or extent of this activity.

- Oxford Dictionary

Why do we do it?

The Enlightenment tradition (reach 'the hard to reach')

A public service duty to share knowledge with the wider public. If people understand science they are more likely to engage with it

What's the problem?

Our content isn't accessible to some people

Assumptions about fixing it?

We need to create rich formal and informal learning. We can address the problem by coming up with more creative and inspirational ways of sharing knowledge

Focus of interventions?

- Techniques to making knowledge accessible, including open access
- Providing authoritative accounts and expertise

The Socio-cultural tradition (engage the 'under-served')

Respecting how different people come to learn and value science differently and the power of culture in shaping our identities and world views

What's the problem?

People's readiness to engage with science is shaped by their culture and social identities- science itself is a culturally constrained

Assumptions about fixing it?

We need to be sensitive to context and culture – and problematize the cultural assumptions about what science is

Focus of interventions?

- Working with people's cultural preferences ; re-framing the culture of science; multiple narratives; working with trusted intermediaries

The Systemic tradition (fixing the system)

Science forms a part of a much wider complex social system – we need to make sense of individual's choices as part of this broader ecology

What's the problem?

We approach 'science' as a closed system – in fact it is deeply implicated in wider systems of culture, power and politics

Assumptions about fixing it?

Thinking systemically can help us grasp the complex interdependencies that shape individual choices and intervene to better align or harmonise the system

Focus of interventions?

- Understanding the systems that impinge on science engagement and intervening to enhance them
- Brokering and aligning interventions

Five approaches to Opening Up Science
National Forum for Public Engagement with STEM
Sept 2016

The Participatory tradition (empower the 'disadvantaged')

People's readiness to participate is strongly determined by inequity and the exercise of power

What's the problem?

Poverty, marginalisation, access and self-efficacy affect people's readiness and appetite to engage with science

Assumptions about fixing it?

We need to address inequality and structural barriers if we are to open up science to the 'disadvantaged'

Focus of interventions?

- Community development; widening participation

The Marketing tradition (target the 'dis-engaged')

We are 'selling' science in the wrong way – we need to tailor our messages to our audiences

What's the problem?

Our messages aren't getting through

Assumptions about fixing it?

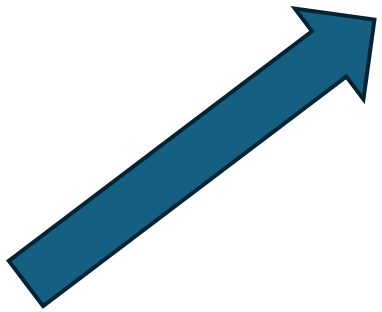
If we better understand our audiences and their motivations / interests / values we can target them more effectively – and reach the publics we value

Focus of interventions?

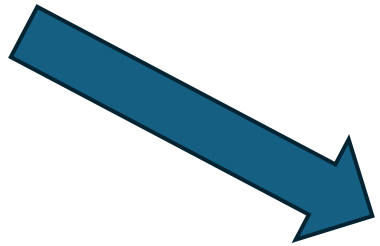
- Intelligence gathering
- Tailoring message to audience; targeting more effectively

Why do we do it?

Access and Participation Plan



University strategy



Six objectives:
Black, Asian and Minority Ethnics Student access
Index of Multiple Derivation Quintile 1 student access
Index of Multiple Deprivation Quintile 1 student continuation
Index of Multiple Deprivation Quintile 1 student completion
Degree awarding for students with a reported disability
Degree awarding for Black, Asian and Minority Ethnic students

Strategy 2031

- Support knowledge exchange including public engagement through a range of pump priming grants to strengthen our impact, partnerships and research environment
    - Renew our commitment to widening participation and outreach to raise educational attainment and aspiration, so that students from all backgrounds are able and supported to achieve their full potential

Why should you do it?

Involvement in outreach is good for:

Your communication skills

Your teamwork skills

Your problem-solving skills

Your research landscape awareness – yes, really!

Opportunity to apply for grants

Opportunity to write publications outside your research area!

Opportunities across the School

UNIVERSITY OF LIVERPOOL

Science Jamboree 2025

Year	Badge colour	Number of days	Number of visitors	Number of students
2016	Purple	1	300	60
2017	Dark Blue	2	700	120
2018	Light Blue	2	700	100
2019	Green	1	600	80
2020	Yellow	At home – c20 Groups took part		20
2021	Orange	128 Kit Boxes sent out		20
2022	Red	1	470	80
2023	Black	1	550	64
2024	Pink	1	515	60

Maths Club

Reflections on a Laser Beam

Inspired by a problem on Project Euler (projecteuler.net), we will explore multiple reflections of a laser beam in a cavity, asking in how many different ways you can do an internal reflection before leaving through the entrance hole. The journey to a solution will allow us to talk about maths, physics, coprime numbers, non-orthogonal grids and alternative measures of distance. We will have to think both inside and outside the box for this one.

Probabilities, Dice, Dungeons and Dragons

Life, Death and Cellular Automata

How complex must a machine be to make a copy of itself? Can such a machine be created with simple rules? In this session, we will use Python to look at the emergence of complexity from a surprisingly simple mathematical model.

Faculty Events

Year 6 Inward Visits

- Groups of Year 6 are hosted in the Central Teaching Laboratories every June. This may be their first opportunity to visit a university, and we hope to to raise their aspirations before their move to high school.

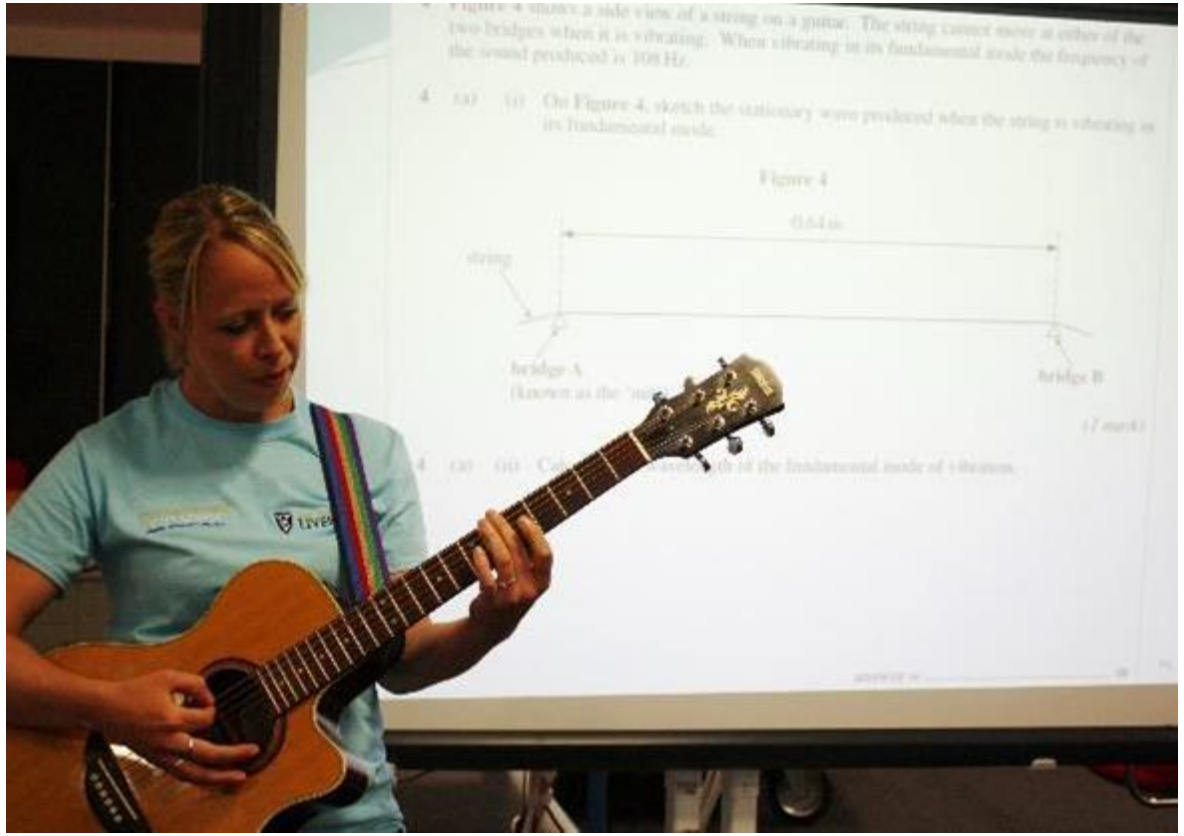
Year 9 STEM (Science, Technology, Engineering and Mathematics) Taster Days

- We invite local schools to send their 15 most able Year 9 pupils each January, before they make their GCSE choices, to inspire them to consider studying separate sciences and higher-tier mathematics.

Year 12 STEM Masterclasses

- Students at the end of their first year of A-Levels can sign up to a wide range of workshops from across the Faculty of Science and Engineering. This helps them find out more about what its like to study at university

Year 10 Girls in Maths



Aimed at increasing participation in A-Level Maths by young women as a gateway to STEM degrees and careers

Around ~200 girls each year come to CTL to take part in a range of activities

Followed very importantly by a careers carousel to demonstrate the breadth of careers available to them!

Next event will take place March 2026

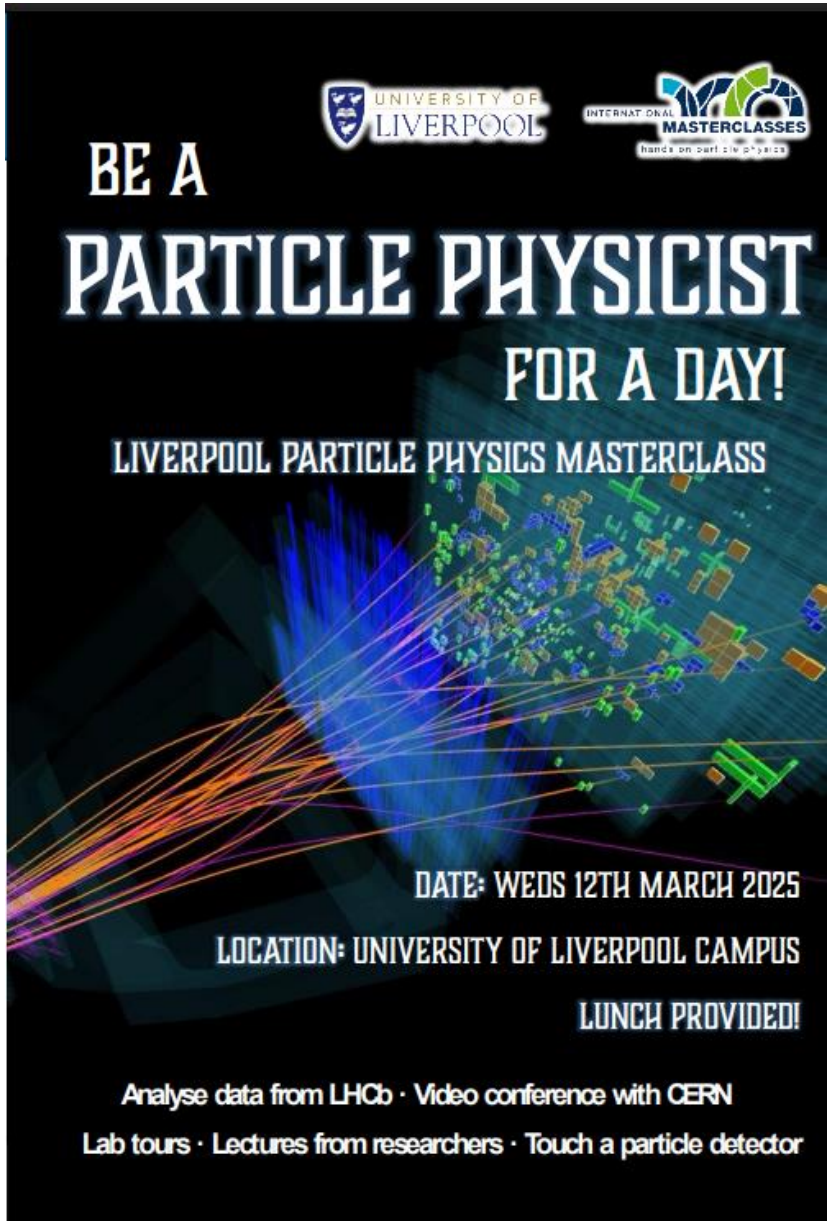
Opportunities within Physics

Particle Physics Masterclass

Led by Saskia Charity in 2025
First one in Liverpool in over a decade!
Attended by over 150 students from >20 schools
~40 staff and students to run the day

10:00 → 10:10	Welcome		10m
10:10 → 10:55	Particle Physics Overview	Introductory talk linked to A-level by Saskia	45m
10:55 → 11:10	Comfort break		15m
11:10 → 12:00	LHCb Lectures		
11:10	LHCb Experiment Overview	Talks on LHCb by **David Hutchcroft** + **Paras Naik** with Liverpool-built VELO detector on display	20m
11:35	LHCb Hands-on Session Introduction		20m
12:00 → 13:00	Lunch (CTL atrium)		1h
13:00 → 14:45	Hand-on Session (+ Lab tours)	Hands-on activity on real LHCb data, led by David + tours of teaching labs with demonstrations by UGs	1h 45m
14:45 → 15:00	Walk to Yoko Ono Lennon Centre		15m
15:00 → 16:00	Video Conference with CERN	Compare results with other groups + virtual tour of LHCb led by Liverpool PhD student **Ho Sang Li**	1h
16:00 → 16:30	Feedback and Close		30m

Rio de Janeiro, UFRJ | Geneva, CERN | Pisa | Bologna | Liverpool



Physics Olympics

Thanks to the kind sponsorship of Mirion Technologies – the Physics Olympic is coming back!

Aiming to have ~200 students in 40 teams competing in a series of activities for a chance to win the grand prize!

Require around 30 staff and students to run the event

Fantastic opportunity for training and involving new members of the outreach group

Work Experience

Now hosting 32 students

Talks around six research areas

Team building exercises

Mini research-based project

Finish with trip to Daresbury lab

School Visits

Opportunities within Maths

Challenge Competitions

Two competitions

- Organised by the maths department
- Challenge for Year 8 and below
- Senior for Year 10 and below

In 2024:

947 entries for challenge

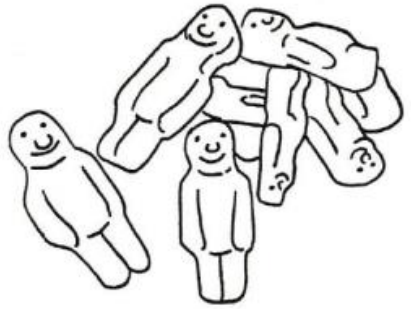
573 entries for senior

6. Fancy Fondant

Sandra is making fondant in a cylindrical pan of diameter 24cm.
The length of the spoon she is using to stir is 25cm.
It accidentally falls into the fondant.
What is the minimum volume of fondant necessary to hide the spoon completely?
You may ignore the spoon's own volume.

1. Jelly Babies

Susha is trying to divide a packet of jelly babies between her 4 children. Firstly, she gives some to the eldest; the second gets a third of what is left; the third gets 5/8 of what's left; and the youngest receives the rest of the packet, which is 2/5 of their eldest sibling's share. Each child receives fewer than 20 jelly babies. How many are in the packet and what number does each child get?

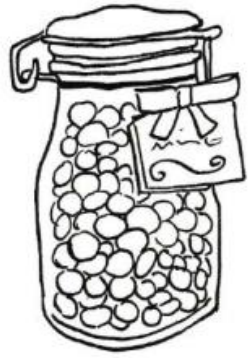


2. Clean Break

Ellie's bar of chocolate has four rows of six squares. She wants to divide it into individual squares using clean straight breaks, where each break makes two pieces out of one. What is the minimum number of breaks she needs to do?
Her husband, Charlie, has a larger bar, with 8 rows of 6 squares. The top-left and top-right squares both contain a nut. Neither Charlie nor Ellie likes nuts and each of them wants to avoid getting one. Starting with Charlie, they take it in turns to snap the bar into 2 pieces along a line between 2 rows or 2 columns, eating 1 of the 2 pieces produced. Who can guarantee not to eat a nut? Is this true for any size of bar?

3. Imperial Volunteers

Pat, Sharon and Helen are litter picking along the canal with 7 volunteers. They have 35 mint imperials. Pat eats 1, Sharon eats 2 and Helen eats 3. They leave the rest for the volunteers. All of them are eaten. Show that at least one volunteer ate at least 5 mint imperials.



MEM Masterclass Series

Series of 5 masterclasses aimed at Y8 students and organised by UoL, hosted across Liverpool

"The Masterclasses materials provide an excellent opportunity for able and enthusiastic pupils to explore a range of mathematical ideas. Topics covered are very varied, including fractals, logo and turtle graphics, origami, codes and ciphers, probability games, number magic, mathematicians, mechanics and juggling."

School Visits

Creating your own projects

Pots of money do occasionally come up from research councils!

Some examples from physics include:

STFC SPARK Award
STFC Nucleus
IOP Public Engagement Scheme (PEGS)

If this is something you're interested in, then do reach out to your local contact…

What support is available

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