

Luisa Cifarelli graduated in Physics in Bologna in 1975. Initially a researcher at INFN<sup>1</sup>, Unit of Bologna, she then moved on to university. A full professor of Experimental Physics at various Italian universities since 1991, she was employed at the *Alma Mater Studiorum* – University of Bologna from 2001 to 2022, as part of the "Augusto Righi" Department of Physics and Astronomy.

### RESEARCH ACTIVITIES AND SCIENTIFIC PRODUCTION

Her research in experimental physics has mainly taken place in large international collaboration experiments within the INFN activities. Her research interests have always concerned subnuclear physics at very high energies at major European laboratories such as CERN<sup>2</sup> in Geneva and DESY<sup>3</sup> in Hamburg, and also astroparticle physics at the INFN's Gran Sasso Laboratory (LNGS<sup>4</sup>).

- In the course of her work, she has been able, in particular, to perform cutting-edge experiments at new particle colliders of the highest energy available: ISR (Intersecting Storage Rings), LEP (Large Electron-Positron Collider) and LHC (Large Hadron Collider) at CERN, and HERA (Electron Proton Collider) at DESY.

- For the past twenty years, she has been involved in the design, construction and use of a powerful time-of-flight system, with record-breaking time precision (50 picoseconds), one of the main components of the ALICE (A Large Ion Collider Experiment) apparatus at the LHC. ALICE studies proton-proton, proton-nucleon and nucleus-nucleus (Pb-Pb, Xe-Xe) collisions of very high energy, in which phenomena occur that are at the origin of our knowledge, such as the deconfinement of quarks and gluons in a plasma that is thought to have constituted the extreme phase of matter in the Universe in the first microseconds after the Big Bang.

- She currently plays a key role in the EEE (Extreme Energy Events) experiment, designed to search for extensive cosmic showers with a special observatory made up of muon detectors installed in about sixty schools throughout Italy, and leads the PolarquEEEst experiment to extend this study from Italy to the Arctic with scientific expeditions (at sea and on land) and other detectors, some of which installed on the Svalbard Islands.

- Finally, she is taking part in the DarkSide project to search for dark matter at LNGS using a large and sophisticated liquid argon detector currently under construction.

- In all these experiments, she has played important roles of coordination and responsibility, especially with regard to data analysis and interpretation.

- Her achievements, to name but a few, include: new limits on the production of free quarks, the discovery of novel properties of hadrons with different "flavours" and of a new baryonic particle with "beauty", the evidence of universal properties of multihadron final states produced in different types of interactions, and the high-precision check of matter-antimatter symmetry.

- She has presented results and projects at numerous congresses, conferences and post-graduate schools (national and international), as well as at various scientific commissions (INFN, CERN), and has held invited seminars at various universities (Italian and foreign) and various international institutions or laboratories (CERN, DESY, JINR<sup>5</sup>, CNRS<sup>6</sup>, EMFCSC<sup>7</sup>, Pontifical Academy of Sciences, *Accademia Sinica*, etc.).

- She has a very large scientific production to her credit: she has published as an author or co-author over 1100 scientific papers in international journals, in proceedings of international conferences, schools or symposia, and also as proposals, notes or internal reports (CERN, INFN, DESY).

### INSTITUTIONAL ACTIVITIES IN RESEARCH LEADERSHIP AND MANAGEMENT

Throughout her career, especially as a representative of a prestigious institution such as the University of Bologna, she has held numerous research leadership and management positions at national and

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<sup>1</sup> INFN – *Istituto Nazionale di Fisica Nucleare* (National Institute of Nuclear Physics), Italy

<sup>2</sup> CERN – European Organisation for Nuclear Research, Geneva, Switzerland

<sup>3</sup> DESY – *Deutsches Elektronen-Synchrotron* (German Electron Synchrotron), Hamburg, Germany

<sup>4</sup> LNGS – *Laboratorio Nazionale del Gran Sasso* (National Gran Sasso Laboratory), L'Aquila, Italy

<sup>5</sup> JINR – Joint Institute for Nuclear Research, Dubna, Russia

<sup>6</sup> CNRS – *Centre National de la Recherche Scientifique* (National Centre for Scientific Research), France

<sup>7</sup> EMFCSC – *Centro Majorana* – "Ettore Majorana" Foundation and Centre for Scientific Culture, Erice, Italy

international laboratories or scientific institutions.

- She was President of the public Italian research organisation *Centro Fermi*<sup>8</sup> (2011-2019).
- She was President of the European Physical Society (EPS) (2011-2013).
- She was President of the Italian Physical Society (SIF) (2008-2019) and is currently Honorary President of the Society.
- She was President of the Forum on International Physics (FIP) of the American Physical Society (APS) (2020).
- She has served on several national and international boards, committees and commissions, in particular:
  - the NATO<sup>9</sup> Advisory Panel on Computer Networks (1993-2000)
  - the CERN Council (2004-2006), as delegate of Italy
  - the INFN Board of Directors (2002-2008), as representative of MIUR<sup>10</sup>
  - the CNRS Scientific Council (2014-2018)
  - the JINR Scientific Council (2013-2022)
  - the APS Committee on International Scientific Affairs (CISA) (2013-2017) (2019-2021)
  - the Governing Board of the Bologna Academy of Sciences (*Accademia delle Scienze dell'Istituto di Bologna*) (2019-2022).
- She is currently a member of:
  - the DIPC<sup>11</sup> Scientific Advisory Committee
  - the EMFCSC (*Centro Majorana*) Scientific Committee
  - the ICSC WL<sup>12</sup> Scientific Committee
  - the Scientific Committee of the Bologna Academy of Sciences.
- As for her academic or honorary recognitions, she is:
  - Honorary Doctor of the JINR
  - "Gero Thomas" Medal of the EPS
  - fellow of the Institute of Physics (IOP)
  - fellow of the American Physical Society (APS)
  - member of the Academy of Europe (*Accademia Europaea*)
  - "Benedictine" member (i.e. fellow) of the Bologna Academy of Sciences.

## TEACHING AND ACADEMIC ACTIVITIES

She has carried out a long and intense teaching activity at several universities (Naples *Federico II*, Pisa, Salerno and Bologna) and several faculties (Science, Medicine, Engineering). She has been a member of many selection committees in the academic sphere, in Italy and abroad.

- At the University of Bologna, she has taught the following courses:
  - Subnuclear Physics (MSc in Physics)
  - Introduction to Modern Physics (BSc in Physics)
  - Relativistic Physics (BSc in Physics).
- She has been the supervisor of dozens of MSc and PhD theses in Physics, thus contributing significantly to the development of her research group.
- She has given doctoral lectures in Bologna (for the first PhD cycle in Italy) and subsequently in other locations.
- She has conceived and coordinated since 2018 the series "On the Shoulders of Giants" of specialised lectures for Physics students at the Bologna Academy of Sciences, in collaboration with the Department of Physics and Astronomy (DIFA) of Bologna, the Italian Physical Society (SIF) and the

<sup>8</sup> *Centro Fermi – Museo Storico della Fisica e Centro Studi e Ricerche "Enrico Fermi"* ("Enrico Fermi" Historical Museum of Physics and Study and Research Centre), Italy "

<sup>9</sup> NATO – North Atlantic Treaty Organization, Brussels, Belgium

<sup>10</sup> MIUR – *Ministero dell'Istruzione, dell'Università e della Ricerca* (Ministry of Education, University and Research), Italy

<sup>11</sup> DIPC – Donostia International Physics Centre, Donostia-San Sebastian, Spain

<sup>12</sup> ICSC WL – International Centre for Scientific Culture - World Laboratory, Geneva, Switzerland

Italian Association of Physics Students (AISF).

- Since 2012, she has founded and directed the Joint EPS-SIF International School on Energy in Varenna, Italy for PhD students and postdoctoral researchers from various scientific disciplines.
- She has organised and chaired numerous national and international conferences or postgraduate schools, especially at the EMFCSC (*Centro Majorana*) in Erice, Italy, she has served on the scientific committees of many international conferences and edited numerous volumes of proceedings or lecture notes.
- She has been a member of the selection commission in a large number of local and national competitions for the recruitment of professors and researchers at various universities and research organisations (INFN, CNR<sup>13</sup>).
- She has served on international evaluation panels (ANR<sup>14</sup>, ESF<sup>15</sup>).

### EDITORIAL ACTIVITIES

She has been and still is involved in numerous editorial activities of peer review for international scientific journals and also in the publication of journals for the dissemination of scientific culture.

- She is on the editorial board of the international scientific journals *LA RIVISTA DEL NUOVO CIMENTO* (SIF), *THE EUROPEAN PHYSICAL JOURNAL PLUS* (SIF-Springer Nature) and *SCIENTIFIC REPORTS* (Springer Nature). She was Editor in Chief of the first two for many years.
- She is on the Board of Directors of *EPL* (Euro Physics Letters), a journal published in partnership by the major European physical societies.
- She is also the current Editor of *IL NUOVO SAGGIATORE* (SIF), the free-to-read scientific dissemination magazine of the Italian Physical Society, and is a member of the editorial board of the magazine *PROMETEO* (Mondadori).

### ACTIVITIES FOR THE DISSEMINATION OF SCIENTIFIC CULTURE

She has carried out an intense activity in the dissemination of scientific culture through seminars and conferences at schools and cultural centres in Italy and abroad, through the publication of books but also through exhibitions and films for the general public, with particular attention to the female gender.

- She has edited several volumes (celebratory or of a historical-scientific character or of selected papers) in Italian and English.
- She has devised and supervised the interactive exhibition "Enrico Fermi, a dual genius between theories and experiments", set up in Genoa (2015-2016) at the *Museo Civico di Storia Naturale* (National History Museum), in Bologna (2016) at the *Ex Chiesa di San Mattia, Polo Museale dell'Emilia-Romagna* (Former Church of St. Matthew, Emilia-Romagna Museum Complex), and finally in Rome (2019-present) in the museum spaces of the *Centro Fermi* historic seat in *via Panisperna*.
- She has contributed to the production of two documentary films on the sea expedition to the Svalbard Islands, "Polarquest" (2019) and "Nanuq, an Arctic journey from past to future" (2020), and two documentary films for the public Italian TV channel *RAI Storia*: "A university chair for Laura Bassi. Bologna 1732" (2020) and "Einstein speaks Italian" (2022).

### SELECTION OF 25 SIGNIFICANT PUBLICATIONS

1) *Search for fractionally charged particles produced in proton proton collisions at the highest ISR energy*

M. Basile, G. Cara Romeo, L. Cifarelli, P. Giusti, T. Massam, F. Palmonari, G. Valenti, A. Zichichi  
*Il Nuovo Cimento A* 40 (1977) 41

2) *The energy dependence of charged particle multiplicity in pp interactions*

M. Basile, G. Cara Romeo, L. Cifarelli, A. Contin, G. D'Ali, P. Di Cesare, B. Esposito, P. Giusti, T. Massam, R. Nania, F. Palmonari, G. Sartorelli, M. Spinetti, G. Susinno, G. Valenti, A. Zichichi

<sup>13</sup> CNR – *Consiglio Nazionale delle Ricerche* (National Research Council), Italy

<sup>14</sup> ANR – *Agence Nationale de la Recherche* (National Research Agency), France

<sup>15</sup> ESF – *European Science Foundation*, Strasbourg, France

Physics Letters B 95 (1980) 311

3) *Evidence for a new particle with naked “beauty” and for its associated production in high-energy (pp) interactions*

M. Basile, G. Bonvicini, G. Cara Romeo, L. Cifarelli, A. Contin, G. D'Ali, P. Di Cesare, B. Esposito, P. Giusti, T. Massam, R. Nania, F. Palmonari, G. Sartorelli, G. Valenti, A. Zichichi  
Lettere al Nuovo Cimento 31 (1981) 97

4) *The “leading” particle effect in hadron physics*

M. Basile, G. Cara Romeo, L. Cifarelli, A. Contin, G. D'Ali, P. Di Cesare, B. Esposito, P. Giusti, T. Massam, R. Nania, F. Palmonari, V. Rossi, G. Sartorelli, M. Spinetti, G. Susinno, G. Valenti, L. Votano, A. Zichichi  
Il Nuovo Cimento A 66 (1981) 129

5) *The effective experimental constraints on  $M_{SUSY}$  and  $M_{GUT}$*

F. Anselmo, L. Cifarelli, A. Peterman, A. Zichichi  
Il Nuovo Cimento A 104 (1991) 1817

6) *The  $\Lambda_b^0$  beauty baryon production in proton proton interactions at  $\sqrt{s} = 62$  GeV: a second observation*

G. Bari, M. Basile, G. Bruni, G. Cara Romeo, R. Casaccia, L. Cifarelli, F. Cindolo, A. Contin, G. D'Ali, C. Del Papa, S. De Pasquale, P. Giusti, G. Iacobucci, G. Maccarrone, T. Massam, R. Nania, F. Palmonari, G. Sartorelli, G. Susinno, L. Votano, A. Zichichi  
Il Nuovo Cimento A 104 (1991) 1787

7) *The most powerful scintillator supernovae detector: LVD*

M. Aglietta, ... L. Cifarelli et al. (LVD Collaboration)  
Il Nuovo Cimento A 105 (1992) 1793

8) *The evolution of gaugino masses and the SUSY threshold*

F. Anselmo, L. Cifarelli, A. Peterman, A. Zichichi  
Il Nuovo Cimento A 105 (1992) 581

9) *Observation of events with a large rapidity gap in deep inelastic scattering at HERA*

M. Derrick, ... L. Cifarelli et al. (ZEUS Collaboration)  
Physics Letters B 315 (1993) 481

10) *QCD studies and determination of  $\alpha_s$  in  $e^+e^-$  collisions at  $\sqrt{s} = 161$  GeV and 172 GeV*

M. Acciarri, ... L. Cifarelli et al. (L3 Collaboration)  
Physics Letters B 404 (1997) 390

11) *Higgs candidates in  $e^+e^-$  interactions at  $\sqrt{s} = 206.6$  GeV*

M. Acciarri, ... L. Cifarelli et al. (L3 Collaboration)  
Physics Letters B 495 (2000) 18

12) *Measurement of the neutral current cross-section and F2 structure function for deep inelastic e+p scattering at HERA*

S. Chekanov, ... L. Cifarelli et al. (ZEUS Collaboration)  
The European Physical Journal C 21 (2001) 443

13) *Measurement of the running of the electromagnetic coupling at large momentum-transfer at LEP*

P. Achard, ... L. Cifarelli et al. (L3 Collaboration)  
Physics Letters B 623 (2005) 26

14) *Deep inelastic scattering with leading protons or large rapidity gaps at HERA*

S. Chekanov, ... L. Cifarelli et al. (ZEUS Collaboration)  
Nuclear Physics B 816 (2009) 1

15) *Pion, kaon, and proton production in central Pb-Pb collisions at  $\sqrt{s_{NN}} = 2.76$  TeV*

- B. Abelev, ... L. Cifarelli et al. (ALICE Collaboration)  
Physical Review Letters 109 (2012) 252301
- 16) *Performance of the ALICE Time-Of-Flight detector at the LHC*  
A. Akindinov, ... L. Cifarelli et al. (ALICE TOF Group)  
The European Physical Journal Plus 128 (2013) 44
- 17) *Precision measurement of the mass difference between light nuclei and anti-nuclei*  
J. Adam, ... L. Cifarelli et al. (ALICE Collaboration)  
Nature Physics 11 (2015) 811
- 18) *Centrality dependence of the charged-particle multiplicity density at midrapidity in Pb-Pb collisions at  $\sqrt{s_{NN}} = 5.02$  TeV*  
J. Adam, ... L. Cifarelli et al. (ALICE Collaboration)  
Physical Review Letters 116 (2016) 222302
- 19) *Enhanced production of multi-strange hadrons in high-multiplicity proton-proton collisions*  
J. Adam, ... L. Cifarelli et al. (ALICE Collaboration)  
Nature Physics 13 (2017) 535
- 20) *The Extreme Energy Events experiment: an overview of the telescopes performance*  
M. Abbrescia, ... L. Cifarelli et al. (EEE Collaboration)  
Journal of Instrumentation 13 (2018) P08026
- 21) *Transverse momentum spectra and nuclear modification factors of charged particles in pp, p-Pb and Pb-Pb collisions at the LHC*  
S. Acharya, ... L. Cifarelli et al. (ALICE Collaboration)  
Journal of High Energy Physics 11 (2018) 13
- 22) *Unveiling the strong interaction among hadrons at the LHC*  
S. Acharya, ... L. Cifarelli et al. (ALICE Collaboration)  
Nature 588 (2020) 232
- 23) *New high precision measurements of the cosmic charged particle rate beyond the Arctic Circle with the PolarquEEEst experiment*  
M. Abbrescia, ... L. Cifarelli et al. (EEE Collaboration)  
The European Physical Journal C 80 (2020) 665
- 24) *Direct observation of the dead-cone effect in quantum chromodynamics*  
S. Acharya, ... L. Cifarelli et al. (ALICE Collaboration)  
Nature 605 (2022) 440
- 25) *Measurement of anti- $^3\text{He}$  nuclei absorption in matter and impact on their propagation in the Galaxy*  
S. Acharya, ... L. Cifarelli et al. (ALICE Collaboration)  
Nature Physics 19 (2023) 61