collision energy, luminosity, or improved detectors. In addition to a possible increase to 14 TeV collision energy, a luminosity upgrade of the LHC, called the High Luminosity Large Hadron Collider, started in June 2018 that will boost the accelerator's potential for new discoveries in physics, starting in 2027.[162] The upgrade aims at increasing the luminosity of the machine by a factor of 10, up to 10^{35} $cm^{-2}s^{-1}$, providing a better chance to see rare processes and improving statistically marginal measurements.

Safety of particle collisions

The experiments at the Large Hadron Collider sparked fears that the particle collisions might produce doomsday phenomena, involving the production of stable microscopic black holes or the creation of hypothetical particles called strangelets.[163] Two CERN-commissioned safety reviews examined these concerns and concluded that the experiments at the LHC present no danger and that there is no reason for concern,[164][165][166] a conclusion endorsed by the American Physical Society.[167]

The reports also noted that the physical conditions and collision events that exist in the LHC and similar experiments occur naturally and routinely in the universe without hazardous consequences,[165] including ultra-high-energy cosmic rays observed to impact Earth with energies far higher than those in any man-made collider.

Popular culture

The Large Hadron Collider gained a considerable amount of attention from outside the scientific community and its progress is followed by most popular science media. The LHC has also inspired works of fiction including novels, TV series, video games and films.

CERN employee Katherine McAlpine's "Large Hadron Rap"[168] surpassed 7 million YouTube views.[169][170] The band Les Horribles Cernettes was founded by women from CERN. The name was chosen so to have the same initials as the LHC.[171][172]

National Geographic Channel's *World's Toughest Fixes*, Season 2 (2010), Episode 6 "Atom Smasher" features the replacement of the last superconducting magnet section in the repair of the collider after the 2008 quench incident. The episode includes actual footage from the repair facility to the inside of the collider, and explanations of the function, engineering, and purpose of the LHC.[173]

The Large Hadron Collider was the focus of the 2012 student film *Decay*, with the movie being filmed on location in CERN's maintenance tunnels.[174]

The feature documentary *Particle Fever* follows the experimental physicists at CERN who run the experiments, as well as the theoretical physicists who attempt to provide a conceptual framework for the LHC's results. It won the Sheffield International Doc/Fest in 2013.

Fiction

The novel *Angels & Demons*, by Dan Brown, involves antimatter created at the LHC to be used in a weapon against the Vatican. In response, CERN published a "Fact or Fiction?" page discussing the accuracy of the book's portrayal of the LHC, CERN, and particle physics in general.[175] The movie version of the book has footage filmed on-site at one of the experiments at the LHC; the director, Ron Howard, met with CERN experts in an effort to make the science in the story more accurate.[176]

In the visual novel/manga/anime-series "Steins;Gate", SERN (a deliberate misspelling of CERN) is an organization that uses the miniature black holes created from experiments in the LHC to master time travel