



Institute of Physics  
in Wales

Sefydliad Ffiseg  
yng Nghymru

## Welsh Physics Teachers Conference Brecon 2020

### Physics on the Frontline against Covid-19

#Brecon2020

Monday 5<sup>th</sup> to Saturday 10<sup>th</sup> October 2020

For all teachers of Physics... join the Welsh Physics Teachers Conference Brecon 2020, which will be online this year between 5<sup>th</sup> - 10<sup>th</sup> October 2020.

A fabulous free week of presentations and workshops for teachers, technicians and PGCE students with opportunities to network with colleagues online.

We will offer workshops between 16:00 and 20:00 each evening Monday – Friday, as well as a full programme on Wednesday (09:00 – 20:00) and Saturday morning (09:00 – 13:00) with a choice of workshops, shows and presentations.

Please join us for a full week of workshops and inspiring lectures which include 'Movement, Measurement and the Laws of Motion' – Prof Huw Summers (Swansea University); 'New Worlds' – Prof Mike Edmunds (Cardiff University) and 'The Planet of Pollution' – Prof Averil MacDonald OBE (Southampton University).

Workshops will include Earth in Space; Lego Physics; Sunglasses, Violins and Electrons; Physics with Balloons – and the Annual (virtual) Quiz from Zeera's!

Technicians are also welcome to attend a full day of workshops on Wednesday 7<sup>th</sup> October as well as engage with other events during the week.

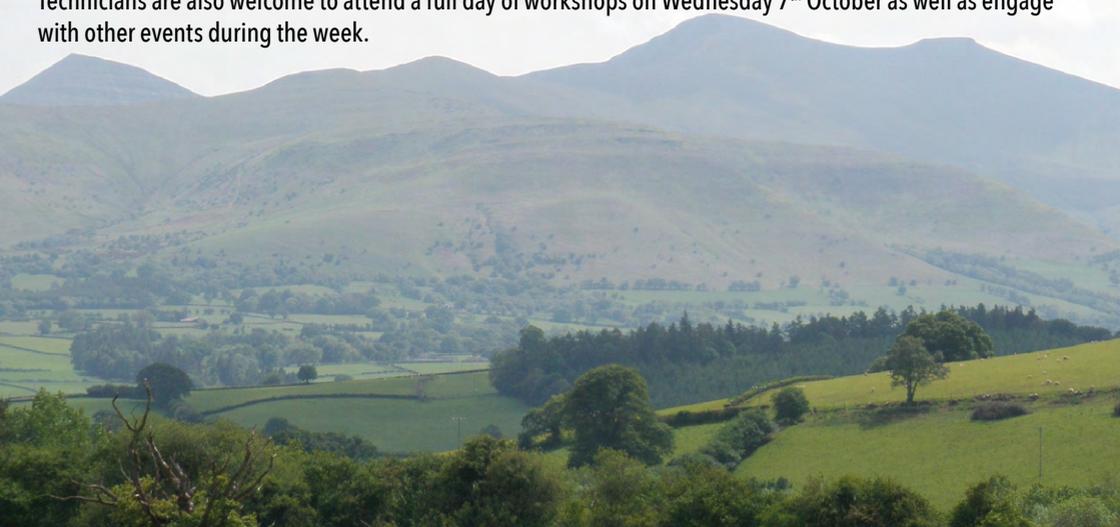
The full programme can be viewed on [talkphysics](#) and free registration via Eventbrite is [here](#).

On the [Eventbrite registration page](#), click the green Register button, then select the days you wish to attend. Click the red Register button, provide your details, select the workshops you wish to join (plus other tick boxes) and finally click Register again.

Please encourage colleagues from other schools and organisations to attend.

Booking is essential so please respond no later than 3<sup>rd</sup> October to avoid disappointment.

For further details please contact [cerian.angharad@iop.org](mailto:cerian.angharad@iop.org)



## Session timetable

*click any session title to go to registration*

ID	Time	Title	Presenter
<b>Monday 5 October</b>			
M1	16:00 – 16:45	Cognitive Load Theory	Alessio Bernardelli
M2	17:00 – 17:45	Science on Stage Part 1	Paul Nugent
M3	18:00 – 18:45	The Resourceful Physics Teacher – Online	Keith Gibbs
M4	19:00 – 19:45	<b>New Worlds</b>	<b>Keynote Speaker: Prof Mike Edmunds, Cardiff University</b>
<b>Tuesday 6 October</b>			
Tu1	16:00 – 16:45	The Problem with Boys	Stephanie Bevan
Tu2	17:00 – 17:45	Electromagnetism 200	David Keenhan
Tu3	18:00 – 18:45	Using Sport to Teach Physics – Like it or Not	Dr Lawrence Cattermole
Tu4	19:00 – 19:45	Social evening	Virtual Quiz at Zeera's
<b>Thursday 8 October</b>			
Th1	16:00 – 16:45	Not just Gamma and X-rays!	Alison Alexander and Ruth Wiltsher
Th2	17:00 – 17:45	Shades of Blended Learning	Keith Jones
Th3	18:00 – 18:45	Improving Gender Balance – Unconscious Bias	Dr Anita Shaw
Th4	19:00 – 19:45	<b>Gravitational Waves</b>	<b>Keynote Speaker: Dr Chris North, Cardiff University</b>
<b>Friday 9 October</b>			
F1	16:00 – 16:45	Physics Education at Home: DIY Activities for Home Learning	Gary Williams
F2	17:00 – 17:45	Earth in Space	Graham Perrin
F3	18:00 – 18:45	Electromagnetism 200	David Keenhan
F4	19:00 – 19:45	<b>The Physics of Bubbles</b>	<b>Keynote Speaker: Sue McGrath</b>
<b>Saturday 10 October</b>			
S1A	09:00 – 09:45	Developing a Research-Informed Physics Curriculum for the 'New KS3'	Anthony Clowser
S1B		Electromagnetism with Practicals	David Cotton
S2A	10:00 – 10:45	Science on Stage Part 2	Paul Nugent
S2B		Lego Physics	Lewis Mattheson
S3A	11:00 – 11:45	GCSE and GCE Update	Helen Francis
S3B		Physics with Balloons	Jo Kent
S4	12:00 – 12:45	<b>Taking up Space</b>	<b>Show – Science Made Simple</b>

ID	Time	Title	Presenter
<b>Wednesday 7 October</b>			
W1	09:00 – 09:45	<b>Movement, Measurement and the Laws of Motion</b>	<b>Keynote Speaker: Prof Huw Summers, Swansea University</b>
W2A	10:00 – 10:45	GCSE and GCE update	Helen Francis, WJEC
W2B		Turning Points	Richard Bonella
W3A	11:00 – 11:45	Cognitive Load Theory	Alessio Bernardelli
W3B		The Resourceful Physics Teacher – Online	Keith Gibbs
W3C		Introducing Programming with the PASCO//code. Node	Dr Nichola Swann
W4A	12:00 – 12:45	Using Sport to Teach Physics – Like it or Not	Dr Lawrence Cattermole
W4B		The Problem with Boys	Stephanie Bevan
W4C		Technician Workshop	<b>To be confirmed</b>
W5A	13:00 – 13:45	Not just Gamma and X-rays!	Alison Alexander and Ruth Wiltsher
W5B		Games and Resources for the Teaching of Electricity and Energy	Tony Reeves
W5C		Technicians Techmeet	Cerian Angharad
W6A	14:00 – 14:45	Shades of Blended Learning	Keith Jones
W6B		Improving Gender Balance from Primary Upwards	Dr Anita Shaw
W6C		LogIT datalogging	Selene Gilles and Mark Finch
W7A	15:00 – 15:45	Earth in Space	Graham Perrin
W7B		Physics Education at Home: DIY Activities for Home Learning	Gary Williams
W8	16:00 – 16:45	Physics with Balloons	Jo Kent
W9	17:00 – 17:45	Gravitational Waves Workshop	Dr Chris North
W10	18:00 – 18:45	Sunglasses, Violins, and Electrons	David Cotton
W11	19:00 – 19:45	<b>The Planet of Pollution</b>	<b>Keynote Speaker: Prof Averil MacDonald OBE, Southampton University</b>

## Session descriptions

### Monday 5 October 2020

#### **Session M1: Cognitive Load Theory in Physics Teaching and Learning / Alessio Bernardelli / KS3-5**

In this workshop we will explore the findings of educational research on Cognitive Load Theory and their implications to the learning of Physics. We will also consider and propose a series of strategies and tools that could be used in the classroom and for remote learning to take into account these ideas and evidence.

#### **Session M2: Science on Stage Part 1 / Paul Nugent / KS3-5**

Science on Stage is a European initiative designed to encourage teachers from across Europe to share best practice in science teaching. Ultimately, the aim of Science on Stage is to enable teachers to deliver science in a more creative and engaging way. This session will explore many of the teaching ideas and resources from [www.scienceonstage.ie](http://www.scienceonstage.ie). Join us for some of the very latest experiments from the recent **Cascais SonS Festival 2019**. The experiments can be carried out by teachers or students, in school or at home.

#### **Session M3: The Resourceful Physics Teacher Online / Keith Gibbs / KS3-5**

Keith, author of 'The Resourceful Physics Teacher', will introduce the teachers to a set of ten Virtual Practical experiments. These can be performed by students at home or used as actual practicals within school. He will also share a series of Physics videos that he has prepared and discuss how they could be used in lessons.

#### **Session M4: New Worlds / Prof Mike Edmunds / KS3-5**

When I was a research student, many moons ago, we had no idea whether the Solar System was unique in the Universe, or whether there were many new worlds out there waiting to be discovered. That question has been spectacularly answered over the past 25 years, and acknowledged in the award of the 2019 Nobel Prize for Physics. I will look at what happened, and why, and how, using basic physics, we are discovering what it would be like to visit those new worlds.

### Tuesday 6 October 2020

#### **Session Tu1: The Problem with Boys / Stephanie Bevan / KS3-4**

In this workshop we will be exploring the perception of boys in the classroom inspired by examples from teachers, the book 'Boys don't Try' by Matt Pinkett and Mark Roberts and lessons learnt from the Institute of Physics Improving Gender Balance Project. We will share the latest research and provide strategies to equip teachers to engage pupils.

#### **Session Tu2: Electromagnetism 200 / David Keenhan / KS3-5**

Electromagnetic theory is one of the cornerstones of Physics. This workshop/webinar is based on demonstrations of the electromagnetic force in action. The force acting on a current-carrying conductor in a magnetic field can be used to cause spin. Galvanometers, electric motors and simple generators all make use of spin. Novel uses of these are a particular feature of this workshop.

#### **Session Tu3: Using Sport to Teach Physics – Like it or Not / Dr Lawrence Cattermole / KS3-5**

This session is for teachers who don't particularly like sport as well as for those who do. By using the rich detail of aspects of particular sports, we can engage students and get them thinking about some of the tricky concepts that so many find difficult. Along with forces and motion, we will look at teaching some aspects of energy, waves, kinetic theory and even a bit of electrical circuits. Sports will include athletics, contact and non-contact sports. Suitable for all key stages.

#### **Session Tu4: Virtual Quiz at Zeera's / Tony Reeves**

Join us for a social evening which will include a quiz and opportunities to network.

## Wednesday 7 October 2020

### **Session W1: Movement, Measurement and the Laws of Motion / Prof Huw Summers, Swansea University / KS3-5**

The development of mass-produced inertial sensors for consumer electronics has provided low-cost, wearable acceleration sensors. These lightweight systems can capture movement kinetics with millisecond resolution and so provide detailed time-series data on human motion. In this talk I will discuss the use of accelerometers to study human movement patterns and describe the signals analysis that provides information in two example studies – activity intensity of school children and the fitness levels of professional footballers. In relation to science teaching, I aim to convince you that accelerometers provide a ready-tool for demonstrating the laws of motion and when applied to human movement also allow exploration of the fundamentals of physiological dynamics.

### **Session W2A: GCSE Science and GCE Physics Update WJEC / Helen Francis,**

**WJEC Domain Leader – Science and Mathematics / KS4-5**

The Examinations Board will provide an update on GCSE examinations, and discuss Science and GCE Physics.

### **Session W2B: Turning Points / Richard Bonella / KS4-5**

This session will focus on the special relativity element, which is a very condensed version of a more thorough approach and include concepts, mental models and maths, sample problems, good online resources linked to the AQA, Turning Points' option or equivalent.

### **Session W3A: Cognitive Load Theory in Physics Teaching and Learning / Alessio Bernardelli / KS3-5**

In this workshop we will explore the findings of educational research on Cognitive Load Theory and their implications to the learning of Physics. We will also consider and propose a series of strategies and tools that could be used in the classroom and for remote learning to take into account these ideas and evidence.

### **Session W3B: The Resourceful Physics Teacher Online / Keith Gibbs / KS3-5**

Keith, author of 'The Resourceful Physics Teacher', will introduce the teachers to a set of ten Virtual Practical experiments. These can be performed by students at home or used as actual practicals within school. He will also share a series of Physics videos that he has prepared and discuss how they could be used in lessons.

### **Session W3C: Introducing Programming with the PASCO//code.Node / Dr Nichola Swann**

Discover the easiest way to teach sense and control programming with the latest innovation from PASCO Scientific. In this introductory session, we will demonstrate how to construct simple programs using the //code.Node's inbuilt sensors and outputs, and show how the unit can be used with any of PASCO's current and legacy datalogging sensors. Resource packs will be provided to enable you to build on the skills learnt in this session, and use our new Blockly coding capability at home for free.

### **Session W4A: Using Sport to Teach Physics – Like it or Not / Dr Lawrence Cattermole / KS3-5**

This session is for teachers who don't particularly like sport as well as for those who do. By using the rich detail of aspects of particular sports, we can engage students and get them thinking about some of the tricky concepts that so many find difficult. Along with forces and motion, we will look at teaching some aspects of energy, waves, kinetic theory and even a bit of electrical circuits. Sports will include athletics, contact and non-contact sports. Suitable for all key stages.

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### **Session W4C: Technician Workshop / To be confirmed**

### **Session W5A: Not just Gamma and X-rays! / Alison Alexander and Ruth Wiltsher / KS3-4**

Using the electromagnetic spectrum and sound in medicine and dentistry. Medical applications of X-rays, gamma rays and ultrasound scanning are frequently used to demonstrate the use of physics concepts. This session will explore some of the less frequently mentioned applications of electromagnetic radiation and sound, including pulse oximeters, in ear thermometers and the breaking up of gallstones by sound waves.

### **Session W5B: Games and Resources for the Teaching of Electricity and Energy / Tony Reeves / KS3-4**

Tony Reeves has taught Physics for 108 terms. In 40 minutes he will endeavour to share some of the things that have worked well on the following topics from the WJEC GCSE Physics Specification: 1.1 Electric circuits; 1.2 Generating electricity; 1.3 Making use of energy; 1.4 Domestic electricity. Resources will include Top Trumps Energy cards (Word and pdf), an Energy Mix Simulation (Excel) and some PowerPoints that you can adapt to suit your own teaching.

### **Session W5C: Technicians Techmeet / Cerian Angharad**

Join the Techmeet to share ideas and resources with colleagues across Wales and beyond.

### **Session W6A: Shades of Blended Learning / Keith Jones / KS3-5**

In these disruptive times in school, there has never been a greater need for students to become more independent learners and for teachers to be more innovative in their learning strategies. A blended learning strategy offers face-to-face, traditional' learning, complemented by self-study, both online and offline. This session will offer teachers the chance to explore and share 'what works best', using examples from both Google Docs and MS Forms.

### **Session W6B: Improving Gender Balance / Dr Anita Shaw / KS3-4**

As in the rest of the UK, Wales' gendered subject choices at A level underline a wider gender imbalance in our schools. But where does this start? We worked with two secondary schools in South Wales and seven of their feeder primaries. In this presentation we'll look at the baseline data from the primary schools' teacher and pupil questionnaires. This will include information about teacher speciality, their current experience of gender-related initiatives, pupils' perceptions of who does which roles, pupils' career aspirations and more. We'll look at how this data informed our action plans and touch on some of the areas where we could see the possibility for change.

### **Session W6C: Technician workshop / Selene Gilles (Breckland Scientific) and Mark Finch (LogITworld)**

LogIT datalogging: advice, live Q&A and videos of experiments on calibrating light gates using Sensorlab software.

### **Session W7A: Earth in Space / Graham Perrin / KS3-4**

Excitement about Space is building again – Perseverance heading to Mars, Artemis back to the Moon. In this workshop, we'll look at our relationship with the heavens. We'll look at topics relevant to WJEC units 2.5 and 2.6 and, in the spirit of the Science Capital Teaching Approach, we'll look at the important contributions that people from Wales have made to the field.

### **Session W7B: Physics Education at Home: DIY Activities for Home Learning / Gary Williams / KS3-5**

The journal *Physics Education* has made available more than 100 papers and articles from their archive that cover activities which students can do at home. These tend to be ideas for experiments or investigations for older students, but there is a wide variety of resources from ideas for project work to ready to go questions, from 16+ to primary. Join Gary Williams, the Editor-in-Chief of *Physics Education* to discuss some of the listed papers and a few extra ideas too. All the links can be found here: <https://iopscience.iop.org/journal/0031-9120/page/physics-education-at-home>

### **Session W8: Physics with Balloons / Jo Kent / KS3 (predominantly)**

Using balloons to demonstrate a variety of physics phenomena which can be done by students at home, or demonstrated by a teacher. I will demonstrate a selection of simple activities which aim to keep students engaged with the subject.

### **Session W9: Gravitational Waves Workshop / Dr Chris North, Cardiff University / KS4-5**

Although gravitational waves are not directly on the curriculum, they are of course a topical subject in science. there are a number of different ways in which they can be used to link to topics that are: from properties of waves, to trigonometry, and from interference to cosmology. There are also opportunities for looking at noisy data, and even (for the more adventurous) using code to extract and analyse data. We will explore the curriculum links and existing resources that can be used at GCSE and above. There are example datasets for hands-on experiments which might be useful if group practicals are impractical.

### **Session W10: Sunglasses, Violins, and Electrons / David Cotton / KS3-5**

Suitable for specialist Physics teachers. This session will concentrate on wave topics and will look mainly at teaching polarisation and standing waves. There will be demonstrations and ideas for practical work as well as ways to link standing waves to other aspects of physics. This session will include ways to visualise sound, including effective use of a Reuben's tube, and ways to perform the required practical of measuring the speed of sound in a metal bar.

### **Session W11: The Planet of Pollution / Prof Averil MacDonald OBE, Southampton University KS3-5**

The risks to the planet of pollution, plastics and fossil fuels are well reported. But exactly what could and should anyone of us do to protect the planet? There are many myths and misunderstandings mixed up with the good advice offered by the campaigning groups. Averil will explain some of the unintended consequences of the suggested actions, clarify what really can make a difference and try to answer any questions you have.

## **Thursday 8 October 2020**

### **Session Th1: Not just Gamma and X-rays! / Alison Alexander and Ruth Wiltsher / KS3-4**

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### **Session Th2: Shades of Blended Learning / Keith Jones / KS3-5**

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### **Session Th3: Improving Gender Balance – Unconscious Bias / Dr Anita Shaw / KS3-4**

How can we work towards gender balance in schools when our unconscious bias gets in the way? In this presentation we'll look at what unconscious bias is, how prevalent and pervasive it is, and how we can address it in our quest to ensure social justice for all.

### **Session Th4: Gravitational Waves / Dr Chris North, Cardiff University / KS4-5**

Gravitational Waves have frequently hit the headlines ever since the first direct detection in 2017: Since then there have been a number of further developments, with the detection of the first binary neutron star collision in 2019: As well as being cutting edge research, helping solve mysteries of the cosmos, gravitational waves are relevant to the curriculum. I'll give an overview of gravitational waves and their detection, and a few ways in which they can be used in schools.

## **Friday 9 October 2020**

### **Session F1: Physics Education at Home: DIY Activities for Home Learning / Gary Williams / KS3-5**

The journal Physics Education has made available over 100 papers and articles from their archive that cover activities which students can do at home. These tend to be ideas for experiments or investigations for older students but there is a wide variety of resources from ideas for project work to ready to go questions, from 16+ to primary. Join Gary Williams, the Editor-in-Chief of Physics Education to discuss some of the listed papers and a few extra ideas too. All the links can be found here: <https://iopscience.iop.org/journal/0031-9120/page/physics-education-at-home>

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### **Session F3: Electromagnetism 200 / David Keenhan / KS3-5**

Electromagnetic theory is one of the cornerstones of physics. This workshop/webinar is based on demonstrations of the electromagnetic force in action. The force acting on a current-carrying conductor in a magnetic field can be used to cause spin. Galvanometers, electric motors and simple generators all make use of spin. Novel uses of these are a particular feature of this workshop.

### **Session F4: Bubbles: The Miracle of Physics! / Sue McGrath / KS3-4**

Static electricity is the secret force behind bubbles. It is the force that is responsible for surface tension in water. A force so big it actually prevents the formation of long-living, bubbles big or small.

In this session Sue will share with you some lovely demonstrations explaining some of the physics surrounding bubbles – then will get you all involved in a bubble investigation – focussing on fair testing – with the aim to make the best bouncing bubble solution using just fairy liquid, water and glycerine.

## **Saturday 10 October 2020**

### **Session S1A: Developing a Research-Informed Physics Curriculum for the 'New KS3' / Anthony Clowser / KS3**

Set in the context of Curriculum for Wales, a research and evidence based approach to teaching Physics at KS3 will be discussed. The scheme is based upon research into the cognitive demand required in the earlier stages of secondary school Science and common misconceptions held by learners.

### **Session S1B: Electromagnetism with Practical / David Cotton / KS3-5**

This workshop will be about the teaching of electromagnetism. It will include ideas and demonstrations with some easy to set up ideas for explaining Lenz's Law. It will include demonstrations using electromagnetism in the sound industry and ideas that will link the specifications to real equipment. Ideal to engage students that play musical instruments and those that just enjoy music.

### **Session S2A: Science on Stage Workshop Part 2 / Paul Nugent / KS3-4**

Science on Stage is a European initiative designed to encourage teachers from across Europe to share best practice in science teaching. Ultimately, the aim of Science on Stage is to enable teachers to deliver science in a more creative and engaging way. This session will explore many of the teaching ideas and resources from [www.scienceonstage.ie](http://www.scienceonstage.ie). Join us for some of the very latest experiments from the recent **Cascais SonS Festival 2019**. These experiments can be carried out by teachers or students, in school or at home. This workshop will feature different experiments from Part 1.

### **Session S2B: Lego Physics / Lewis Mattheson / KS3-5**

Join Lewis as he demonstrates many ways that you can use LEGO with your students from KS3 up to A Level, with ideas for bringing particle physics to life as a hands-on activity your pupils can get involved with. Participants will receive a small set of LEGO and instructions on how the pieces can be used for the whole school.

### **Session S3A: GCSE Science and GCE Physics Update WJEC / Helen Francis, WJEC Domain Leader – Mathematics / KS4-5**

The Examinations Board will provide an update on GCSE examinations, and discuss Science and GCE Physics.

### **Session S3B: Physics with Balloons / Jo Kent / KS3 (predominantly)**

Using balloons to demonstrate a variety of physics phenomena which can be done by students at home, or demonstrated by a teacher. I will demonstrate a selection of simple activities which aim to keep students engaged with the subject.

### **Session S4: Taking up Space / Science Made Simple / KS3-4**

There are some exciting and unexpected things going on to improve our lives, here at home and all over the world. And many of these things are thanks to the space industry. People working in space are not just astronauts – there are many different jobs requiring many different skills. This 40-minute interactive show helps Year 8 students see how the STEM skills they learn in school could lead them into a job in the space industry.