

European research project celebrates its half-century

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Ireland is not a member of one of the world's top research facilities - perhaps it is time to join, writes Cormac O' Raifeartaigh.

Deep beneath the Franco-Swiss border lies a vast, underground scientific laboratory that first came into being 50 years ago, CERN, the world's largest centre for the study of the atomic nucleus and its particles.

An inter-European project founded in 1954 in order to counter the brain-drain of European science to the US, the Conseil Européen pour la Recherche Nucléaire (CERN) has long since become one of the world's major scientific success stories, its particle accelerators providing vital information a the most fundamental question of science - the structure of matter and the nature of the forces that bind it together.

The study of the sub-atomic world using accelerators began at Cambridge in 1932, when young Irish physicist Ernest Walton smashed the atomic nucleus by bombarding it with a beam of artificially accelerated protons. That experiment proved the fundamental structure of matter could be examined by blasting it with high-energy beams from particle accelerators. However, the construction costs of ever more sophisticated accelerators soon became prohibitive for individual European nations, and a collaborative European accelerator research facility was established in Geneva, Switzerland in 1954.

The subsequent success of CERN is legendary. Experiments at CERN and at similar accelerator facilities in the US have revealed the fundamental constituents of matter, carrying the unlikely names quarks and leptons. It also provides the testing ground for modern theories of matter.

The important theoretical conjecture that two "fundamental" forces of nature (the electromagnetic and weak nuclear interactions) are different manifestations of a single unified force was dramatically confirmed at CERN in 1983. The next generation of CERN experiments will search for the "supersymmetric" particles predicted by current unification theories.

An exciting glimpse of the birth of the universe was offered in 1999 when CERN scientists re-created an exotic state of matter thought to have existed for a few microseconds after the Big Bang, a state known as the quark-gluon plasma.

Side by side with such important breakthroughs, striking relativistic and quantum effects are routinely recorded in CERN's accelerators, confirming the basic tenets of modern physics.

The leading edge technology required by this most fundamental of research projects has led to significant technological advances now applied in a wide range of applications.

For example, the need for CERN scientists to analyse and share complex scientific data on the Internet led directly to the development of the World Wide Web in 1990 by CERN physicist Tim Berners-Lee.

A more recent CERN-inspired advance has been the development of the GRID, a new generation of computing technology that facilitates the processing of vast amounts of data by harnessing the computing power of millions of individual interconnected computers.

Accelerator research has had an enormous impact on medicine, with accelerators now widely used in both medical imaging and therapy.

Other spin-offs include a new approach to commercial nuclear power that may one day obviate the problems of

nuclear waste disposal.

The spectacular success of CERN has been accompanied by a swelling of CERN member states from 12 to 20 European countries and major non-European nations such as Russia, Israel, India, the US and Japan. All make substantial financial contributions in order to participate in research at the facility.

More than half the world's particle physicists now come to do research at CERN, and several Nobel prizes have been awarded for work carried out there.

However, to the amazement of other European nations, Ireland is not a member of CERN. For 50 years, mathematicians, physicists, engineers and computer scientists from the Republic - and their students - have been denied the opportunity to engage officially with their international peers in Europe's most fundamental scientific project. More pragmatically, Irish high-tech companies are severely disadvantaged in bidding for the huge contracts available in engineering and information technology industries.

This year, the 50th anniversary of the CERN project coincides with the Irish presidency of the EU - what better time for Ireland to join its European neighbours in one of the world's most important and successful international scientific collaborations?

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