

Get into Space with Physics

How is physics used in space?

Exploration of space and the investigation of our own planet from orbit would be impossible without physics. It is applied in many different fields: allowing us to travel safely using satellite navigation, helping us to plan ahead for extreme weather events and to answer questions about the universe around us.

Global Positioning System (GPS)

Many technologies rely on a network of satellites in orbit around the Earth known as GPS. It is owned and maintained by the US government. Each satellite in the network transmits a signal telling the receiver where it is and the time the message was sent. Normally four signals are required for a receiver to calculate a position.

Corrections to the clock on the satellite are needed before the signal is sent: (i) take into account the slowing down effect on the clock due to the satellite travelling at speed in orbit and (ii) to correct for the satellite being at a greater altitude than the receiver, this speeds the clock up. Correction (i) is from Einstein's theory of special relativity and (ii) is from his theory of general relativity.

Using this system we can track vehicles, navigate and observe and manage disasters including earthquakes. Europe has begun launching its own network of GPS satellites called Galileo. It will be more accurate than the current system. It will be 2020 before the full set of 27 satellites are operational in orbit. There are currently four satellites in orbit being tested and the highly accurate clocks were installed by Astrium in Portsmouth.

Astronomy and astrophysics research

Humans have always asked questions about the universe around us, we have always been keen astronomers. There are many researchers in the UK who are carrying on this tradition. They have access to sophisticated spacecraft, telescopes and laboratories to help them gather data, analyse and answer questions. Astronomy and astrophysics is different to other sciences as it is difficult to carry out experiments. If we want to study star formation we can't just create our own. We have to observe star formation all over the galaxy, come up with theories, create computer models and gather evidence to be able to draw conclusions.

Using this approach we have found out many surprising things: the existence of black holes, that planets may be a lot more common than we think (a spacecraft called Kepler has detected over 2,000 planets orbiting other stars) and that we can't see all of the mass there seems to be in the universe (70% seems to be something called Dark Energy, 25% is Dark Matter with the remaining 5% being what we can see, aka Normal Matter).

There are still many questions to answer, why don't you do some research of your own? You can access telescopes around the world via the Faulkes Telescope and the National Schools Observatory.

Weather research and forecasting

Understanding and being able to predict our climate is a very important area of the application of physics. Many vehicles rely on accurate weather information for transport, including aircraft and ships. Earth's weather systems are very complex and interconnected, therefore gathering data helps us to analyse and answer questions.

We can study properties such as temperature, wind direction and cloud type over different sizes of geographical areas and times due to the satellites in orbit. However, without an understanding of fluid mechanics we would not be able to interpret the information. By looking at the sea and the atmosphere we can study the effect that forces have on their motion and what they look like when they are in motion.

There are many aspects that have not been mentioned. Why not explore this topic for yourself?

For more guides like this and further information on space careers visit www.lfthomas.co.uk

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See what you can discover!

How do I get into space?

Subject options for your A-levels, Highers or International Baccalaureate are very important as they influence what courses and career options you have in the future. If you are aiming to take a physics-related subject at university you should be taking maths and physics at A-level, Higher and HL for the International Baccalaureate. Further maths is not normally a formal requirement but it is helpful if you have a look at university entry requirements when making your decisions. This means that you won't get a nasty shock when you go to apply to your chosen university and you find that you don't have the right qualifications. However, be careful! Entry requirements are different between universities and they can change.

Many of the roles within the space industry are termed "highly skilled". This means that you need a university qualification to be able to complete the job. This is due to the knowledge, skills and experience gained from a university degree. There are many physics degrees on offer around the UK. The Institute of Physics offers an informative guide to these at www.myphysicscourse.org

Companies within the space industry are keen to encourage more people to take space-related topics at university and offer scholarships. This is a combination of financial support through the academic year and work placements during the summer periods. This is an excellent way to gain work experience whilst completing your education and there is of course potential for employment when you graduate. One such company is Avanti PLC.

What can I do in space?

By completing qualifications in physics, there will be many employment opportunities open to you. Physicists have excellent problem solving, analytical and mathematical abilities. Communication skills are also very important. Below is a small selection of employment areas. More options can be found at www.futuremorph.org and salary information is sourced from www.prospects.ac.uk

Aerospace Engineer | Minimum requirements: Undergraduate degree | Starting salary: £20,000 - £25,000

You don't need to take an engineering degree to work as an engineer when you graduate. There are many different aspects to this job and aerospace engineers can have responsibility for many different areas of a spacecraft. This could be the design of a propulsion system or testing new materials for use in the spacecraft. Often aerospace engineers will specialise in a particular area.

Researcher | Minimum requirements: Undergraduate degree and Postgraduate degree | Starting salary: £25,000 - £35,000

Specialising in a particular area, you would carry out experiments, gather data and analyse before drawing conclusions. You will write papers and give talks at conferences to communicate your findings. You can work either in theory, where you develop new ideas to solve a problem or experiment where you test theories using different approaches.

Useful links

Faulkes Telescope	www.faulkes-telescope.com
National Schools Observatory	www.schoolsobservatory.org.uk
IOP Physics degree guide	www.Myphysicscourse.org
Futuremorph	www.futuremorph.org/my-future-finder/space
UK Space Agency	www.bis.gov.uk/ukspaceagency
ESERO: the UK Space Education Office	www.esero.org.uk

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