Physics Through History

The idea of this lesson is to invest some time into expanding students' ideas about the nature of progression in physics. Specifically, students should be encouraged to contrast the way in which physics is presented to them (topics that are done and dusted) with the actual process of doing physics through history, so that they gain some sense of the time that is often required for ideas to mature and be accepted. Also, we often present ideas in a rather different form to the way in which they were originally formulated, having had time and experience to reflect on them and gain a better understanding (sometimes even the discoverer does not fully understand the scope of their own work).

For some students, this will allow them to engage with science more by putting a human face on discovery. However, the nature of the Year 10 curriculum is such that most of the key figures involved are Western and male. It is important that this is discussed, bringing out the point that other cultures have developed sophisticated understandings of the world and that, in modern science, women are more equally represented.

Exercise: A physics timeline

You will need to have sets of cards prepared. The resource *Physics Through History* has a table of key events, people and eras that can be cut into separate cards for this exercise. The cards should be grouped into separate piles for discovery, physicist and date (keep the history cards separate for the moment). Students have to match all three. If you wish, lesson time can be saved by already matching either the scientist with the discovery or the discovery and the date. This could be done by cutting the table in the resource so that items from more than one column appear on a card.

Students will need some input in order to complete the task, which is an opportunity for you to be advising the students and expanding some of their ideas. There are different threads of discovery represented in the cards, e.g. a thread to do with progress in mechanics and one to do with our understanding of the universe. Point out these threads to the pupils and emphasise the time over which ideas mature.

The next part of the exercise is to add in the cards representing key periods and events in history. The list has been selected to provide an interesting and appropriate match for the periods covered by the physics cards; it is not supposed to represent an exhaustive historical timeline. Many students will not be aware of how the science slots into the history.

Possible topics for further discussion

- Discoveries appear to be being made at a greater rate as we get nearer to modern times. Why might that be the case? *(There are many possible answers related to: the money available for research, the number of people involved in science, the opportunities for collaboration and discussion across the world, as well as advancing technology. Point out to the students that as we get closer to modern*

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times, so the number of names linked to a discovery increases. In many cases, significant figures in a team of hundreds of scientists are being named, rather than the whole team that contributed. There appears to be a gap in the timeline in the early to mid-2000s. This is due to the specific physics threads having been chosen for the timeline, which does not cover all aspects of physics. Also, some discoveries are too technical to be accessible to non-experts.)

- Is it possible for a wrong idea to be important? *(An idea can be important even if it eventually turns out to be wrong due to the developments it encouraged at the time. An idea can also be historically important if it deflected and held up progress because people believed it to be true against growing evidence. Sometimes ideas turn out to be incomplete rather than wrong. Newton thought that light was a stream of particles. Young's experiments supposedly demonstrated that it was a wave effect. In the end, wave-particles duality shows us that both views were equally wrong and equally correct.)*
- Would Newton or Galileo be important physicists if they were alive today? *(Of course, we can't know the answer to this. Their lives would be very different, and they might not choose to work in science at all. However, we can say that they would have equally brilliant minds, capable of making profound contributions. Contrast this question with similar ones that often get asked: are modern-day footballers better than their predecessors from the 1960s? The same question could be asked about tennis players, Formula 1 drivers, cyclists or those in any other sport. How do we compare Prime Ministers from different eras?)*
- Is progress in science an illusion? We think of modern theories as being 'right' and older ones as being 'wrong', but will not the future judge our theories in the same way? *(It is perfectly possible that an idea currently judged to be correct and fruitful will turn out in the future to be a dead end or distraction. That is the nature of scientific development and should be applauded rather than feared. The danger arises when some scientists and lay persons make dogmatic pronouncements about matters outside the direct remit of science, based on a dogmatic view of current knowledge. While history does contain examples of earlier ideas being wrong (many of the ancient views of the universe for example), theories are often found to be incomplete or only accurate in a restricted regime. Newton's laws of motion, for example, have been superseded by relativity, but remain perfectly adequate for many situations, including navigating spacecraft. It is important not to judge ideas of the past too harshly. Being wrong does not imply some lack of ability. Our scientific predecessors were not inherently less talented than contemporary workers. They did the best that they could, given the observational evidence and technology available to them at the time.)*