

March 2023

The Physics Zone (physics23.imascientist.org.uk/) ran from 6 to 31 March 2023 and was funded by UK Research and Innovation, the STEM Ambassador Scheme and the Mathematical, Physical and Life Sciences Division at the University of Oxford.

The Zone featured 30 physicists working in industry including geologists, signalling apprentices and radiotherapists to academics researching quasars, nuclear engineering, medical exploration of the human brain and developing better batteries. Participants wrote 14,326 Chat lines and students asked 229 questions.

Key activity figures

	Physics Zone	March 2023 Mean
Students logged in	802	815
Students active	89%	90%
Schools	31	33
Scientists allocated	42	42
Scientists active	29 (69%)	28
Chats booked	83	75
Chats took place	47	48
Lines of Chat	14,326	12,417
Average lines per Chat	305	256
Follow up questions asked	229	201
Follow up questions approved	183	151
Answers given to follow up questions	335	451
Scientist comments	18	41
Student comments	7	5
Votes	492	453

Who took part?

802 students from 31 UK schools logged into the Zone and connected with 29 physicists. 75% of active students were from priority schools: 36% from underserved schools and 53% from widening participation schools.

A total of 492 votes were cast by students. The winning physicist with the most student votes was **Yannick Verbelen**, who is a nuclear engineer and researcher at University of Bristol.

Activity

83 Chats were booked. 47 took place. Out of the remaining 36 Chats booked, 22 were cancelled whilst in 15 cases, the school did not attend and did not give notice. Many reasons exist for missed attendance including strikes and bad weather. All schools were chased and invited to rebook.

There were 8 Chats where the teacher asked questions on behalf of their students. It is also common for students to share login details or computers during Chats. Therefore, the number of students engaged is expected to be higher.

Students asked 229 follow up questions of which 183 were approved and sent to scientists.

School activity

Students from 33 schools across the UK actively participated in the Zone.

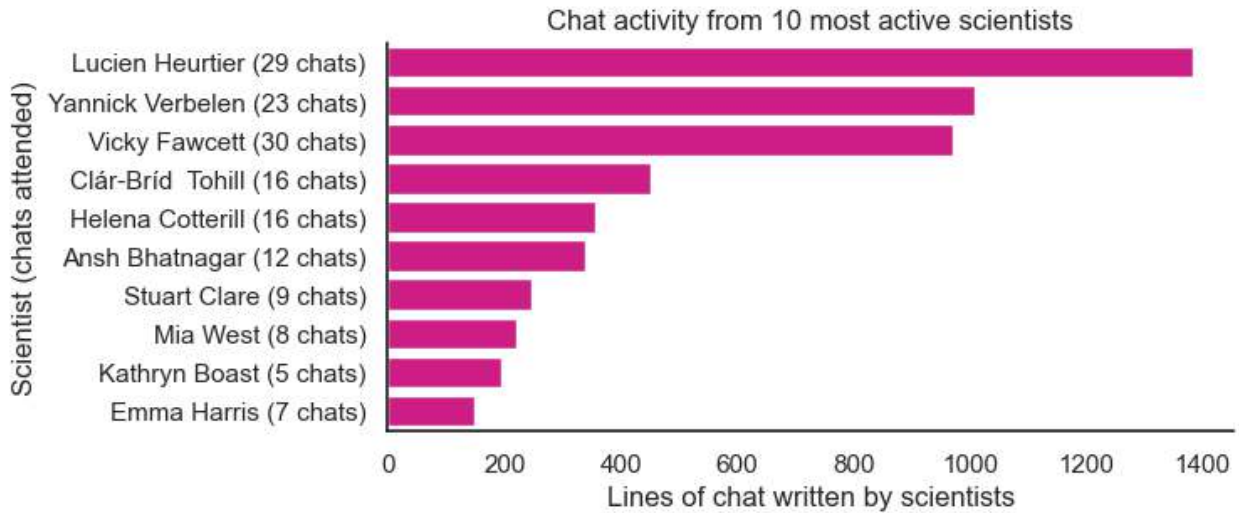
School	Active users	Chats attended	Chat lines (total)	Chat lines (per user)	Follow up questions approved	Votes
Sir Harry Smith Community College, Cambridgeshire (U)	89	4	895	10	7	79
Southfields Primary School, Cambridgeshire (WP)	61	4	550	9	3	39
Mulberry School for Girls, London (WP)	60	3	544	9	62	53
Pennyman Primary Academy, Cleveland (WP/U)	40	1	565	14	2	11
Furness Academy, Cumbria (WP/U)	39	4	429	11	5	28
Ercall Wood Academy, Shropshire (WP)	39	3	532	14	13	30
Scarcroft Primary School, North Yorkshire	33	1	395	12	7	9
Trinity Primary Academy, London (WP)	28	1	493	18	7	15
Hounslowdown School, Hampshire	27	2	462	17	44	29
Malton School, North Yorkshire (U)	26	1	109	4	0	26
The City of Leicester College, Leicestershire (WP)	26	2	393	15	4	3
*Fulwood Academy, Lancashire (WP)	25	2	185	7	2	9
Clevedon School, Somerset	25	1	387	15	0	25
Darrick Wood School, Kent (U)	24	1	143	6	1	24
Redmoor Academy, Leicestershire (U)	22	1	129	6	1	22
Pineham Barns, Northamptonshire	21	1	199	9	1	15
Jarvis Brook School, East Sussex (WP/U)	18	1	163	9	13	20
Sir Herbert Leon Academy, Buckinghamshire (WP)	16	1	183	11	0	0
Exeter College, Devon	15	1	51	3	1	14
Unsworth Academy, Lancashire (WP)	15	1	144	10	5	8

School	Active users	Chats attended	Chat lines (total)	Chat lines (per user)	Follow up questions approved	Votes
St Benedict's Catholic College, Essex	14	1	127	9	0	0
Stirling High School, Stirling	13	1	157	12	1	9
Yavneh College, Hertfordshire	13	1	52	4	0	11
The Frances Bardsley Academy for Girls, Essex	7	1	34	5	0	6
Albright Education Centre, West Midlands (WP)	7	1	86	12	0	6
Cox Green School, Berkshire	4	1	41	10	0	0
*Furness Primary School, London	3	2	225	75	4	0
The Beaulieu Park School, Essex	3	1	57	19	0	0
*Gravel Hill Primary School, Kent (WP)	1	3	47	47	0	1
*Roundwood Primary, Buckinghamshire (WP)	1	1	30	30	0	0
*Hodthorpe Primary School, Nottinghamshire (U)	0	1	42	42	0	0

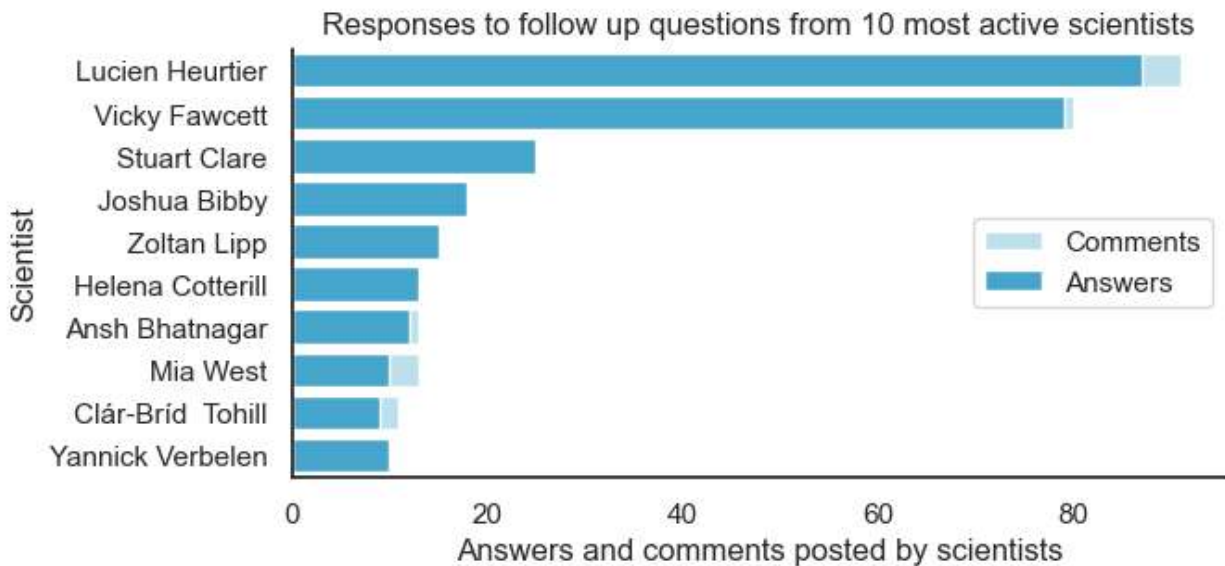
** In these chats teachers typed questions on behalf of their students, with the chat displayed on a screen.*

We want to increase the participation of under-represented groups. Find out what we mean by under-served (U) and widening participation (WP) schools, and how you can support us in working with more of these: about.imascientist.org.uk/under-served-and-wp

Scientist activity



The scientists shown wrote 87% of the lines of chat in the zone.
The average scientist attended 7 chats, and wrote 212 lines.



The scientists shown posted 83% of the answers, and 61% of the comments in the zone.
The average scientist posted 12 answers, and 1 comments.

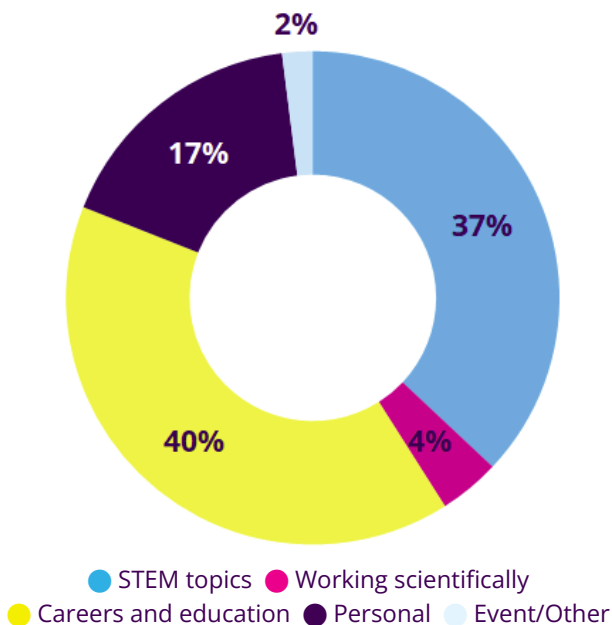
Chats

The word cloud below demonstrates what students and scientists talked about in Chats. The bigger the word, the more frequently it was used.



Follow up questions

The chart below shows an analysis of questions students sent to the scientists. Questions are coded into overarching categories. The examples are coloured by category.



- Can a fire have a shadow?
- Is the universe infinite? Or just very big?
- How did people start working with the brain if they didn't know anything about it??
- How did people start working with the brain if they didn't know anything about it??
- douse it never creep you out when you like operate on brains and like scan the brain and look inside it
- how much do you get paid as a scientist?
- What do u think the hardest milestone of your work will be?
- If you could go back to your childhood what is one thing you would change

Examples of good engagement

A student is making a link between physics and one of the biggest topics in science today. Helena, Vicky and Ansh contribute answers on how physics relates to this study.

Student 1: does physics tie in a lot with climate change - does any research in physics relate to climate change crisis and does it have much involvement

Helena (physicist): The research I did as a Master's student was atmospheric physics and we had a whole subdepartment looking at the climate! I knew people working on climate models, policy, atmospheric dynamics - physics is very much involved!

Vicky (physicist): there is a lot of work being done on renewable energy - both in physics and engineering. Also analysing the weather and climate and how this evolves over time.

Ansh (physicist): Yes, atmospheric physics is the branch most closely related to climate change!

Reviewing the application of the development of particles to everyday life is useful. It provides students with an opportunity to discover how physics can relate to things in their lives. Here, Ansh, provides an insight to this student.

Student 2: Are there any modern day uses for these particles?

Ansh (physicist): So dark matter probably isn't very useful as it is so difficult to get a hold of - it just travels through everything and barely interacts! But it does explain why galaxies are held together and why the outermost stars aren't simply flung out into space - it's because gravity from the dark matter keeps them in the galaxy!

The use of AI technology and robotics is one of the more popular topics amongst students. Yannick, a physicist who is also developing robots to be deployed in areas with high radiation, provided further some useful information.

Student 3: What kind of robots do you build? How do they benefit the world around them? :)

Yannick (physicist): Sure, I have built quite a few different robots because I think robots can be really helpful to our society, for example they can take over dangerous or repetitive or boring tasks from humans which then allows humans to concentrate more time on solving other problems. I focus on robots that can do radiation measurements and mapping, for example, to survey mining sites looking for radiation signatures that could indicate the presence of valuable materials in the ground, which then saves the environment because it means we don't have to do as much digging to get them out of the ground.

Yannick (physicist): What I find quite interesting about robots is that they are just as "dumb" or "intelligent" as the software used to control them. I'd say that 90% of the time spent on building robots is getting the software to control them right, only 10% is spent on building the hardware. And the cool thing is that everyone with a computer at home can learn how to write software, which means you can learn to be a roboticist from the comfort of your chair at home, and it doesn't cost you anything because all of the software development tools like vscode are free to download nowadays. Python as a programming language is also really easy and intuitive to learn.

Student 3: Im so fascinated by coding but i think its difficult to get started (?), I've seen a load of online courses and tutorials but they all seem to cover the same thing in not much depth. Are there any beginner courses either online or in person you recommend?

Yannick (physicist): Certainly there are a lot of tutorials online and I recommend downloading vscode to get started with some simple Python programming, it's easy and free of charge. I often recommend students, for example those looking for work experience, to get started with tutorials on Youtube, and then proceed with more comprehensive examples in books.

Lucien provided some insight into the way that dark matter, or what we think it is, exists and what function it plays in the universe. An area where research is needed as there are a lot of unknowns! The student took the opportunity to ask some follow up questions to gain understanding.

Student 4: How do you know that what you have discovered is dark matter ?

Lucien (physicist): Let me be honest here: Nobody has discovered dark matter yet. Dark Matter is some matter that we strongly think is there, but that we can't see. It's actually more transparent than dark. We suspect it's there for many reasons: One of them is that galaxies turn very fast, and without dark matter, they could not turn so fast without falling apart. So people have built huge detectors to try to detect it (by seeing some atoms moving for no reason for instance) but they have not detected it yet.

Student 4: Do you think it will be proved in our lifetime?

Lucien (physicist): I think it could very well be. There is HUGE progress made on the technical side, now people propose new ways of detecting it using quantum sensors, it is a very exciting and very active field of research. I believe I may know what dark matter is before I die, yes. Also, I don't know if you heard, but there are many new telescopes built that will observe the Universe with a MUCH better precision than before, so we will get to know very soon exactly where is dark matter and how much there is. Without dark matter, we don't understand how galaxies could ever have formed! There are wonderful simulations that were done, which you can watch online: <https://icc.dur.ac.uk/Eagle/highreader.php?page=evo>

You can choose to see stars, dark matter, gas, and what's fascinating is that they are all the same place, because dark matter helps stars forming!

Student 4: Without proof of dark matter how do we know how they affect all things in the galaxies?

Lucien (physicist): because we can make simulations. We know how much matter there is in the Universe, we also can measure how fast the Universe expands, so one can go ahead and try to simulate on a computer how galaxies would form, and if you don't put any dark matter in your simulation... numbers just don't add up... you don't get what we see today around us. We can also see that galaxies turn very fast. And without dark matter, we don't understand how all these stars don't get ejected right away when turning so fast. As far as I'm concerned, my job is to make smart theories to understand what dark matter could be (is it

made of particles? black holes? something else?) and then find smart ways to test these theories with experiments.

Student 4: That's so interesting thank you!

The educational opportunities of some subjects are explored quite thoroughly by students, specifically by those in older year groups. Here, CB explained how important it is to know the module distribution in undergraduate courses, to offer the most options when it comes to specialising.

Student 5: I have heard that most physics undergraduate degrees are the same for the first year and then they start to specialise. Is it possible to change from one specialisation to another at the end of the first year if you find that you are preferring one topic to another?

CB (physicist): I think after the first year in my university you could specialise more in astronomy or particle/theoretical physics by picking modules in those areas. So if you went to university just studying physics then you could change to astronomy after the first year but it also depends on the university so compare the modules you have to take in the first year and if they are the same for straight physics and for astronomy then you could definitely switch!

Student 5: Thanks for the advice!

Scientists of the week

Students voted each week for their favourite scientist to be named scientist of the week.

The scientists of the week were:



Yannick Verbelen, a researcher looking into nuclear engineering at Bristol University



Lucien Heurtier, a particle physicist and cosmologist, researching our Universe's history and dark matter

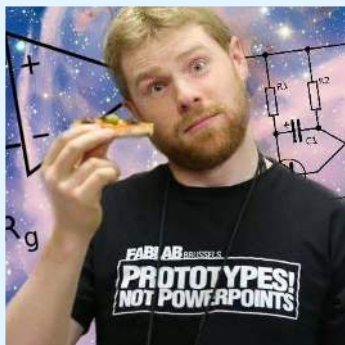


Vicky Fawcett, an astronomer studying quasars - bright galactic nuclei powered by supermassive black holes

Winning scientist

The overall winner, with the most votes at the end of the Zone was **Yannick Verbelen**, a researcher looking into nuclear engineering at the University of Bristol

As Zone winner, they receive £500 to spend on further public engagement projects.



"As a young person growing up, the future seemed uncertain. There are so many questions, but where are the answers? Anyone with a passion for science and a curious mind can be a scientist, and that is an interest that deserves nurturing, because the future of our civilisation depends on it. I want to say a massive thank you to all students who participated: you carefully stepped out of your comfort zone and dared to ask questions about subjects that matter to a real scientist. The kind of questions that will enable you to change the world!"

You can read their full statement at [here](#)

Feedback

"This has been really great for my pupils, thank you so much" **Teacher**

"Thank you so much for spending time with us and I hope you all continue to do amazing research and wish you good luck!"

Student

"Thanks for all the great answers to my questions!"

Student

"thank you so much for the (tricky) questions!"

Lucien (physicist)

"This has been so interesting! Thank you so much for all of your time!"

Teacher

"Thank you. This has been our 1st chat, we will definitely join again"

Teacher

"Was really cool chatting with all of you, we hope you found it as interesting as we did!"

Yannick (physicist)

Funding partners

The Zone was funded by:



**UK Research
and Innovation**

