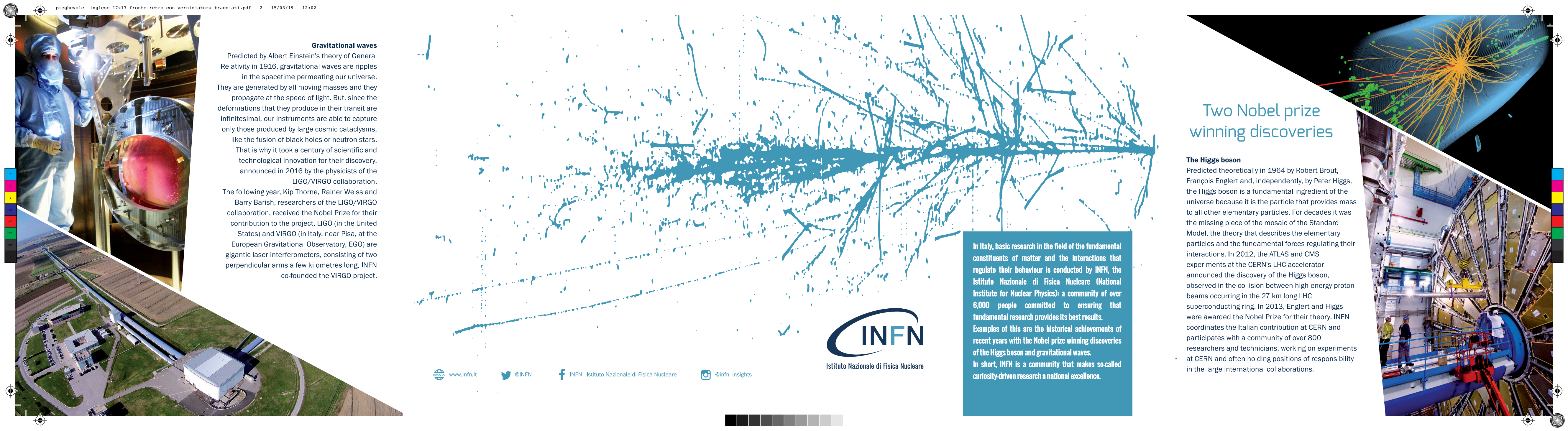






Gravitational waves

Predicted by Albert Einstein's theory of General Relativity in 1916, gravitational waves are ripples in the spacetime permeating our universe. They are generated by all moving masses and they propagate at the speed of light. But, since the deformations that they produce in their transit are infinitesimal, our instruments are able to capture only those produced by large cosmic cataclysms, like the fusion of black holes or neutron stars. That is why it took a century of scientific and technological innovation for their discovery, announced in 2016 by the physicists of the LIGO/VIRGO collaboration.

The following year, Kip Thorne, Rainer Weiss and Barry Barish, researchers of the LIGO/VIRGO collaboration, received the Nobel Prize for their contribution to the project. LIGO (in the United States) and VIRGO (in Italy, near Pisa, at the European Gravitational Observatory, EGO) are gigantic laser interferometers, consisting of two perpendicular arms a few kilometres long. INFN co-founded the VIRGO project.



Istituto Nazionale di Fisica Nucleare

In Italy, basic research in the field of the fundamental constituents of matter and the interactions that regulate their behaviour is conducted by INFN, the Istituto Nazionale di Fisica Nucleare (National Institute for Nuclear Physics): a community of over 6,000 people committed to ensuring that fundamental research provides its best results. Examples of this are the historical achievements of recent years with the Nobel prize winning discoveries of the Higgs boson and gravitational waves. In short, INFN is a community that makes so-called curiosity-driven research a national excellence.

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Two Nobel prize winning discoveries

The Higgs boson

Predicted theoretically in 1964 by Robert Brout, François Englert and, independently, by Peter Higgs, the Higgs boson is a fundamental ingredient of the universe because it is the particle that provides mass to all other elementary particles. For decades it was the missing piece of the mosaic of the Standard Model, the theory that describes the elementary particles and the fundamental forces regulating their interactions. In 2012, the ATLAS and CMS experiments at the CERN's LHC accelerator announced the discovery of the Higgs boson, observed in the collision between high-energy proton beams occurring in the 27 km long LHC superconducting ring. In 2013, Englert and Higgs were awarded the Nobel Prize for their theory. INFN coordinates the Italian contribution at CERN and participates with a community of over 800 researchers and technicians, working on experiments at CERN and often holding positions of responsibility in the large international collaborations.

