Explained in 60 Seconds

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Best Practices

What is elementary particle physics?

Physics has demonstrated that the everyday phenomena we experience are governed by universal principles applying at time and distance scales far beyond normal human experience. Elementary particle physics is one avenue of scientific enquiry into these principles. What rules govern energy, matter, space, and time at the most elementary levels? How are phenomena at the smallest and largest scales of time and distance connected?

To address these questions, particle physicists seek to isolate, create and identify elementary interactions of the most basic constituents of the Universe. One approach is to create a beam of elementary particles in an accelerator and to study the behaviour of those particles — for instance, when they impinge upon a piece of material or when they collide with another beam of particles. Other experiments exploit naturally occurring particles, including those created in the Sun or resulting from cosmic rays striking the Earth's atmosphere. Some experiments involve studying ordinary materials in large quantities to discern rare phenomena or search for as-yet-unseen phenomena. All of these experiments rely on sophisticated detectors that employ a range of advanced technologies to measure and record particle properties.

Particle physicists also use results from ground- and space-based telescopes to study the elementary particles and the forces that govern their interactions. This latter category of experiments highlights the increasing importance of the intersection of particle physics, astronomy, astrophysics, and cosmology.

From *Revealing the Hidden Nature of Space and Time: Charting the Course for Elementary Particle Physics* (2006), Committee on Elementary Particle Physics in the 21st Century, National Research Council.

Key Words

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This is a composite image showing a small region of the Chandra Deep Field North. The diffuse blue object near the centre of the image is believed to be a cosmic "ghost" generated by a huge eruption from a supermassive black hole in a distant galaxy. A deep image from the Chandra X-ray Observatory, and in red is an image from the Multi-Element Radio Linked Interferometer Network (MERLIN), an array of radio telescopes based in the United Kingdom. An optical image from the Sloan Digital Sky Survey (SDSS) is shown in white, yellow and orange. Credit: X-ray (NASA/CXC/IoA/A.Fabian et al.); Optical (SDSS), Radio (STFC/JBO/MERLIN).