www.scienceinschool.org

Accelerators are everywhere, perhaps closer than you think...

Teacher notes

Location

Since large, powerful research accelerators are too expensive for a single university to build and run, they are generally considered as shared facilities that many researchers from different institutions can share and use as a 'user facility'. For this reason, they are near to university hubs where researchers are based and close to an international airport. In addition, neutron and light sources are often situated close together geographically because researchers often want to use both as complementary techniques to gain a range of information about their samples. They also tend to be situated close to power plants, as they can be power intensive.

Since they are very expensive, they have historically been located in countries with larger economic resources. There is a push now to try to build more synchrotrons and neutron sources in Africa, for example, to make cutting-edge research available to those studying in African countries.

Accelerator diplomacy

If accelerators are powerful tools for discovery, they are also unique tools for diplomacy. Expensive and intricate as they are, these machines have the potential to foster collaborative approaches toward shared scientific objectives, uniting nations in the pursuit of peace. Indeed, these expensive and complex machines can foster collaborative approaches for a common scientific goal and gather nations around a peaceful union. As an example, the SESAME light-source project unites more than eight countries in the conflicted Middle East region, along with 17 observer nations, including one dedicated to supporting Science for Peace.

Another noteworthy model of science diplomacy is the LHC collaboration at CERN. Born after the Second World War, it unites scientists from every corner of the globe, with science as their shared objective.

Ethical implications

People use particle accelerators for radically different types of research, from understanding the origins of the universe, to studying superconducting materials, from developing new medicines, to unravelling the mysteries of prehistoric fossils. Some of this research can have a powerful positive impact for society. One can mention the notable example of Andrei Sakharov, who was recognized with the 1975 Nobel Peace Prize. In 1950, Sakharov proposed the idea for a controlled nuclear fusion reactor, the tokamak. Tokamak fusion reactors are based on accelerating particles by containment and offer the promise of a new type of power station, replicating the processes within the sun and potentially reducing the dependence on fossil fuels in the future.

At the other end of the spectrum, one can also mention the use of particle accelerators for nuclear weapons, as Ernest O. Lawrence was deeply involved in the Manhattan Project, which went on to produce the world's first atomic bomb.