

Year 11 transition to A-level Physics



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Introduction

This is an exciting time! Physics is one of the most **interesting** A-levels, and you're about to embark on a **fascinating** journey of discovery.

You might not be completely sure which A-levels you want to study at this point, and that's ok. It's a big decision, and it's worth taking time to make the right choices for you. Start by reading the next page – it's called "**Why study A-level Physics?**". It also has some useful suggestions about how to pick a good combination of subjects.



Think of the next few weeks as **an opportunity** – an opportunity to learn whatever **you** want to learn, and to study in whatever style suits **you**! Everything that you learn in the coming weeks and months will **make the transition to A-levels easier**. It might even help you decide what you want to do with your life beyond A-levels! This pack is full of ideas and suggestions, and I encourage you to follow whichever ones appeal most. There are a lot of web links - it really is worth following them!



A **good routine is essential** to preparing well for your A-levels. It's much better to do a few hours of study and exploration each week and to keep going until July, than to work so hard in the next few days that you burn yourself out! I suggest you spend 2-3 hours each day, Monday-Friday, split evenly between the subjects you plan to study next year. If you do this, you'll be doing **3-4 hours of Physics each week**, which will make a massive difference when you start in September! It doesn't have to all be serious GCSE-style work: mix in some inspiring videos, fun quizzes and fascinating podcasts, and you'll find the time flies by!

TOP TIP: if you ever you start to feel frustrated or bored with any of your Physics preparation, **stop & swap!** Swap to a different topic or different book or website – perhaps do a home experiment or watch your favourite Physics youtube channel to re-energise yourself. The most effective way to learn sustainably over the holidays is to **enjoy it!** If you think that the bit you were struggling with was really important, email one of us for help, or start a list of things to ask me for help with in September. (I am always SO impressed when students bring me a list of questions or skills they want help on – it shows real determination to succeed!)

Best of luck, and take care this summer!

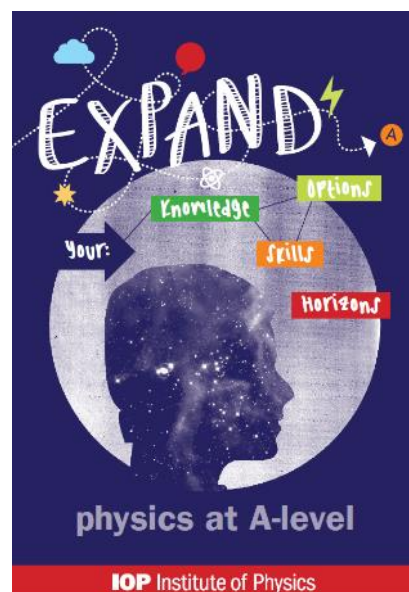
Ms Cross



Why study A-level Physics?

Physics is **THE most fascinating subject** to study at A-level! It's also well-recognized for developing **useful skills** for a wide range of careers such as problem-solving, analysis and communication. You'll be taught in a small class with **lots of individual help**, and your teacher will be experienced – a lot of her students in recent years have done better in Physics than in their other A-levels!

Start by reading this guide to A-level Physics from the Institute of Physics: https://www.iop.org/publications/iop/2015/file_65520.pdf
It includes information about the A-level, as well as ideas on careers after Physics A-level.



How is A-level Physics different from GCSE Physics?

- **New, exciting topics** – a lot of the topics will be the same as GCSE, but there are some really exciting new ones, such as antimatter, quantum physics, medical imaging, cosmology (the future of the Universe) and special relativity.
- There's **more time** for everything – 5 hours per week. It means there's time to learn about fascinating real-world applications, extra practice of anything tricky, and better practicals!
- **Better practicals** – A-level practicals are fascinating, such as measuring the gravitational field strength (g) on Earth, and getting hands-on with radioactivity! We'll also spend a bit more time on practicals so that you develop the skills to design and run your own investigations.
- You build a much **deeper understanding** of each topic, because we spend more time on it before moving on.
- A-level Physics has **more maths** – it's similar to GCSE Higher-Tier Maths, with some trigonometry and simultaneous equations, for example. We'll support you in Physics lessons to develop all of the maths skills you'll need.
- **You don't have to memorise so many equations!** In A-level Physics exams you're given a booklet with almost all of the equations in it.
- **An option topic** – in year 13 you'll get to choose a topic to specialise in, such as Astrophysics, Engineering or Medical Physics.

For more information about the course, see <https://tinyurl.com/yd6u7ybp>

Listen to what other students have to say about A-level Physics: <https://tinyurl.com/y9lym8hf>

This website might also be helpful: <https://tinyurl.com/hj8ks74>

What can I do after A-level Physics?

Physics is known as a facilitating subject – this means that it helps **keep your options open** as it's highly regarded as preparation for lots of different courses. Businesses and universities really value the subject because of the **transferrable skills** it gives you.

There are some great online tools that help you work out what subjects you can study at University with **your combination of A-levels**. Try <https://www.theuniguide.co.uk/a-level-explorer> or https://sacu-student.com/?page_id=5203 (click "start matching now") or <https://www.informedchoices.ac.uk/>.

For more general advice on A-level choices, visit: <https://www.theuniguide.co.uk/advice/a-level-choices>

What should you focus on this summer?

If you want to do really well in A-level Physics next year and beyond, I suggest you set **these three goals** for your summer studying.

1) Maintain & develop your GCSE Physics knowledge

Physics A-level has a reputation for being tricky, but it's a lot easier if you have all the facts you learned at GCSE at your fingertips! It'll help so much next year if you've already found and fixed any gaps in your GCSE knowledge. It will also give you a great deal of satisfaction to complete a refresher of the whole GCSE – commitment is key.

Suggested time: 1 hour per week



2) Maintain & develop your Maths skills

Did you know that students lose **2.6 months'** worth of maths skills over the summer holidays, on average? And this year the summer holiday is especially long! All you need to do to maintain your skills is to **practise** them. An hour a week will make a world of difference. It really works! And maths can be really meditative once you get into the zone – like a good Sudoku puzzle.

Suggested time: 1 hour per week

3) Explore the Physics that interests you! (& build evidence for uni applications)

This is the really **fun** part, and yet it is **just as important** as the first two goals! A-levels require a lot more independent study than GCSEs, so **motivation matters**. Physics is so interlinked that no matter



what you choose to investigate, you will be learning something relevant to at least one A-level Physics topic, and it'll help you enjoy those topics even more next year. These explorations can also be pivotal in discovering what you want to do with **your life after A-levels!**

Finally, the research you do now will be invaluable if you **apply to University**. Uni applicants have to write a UCAS "personal statement" with evidence of their **commitment to learning** and **passion for the subject**. One of the best ways to show this is to learn about something outside of lessons, and now is the perfect time to do that!

Suggested time: 1-2 hours per week

TOP TIP: set up a daily routine!

Set aside 2-3 hours per morning for A-level preparation, and divide the time between your subjects. You'll get loads of useful preparation work done AND enjoy free afternoons!

	Mon	Tue	Wed	Thu	Fri
9am	Physics knowledge	Subject 3	Subject 2	Physics interests	Subject 3
10.30	Subject 2	Physics maths skill	Subject 3	Subject 2	Physics interests

THE NEXT FEW PAGES HAVE IDEAS TO HELP YOU GET STARTED WITH EACH GOAL!

1) Maintain & develop your GCSE Physics knowledge (1hr per week)

Have a look at these resources and **choose ONE or TWO** that suit you best. They are alternative options – **you don't have to do them all!** Keep it manageable - if it's taking too long or you're losing motivation, try a different resource, take a break with an easier topic, or reduce the weekly amount.

TOP TIP: prioritise! Start with useful topics for A-level Physics - see the bottom of this page. Skip topics you're confident on and spend more time on tricky areas.



- **CGP Headstart to Physics** book (available [free from Amazon](#) – I suggest **4 pages per week** for 10 weeks (finish mid-July!))
- **Seneca online** <https://senecalearning.com/> – Choose AQA GCSE Physics. I suggest **8-10 mini sections per week** to cover the whole course by July OR focus only on your weaker topics.
- **GCSE Physics online** – a weekly video, worksheet & livestreamed review session on GCSE topics, plus A-level preparation tasks <https://www.gcsephysicsonline.com/covid-19> and <https://www.gcsephysicsonline.com/pre-a-level>
- **BBC Bitesize NEW interactive tests** – <https://www.bbc.co.uk/bitesize/examspecs/zsc9rdm> (click on a topic, and then the “Test” Section for example: <https://www.bbc.co.uk/bitesize/guides/z8hsrwx/test>) I suggest **1-2 tests per week on your weaker topics**, OR to cover it all, 3 tests per week for 12 weeks.
- **Prepare for the Challenge of A Level Physics book** (free with a free trial of Amazon Unlimited, or £2.50 [kindle edition](#) which can be read on any phone, laptop or ipad)
- OR make use of GCSE resources that you already use and like!

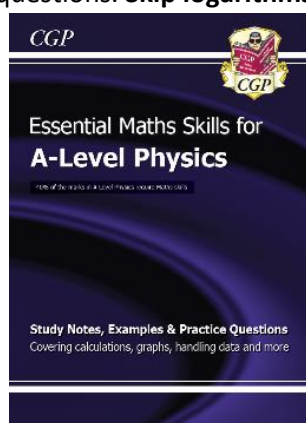
Which GCSE topics are most useful for A-level Physics?

GCSE Physics	Useful for year 12?	Useful for year 13?
Energy	✓ <i>except energy resources & specific heat capacity</i>	✓ <i>specific heat capacity</i>
Electricity	✓ <i>except household electricity & static electricity</i>	✓ <i>Static electricity & AC electricity</i>
Particle model of matter	<i>Only density & states of matter</i>	✓ all of it!
Atomic structure	✓ <i>except half lives, background, fission, fusion</i>	✓ all of it!
Forces	✓ <i>except stopping distances</i>	✓ yr12 skills applied to new topics
Waves	✓ <i>except lenses, uses of EM waves, seismic & ultrasound & blackbody radiation</i>	✓ <i>lenses, ultrasound & blackbody in Astro & Medical option topics</i>
Magnetism and electromagnetism		✓ all of it!
Space physics		✓ <i>in Astro option topic</i>

2) Maintain & develop your Maths skills (1hr per week)

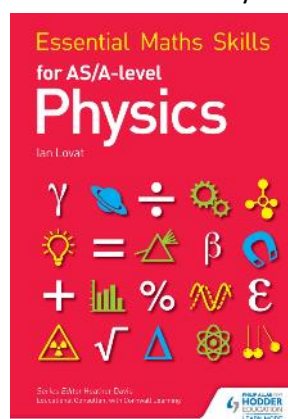
As with the Physics knowledge, don't try to do all of this – **just choose ONE** favourite book or website and run with that, referring to the others only if you need extra practice with a skill. **Skip anything that's so easy** it's boring, and **don't worry about anything so hard you're struggling** – there's no benefit from either. Whatever your level of maths in September I will help you build on it... it'll just be a lot easier if you've maintained your current skills through practice! (I'll be especially impressed in September if you can tell me which questions or skills you need extra help with.)

- **AQA A-level Transition Pack** – The exam board has pulled together a set of recommended Maths Activities for the summer: <https://filestore.aqa.org.uk/resources/physics/AQA-7407-7408-TG.PDF> (see page 9 onwards).
- **Isaac Physics** We'll use this quite often next year. For the summer, you could:
 - Take part in **weekly lessons** https://isaacphysics.org/pages/covid19_gcse (click "Lessons")
 - Join their **mentoring scheme** https://isaacphysics.org/pages/mentor_scheme_y11_home .
 - **Pick a topic** https://isaacphysics.org/pages/gcse_quizzes or https://isaacphysics.org/books/phys_book_gcse#isaacModal or https://isaacphysics.org/books/pre_uni_maths (choose level 1) or https://isaacphysics.org/books/physics_skills_19 (choose section A)
- **23 Equations website** I recommend the **calculation questions** on their website (not on the app): <https://23equations.com/questions/index.html> Aim to answer **8-10 questions each week!** If they're taking too long, change the difficulty level.
- **Equation list** You don't need to memorise many equations for A-level Physics, so feel free to use a list of equations for calculations. <https://tinyurl.com/y8kdxfw5> or <https://tinyurl.com/y9sllsnr>
- **Essential Maths Skills for A-Level Physics books** – Both books have information and practice questions. **Skip logarithms and exponentials** – we don't need them until year 13.



[£6.50 on Amazon](#)

5-6 pages per week to finish in July



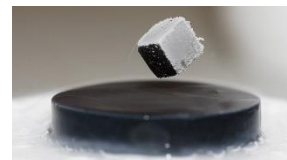
[£10 on Amazon](#)

5-6 pages per week to finish in August

3) Explore the Physics that interests you! & build evidence for applications (1-2hrs/week)

What really fascinates you? Is it the future of the Universe, the northern lights, quantum physics, superconductors or something else? Or maybe you're most interested in the way Physics is applied in healthcare, architecture, engineering, modern technology or to save our planet from climate change?

This section is where you get full freedom to follow your own curiosities – relax, take your time and enjoy it!



Not sure what your interests are?

Not a problem! To get started, I recommend you browse the next few pages, browsing a wide selection of the citizen science projects, online courses and books, and watching a few documentaries, youtube channels, podcasts etc. You'll soon find something that captures your imagination!



Can't choose which interesting topic to research?

That's ok! In fact it's better to investigate several topics as that'll give you a broader sense of what Physics is about. You'll probably find that some of your investigations finish when your curiosity is satisfied, and others lead you deeper

What topic(s) would be most helpful for A-level Physics?

I encourage you to branch out – A-level Physics is so broad that any topic you choose will be helpful! However, if you're really keen to keep your explorations close to the A-level specification, I suggest you find out more about **Particle Physics**, which is fascinating, often in the news, and will be one of our first topics! Key terms to look into might include: antimatter, neutrinos, leptons, quarks, hadrons, baryons, exchange particles and the standard model. Another very interesting year 12 topic is Quantum Physics, especially wave-particle duality.



What evidence should I gather for University applications?

Universities will be particularly impressed with activities that have a slightly higher time commitment: the citizen science projects, online courses, and books, for example. They'll also be impressed if you've explored one topic or idea enough to be able to write or talk about it.

TOP TIP: It's easy to forget what you've done, so keep a record!

Note down what you've done, and ideas you want to investigate next. I also recommend you make brief research notes on any topic you explore more deeply, including anything that inspires or fascinates you as you go. You can refer back to those thoughts when you write your personal statement!

Physics Home Research Log

Activities done:

- Made teabag rockets
- Radio Galaxy Zoo (citizen science)
- Minute Physics youtube - run/walk in rain

Ideas to investigate:

- Tablecloth trick
- How do we know how far away a galaxy is?



Home experiments!

It's amazing what you can do with things lying around the house! Use these as inspiration, and impress your family and friends with amazing tricks.

TOP TIPS: ask permission, stay safe & clear up!

It's always polite to ask before starting a fire in the kitchen or using all the eggs for a physics experiment! Keep your family happy by:

- 1) discussing your plans with them BEFORE you begin
- 2) being very careful to spot possible dangers or messes
- 3) leaving the area sparkling clean with everything you borrowed back in its proper place!

Physics Girl HOME CHALLENGE



20 Easy Experiments in 5 mins

<https://www.youtube.com/watch?v=8aaXZDazPxs>

Marvin and Milo: DO try this at home!



Over 150 simple and fun experiments!

<http://www.physics.org/marvinandmilo.asp>

Steve Spangler: DIY Sci



Learn how to use do-it-yourself experiments to amaze friends!

<https://www.stevespanglerscience.com/lab/experiment-library/> and <https://www.youtube.com/user/TheSpanglerEffect/featured> and <https://www.youtube.com/user/SteveSpanglerScience/videos>

James Dyson Challenge Cards



Can you skewer a balloon without popping it? Coat a nail in copper? What else?

https://www.youtube.com/watch?v=FuAqA_GhVQ0&list=PLpBQHVUIKs3qD7-u1bm164Qs3WJ0ZVU6X and <https://www.jamesdysonfoundation.co.uk/resources/challenge-cards.html>

Citizen science projects

Contribute to real scientific research from the comfort of your bedroom. You could help find regions of space where stars are being born, discover planets orbiting other stars in our galaxy, map global light pollution, or protect the Earth from solar storms! It's easy to get involved - there are lots of options on each of these websites, and they all teach you what to do.

- <https://www.zooniverse.org/projects?discipline=physics&page=1&status=live>
- https://en.wikipedia.org/wiki/List_of_citizen_science_projects
- <https://science.nasa.gov/citizenscience>

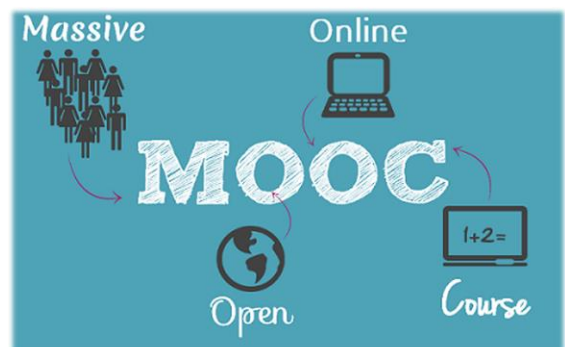


Online courses (MOOCs)

MOOCs are short, free online courses run by Universities. You can study almost anything, and they're aimed at the general public, not geniuses!

They often involve some videos, reading, web chats and interactives, and you can often get a certificate at the end.

If you want to study something relevant to your year 12 course, I recommend Particle Physics or Quantum Physics – both are very new and exciting! But feel free to try anything else that appeals to you.



<https://www.futurelearn.com/>

OpenLearn

<https://www.open.edu/openlearn/free-courses/full-catalogue>



<https://www.edx.org/learn/science>



<https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy>

Movies

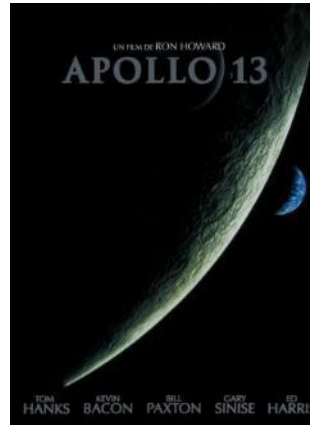
Everyone loves a good story and everyone loves some great science. Great watching for a rainy day!
Try searching for more science-themed movies!



The Martian (2015)
When astronauts blast off from the planet Mars, they leave behind Mark Watney (Matt Damon), presumed dead after a fierce storm.



Interstellar (2014)
A team of explorers travel through a wormhole in space in an attempt to ensure humanity's survival.



Apollo 13 (1995)
Based on a true story. NASA must devise a strategy to return Apollo 13 to Earth safely after the spacecraft undergoes massive internal damage putting the lives of the three astronauts on board in jeopardy.



Hidden Figures (2016)
Based on a true story. The untold story of three brilliant African-American women working at NASA and serving as the brains behind one of the greatest operations in history.



Moon (2009)
An astronaut miner extracting the precious moon gas that promises to reverse the Earth's energy crisis nears the end of his three-year contract, and makes an ominous discovery.



Gravity (2013)
Two astronauts work together to survive after an accident which leaves them stranded in space.



The Boy who Harnessed the Wind (2019)
Based on a true story. Inspired by a science book, 13-year-old William Kamkwamba builds a wind turbine to save his Malawian village from famine.



The Theory of Everything (2014)
Based on a true story. Stephen Hawking, an excellent astrophysics student, learns that he suffers from motor neurone disease and has around two years to live.

TV Series & Documentaries



Chernobyl (2019)

In April 1986, the city of Chernobyl suffers one of the worst nuclear disasters in the history of mankind. Many heroes put their lives on the line to save Europe.

<https://www.amazon.co.uk/Chernobyl/dp/B07TWJD4KS>



8 days: to the Moon and Back (2019)

Using dramatic reconstruction, declassified cockpit audio and film archive, this is the story of the first moon landing.

<https://www.bbc.co.uk/programmes/m0006p5f>



The Sky at Night

Your monthly journey through the fascinating world of space and astronomy with the latest thinking on what's out there in space and what you can see in the night sky.

<https://www.bbc.co.uk/programmes/b006mk7h>



The Pleasure of Finding Things Out (1981)

Professor Richard Feynman, who invented the Feynman Diagrams you'll learn about in year 12, talks about his life and career.

<https://www.bbc.co.uk/iplayer/episode/p018dvvg/horizon-19811982-the-pleasure-of-finding-things-out>



From Ice to Fire: The Incredible Science of Temperature (2018)

Dr Helen Czerski goes on a spectacular journey to the extremes of the temperature scale, where everyday laws of physics break down.

<https://www.bbc.co.uk/programmes/b09rzq05>



How to Make (2020)

Designer, maker and materials engineer Zoe Laughlin dismantles and dissects three classic items, before building her own truly bespoke versions, step by step.

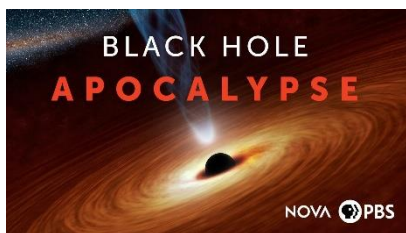
<https://www.bbc.co.uk/programmes/m000gwzg>



Fukushima: Robots in Hell (2016)

On the 11th of March 2011, an earthquake and a tsunami led to to the most serious nuclear accident of the century.

<https://www.amazon.co.uk/Fukushima-Robots-Hell-Marie-Linton/dp/B06XDDTCXT>



Black hole apocalypse (2018)

Astrophysicists show how black holes might hold answers to how the universe evolved, leading to life on Earth and, ultimately, the human race.

<https://www.netflix.com/title/81121172>



13 Factors That Saved Apollo 13 (2015)

180,000 miles from Earth, a disastrous malfunction leaves Apollo 13 leaking oxygen.

<https://www.amazon.co.uk/13-Factors-that-Saved-Apollo/dp/B074F3XDHK>



The planets (2019)

Professor Brian Cox explores the dramatic lives of the eight majestic planets/worlds that make up our solar system.

<https://www.bbc.co.uk/programmes/p07922lr>



The Universe (2007)

Discover the secrets of the universe in this series that pairs animation with insights on distant planets, black holes and other celestial marvels.

<https://www.netflix.com/title/70143831>



Astronauts: Do you have what it takes? (2017)

Chris Hadfield, Dr Kevin Fong and Dr Iya Whiteley put 12 candidates through a series of tests to find out who has what it takes to be an astronaut.

<https://www.bbc.co.uk/programmes/p05bf1jt>

YouTube Channels

Subscribe to these channels and you'll be amazed what you'll learn!



Physics Girl

<https://www.youtube.com/channel/UC7DdEm33SyatDtWYGO2CwdA>



The Royal Institution

<https://www.youtube.com/user/TheRoyalInstitution/playlists>



Minute Physics

<https://www.youtube.com/user/minutephysics/playlists>



Crash Course

<https://www.youtube.com/user/crashcourse/playlists>



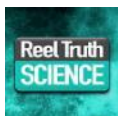
Veritasium

<https://www.youtube.com/user/1veritasium/playlists>



SciShow

<https://www.youtube.com/user/scishow/playlists>



Reel Truth Science Documentaries

<https://www.youtube.com/channel/UCZSE95RmyMUgJWmfra9Yx1A/playlists>



ABC Science

<https://www.youtube.com/user/ABCTVCatalyst/playlists>



Real Engineering

https://www.youtube.com/channel/UCR1luLEqb6UEA_zQ81kwXfg/playlists



NOVA PBS Official

<https://www.youtube.com/user/NOVAonline/playlists>



TED Ed

<https://www.youtube.com/user/TEDEducation/playlists>



The Spangler Effect

<https://www.youtube.com/user/TheSpananglerEffect/featured>

TED Talks

TED talks are really great, thought-provoking (and free!) presentations on a huge range of topics, often given by the world's leading thinkers.

Browse <https://www.ted.com/talks> or try one of these four to start with:



From mach-20 glider to hummingbird drone

"What would you attempt to do if you knew you could not fail?" asks Regina Dugan, then director of DARPA, the Defense Advanced Research Projects Agency. In this talk, she describes some of the extraordinary projects that her agency has created.

https://www.ted.com/talks/regina_dugan_from_mach_20_glider_to_hummingbird_drone?language=en



Is our universe the only universe?

Brian Greene shows how the unanswered questions of physics (starting with a big one: What caused the Big Bang?) have led to the theory that our own universe is just one of many in the "multiverse."

https://www.ted.com/talks/brian_greene_is_our_universe_the_only_universe?language=en



The fascinating physics of everyday life

Physicist Helen Czerski presents various concepts in physics you can become familiar with using everyday things found in your kitchen.

https://www.ted.com/talks/helen_czerski_the_fascinating_physics_of_everyday_life?language=en



We need nuclear power to solve climate change

Joe Lassiter is focused on developing clean, secure and carbon-neutral supplies of reliable, low-cost energy. His analysis of the world's energy realities puts a powerful lens on the touchy issue of nuclear power.

https://www.ted.com/talks/joe_lassiter_we_need_nuclear_power_to_solve_climate_change?language=en

Magazines

Great for news on cutting edge research, or to search for deeper information on a topic.

<https://www.sciencenewsforstudents.org/topic/physics>

<https://www.scientificamerican.com/the-sciences/>

<https://physicsworld.com/>

Podcasts and radio

There is nothing better than listening to an absorbing podcast as you walk, organise your room or drift to sleep at night! It's calming and inspiring at the same time. Luckily there are hundreds to choose from, so you're bound to find something you enjoy. If you're interested in a particular topic, such as gravitational waves, type it into the search box on the BBC website, and you'll probably find a couple of radio shows about it!



The infinite monkey cage

Witty, irreverent look at the world through scientists' eyes. With Brian Cox and Robin Ince.

<https://www.bbc.co.uk/programmes/b00snr0w>



The Curious Cases of Rutherford and Fry Science sleuths Dr Adam Rutherford and Dr Hannah Fry investigate everyday mysteries.

<https://www.bbc.co.uk/programmes/b07dx75g>



Science stories

Surprising stories from the history of science told by Naomi Alderman and Philip Ball.

<https://www.bbc.co.uk/programmes/m000cl4v>



More or Less

Tim Harford and the More or Less team try to make sense of the statistics which surround us.

<https://www.bbc.co.uk/programmes/p02nrss1>



Experiments that changed the world Experiments that changed the way we interact with the world.

<https://www.bbc.co.uk/programmes/p03cgl8h>



They Made Our World

A series of short programmes about inventors and their world-changing inventions.

<https://www.bbc.co.uk/programmes/p0338l7j>



The Great Big Particle Adventure

Comedian and physicist Ben Miller explores the workings of the new LHC atom smasher at CERN in Switzerland and what it is designed to discover.

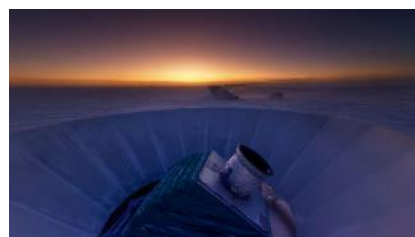
<https://www.bbc.co.uk/programmes/b00db0x1>



In Our Time

Scientific principles, theory and the role of key figures in the advancement of science.

<https://www.bbc.co.uk/programmes/p01gnr34>



Frontiers

Explore new ideas in science and the scientists and researchers responsible for them.

<https://www.bbc.co.uk/programmes/b006qy5p>



Greatest Structures in the World

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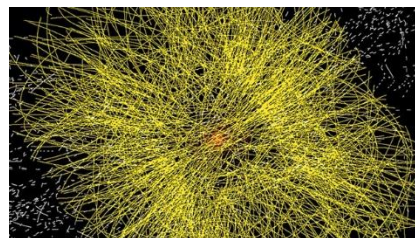
<https://www.bbc.co.uk/programmes/p034ntzk>



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