



## the Pontifical Academy of Sciences

### Carlo Rubbia



**Date of Birth** 31 March 1934

**Place** Gorizia (Italy)

**Nomination** 14 December 1985

**Field** Physics

**Title** Professor, Nobel laureate in Physics, 1984

**Professional address**

European Organization for Particle Physics (CERN)

CH-1211 Geneva 23 (Switzerland)

#### Most important awards, prizes and academies

**Awards:** He has been awarded numerous prizes, including the Nobel Prize in Physics (1984). **Academies:** He is a member of 27 Academies, among which: Accademia Nazionale dei Lincei; Accademia dei XL; American Academy of Arts and Sciences; Pontifical Academy of Sciences; Foreign Member, Polish Academy of Sciences; Foreign Member, Croatian Academy of Sciences and Arts; Foreign Member, Royal Society; Foreign Member, USA National Academy of Sciences; Foreign Member, USSR Academy of Sciences; Third World Academy of Sciences; European Academy of Sciences; Société Européenne de Culture; Ateneo Veneto; Société Française de Physique; Istituto Lombardo; Austrian Academy of Sciences. **Honours:** Appointed Senator for Life by the President of the Italian Republic Giorgio Napolitano (30 Aug 2013); appointed Cavaliere di Gran Croce (Knight of the Grand Cross) by the President of the Italian Republic, Sandro Pertini (1985); Officier de la Légion d'Honneur, by the President of the French Republic, François Mitterrand (1989); Polish Order of Merit at the conclusion of his mandate as Director General of CERN (1993). **Honorary degrees:** University of Geneva, Switzerland (1983); Carnegie Mellon University, USA (1985); University of Genoa, Italy (1985); University of Udine, Italy (1985); University of La Plata, Argentina (1986); Northwestern University, USA (1986); University of Camerino, Italy (1987); University of Chicago, USA (1987); Loyola University, USA (1987); Boston University, USA (1988); University of Sofia, Bulgaria (1990); University of Moscow, USSR (1991); University of Chile, Santiago (1991); Polytechnic University of Madrid, Spain (1992); University of Padua, Italy (1992); Technical University of Rio de Janeiro, Brazil (1993); University of Trieste, Italy (1994); University of Oxford, UK (1994); Catholic University of Lima, Peru (1994); National University of St. Antonio Abad of Cusco, Peru (1994); University of Bordeaux, France (1998); University of Haute Savoie, France (1999); St John's University, USA-Italy (2003); University of Turin, Italy (2004). **Lectures:** Enrico Fermi Lecturer at the Scuola Normale, Pisa, Italy; Philip-Burton-Moon Lecturer, Birmingham, UK (1984); Bakerian Lecturer, London, UK (1985); Weizmann Lecturer, Rehovot, Israel (1986); Primakoff Lecturer, Pennsylvania, USA (1986); Dirac Lecturer, Sydney, Australia (1989); Heisenberg Lecturer (1992); Max Von Laue Colloquium (1993); Werner Von Siemens Chair (1994); Hitchcock Professorship, Berkeley, USA (1994); Einstein Lecturer, Jerusalem (1998); Rheinisch Westfälische Technische Hochschule (RWTH), Aachen (2004); Pontificia Universidad Católica de Chile, Santiago (2008).

#### Summary of scientific research

Soon after his degree on Cosmic Ray Experiments at the Scuola Normale in Pisa, Rubbia spent one and a half years at Columbia University (USA) performing experiments on the decay and the nuclear capture of  $\mu$  mesons at the Nevis Cyclotron. This was the first of a long series of experiments which Rubbia performed in the field of Weak Interactions and which culminated in the observation of the charged and neutral intermediate vector bosons, believed to be the mediators of such a force. From 1970 to December 1988 Rubbia spent one semester each year at Harvard University (Cambridge, Massachusetts), where he was Higgins Professor of Physics. He performed experiments with different accelerators in the United States (Fermilab, near Batavia, Illinois, and Brookhaven National Laboratory on Long Island, NY) and with the three major accelerators of CERN, the European Laboratory of Particle Physics, near Geneva, Switzerland (the Synchro-Cyclotron, the Proton Synchrotron and the Super Proton Synchrotron). Early in 1983 at CERN, an international team of more

than 100 physicists headed by Rubbia, known as the UA1 Collaboration, detected the intermediate vector bosons, a triplet of particles, the  $W^+$ , the  $W^-$  and the  $Z^0$ , which had become a cornerstone of modern theories of elementary particle physics, long before they were observed by Rubbia and collaborators. They are believed to carry the weak force that causes radioactive decay in the atomic nucleus and controls the combustion of the Sun, just as photons, massless particles of light, carry the electromagnetic force which causes most physical and biochemical reactions. To achieve energies high enough to create the intermediate vector bosons (particles roughly one hundred times as heavy as the proton), Rubbia proposed, with David Cline and Peter McIntyre, the use of a beam of protons and a beam of antiprotons, their antimatter twins, counter-rotating and colliding head-on. These revolutionary techniques were developed with Simon van der Meer, with whom Rubbia shared the 1984 Nobel Prize in Physics. Rubbia was one of the leaders in a collaboration effort based deep in the Gran Sasso Laboratory designed to detect any sign of decay of the proton. The experiment seeks evidence that would disprove the conventional belief whereby matter is stable. The experiment, known as ICARUS and based on a new technique of electronic detection of ionizing events in ultra-pure liquid Argon, is now operational at the University of Pavia, awaiting its transfer to the Gran Sasso Laboratory. More recently he proposed the concept of an Energy Amplifier - a novel and safe way of producing nuclear energy exploiting present-day accelerator technologies, which is actively being studied worldwide in order (1) to incinerate high activity waste from accelerators and (2) to produce energy from natural thorium and depleted uranium. The energy resources which potentially could derive from these fuels will be practically unlimited and comparable to those from Fusion. His activities are presently concentrated on the problem of energy supply for the future.

### **Main publications**

Carlo Rubbia is the co-author of 546 scientific publications, 245 of which have been published in major scientific journals. For a complete list please email a request to [carlo.rubbia@cern.ch](mailto:carlo.rubbia@cern.ch).