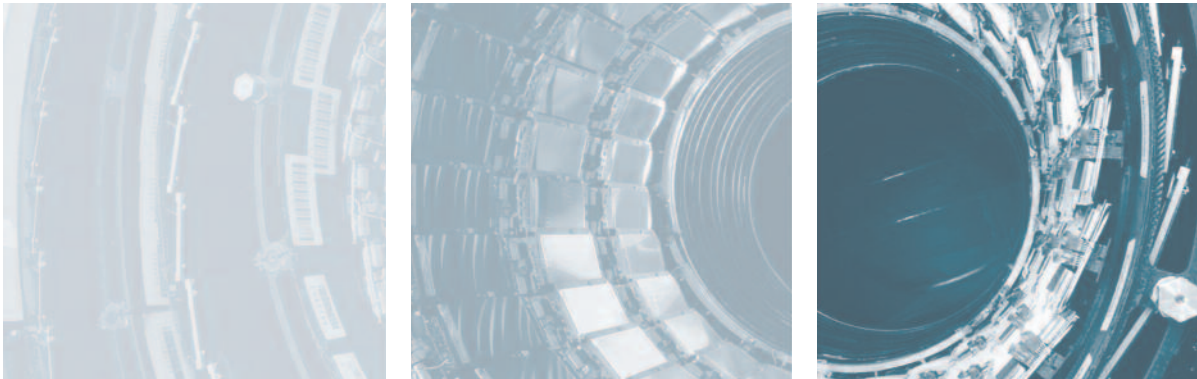


THE PONTIFICAL ACADEMY OF SCIENCES

International Symposium on

# Subnuclear Physics: Past, Present and Future

30 October-2 November 2011 • Casina Pio IV



Introduction p. 3 Programme p. 4 List of Participants p. 8  
Biographies of Participants p. 11 Memorandum p. 20



VATICAN CITY 2011



H.H. Benedict XVI in the garden of the Basilica di Santa Maria degli Angeli e dei Martiri with the statue of “Galilei Divine Man” donated to the Basilica by CCAST of Beijing.

**T**he great Galileo said that God wrote the book of nature in the form of the language of mathematics. He was convinced that God has given us two books: the book of Sacred Scripture and the book of nature. And the language of nature – this was his conviction – is mathematics, so it is a language of God, a language of the Creator.

*Encounter of His Holiness Benedict XVI with the Youth, St Peter’s Square, Thursday, 6 April 2006.*

**I**n the last century, man certainly made more progress – if not always in his knowledge of himself and of God, then certainly in his knowledge of the macro- and microcosms – than in the entire previous history of humanity. ... Scientists do not create the world; they learn about it and attempt to imitate it, following the laws and intelligibility that nature manifests to us. The scientist’s experience as a human being is therefore that of perceiving a constant, a law, a *logos* that he has not created but that he has instead observed: in fact, it leads us to admit the existence of an all-powerful Reason, which is other than that of man, and which sustains the world. This is the meeting point between the natural sciences and religion. As a result, science becomes a place of dialogue, a meeting between man and nature and, potentially, even between man and his Creator.

*Address of His Holiness Benedict XVI to Participants in the Plenary Session of the Pontifical Academy of Sciences, Clementine Hall, Thursday, 28 October 2010.*

# *Subnuclear Physics: Past, Present and Future*

## **INTRODUCTION**

ANTONINO ZICHICHI

**T**he purpose of the Symposium is to discuss the origin, the status and the future of the new frontier of Physics, the Subnuclear World, whose first two hints were discovered in the middle of the last century: the so-called “Strange Particles” and the “Resonance  $\Delta^{++}$ ”. It took more than two decades to understand the real meaning of these two great discoveries: the existence of the Subnuclear World with regularities, spontaneously plus directly broken Symmetries, and totally unexpected phenomena including the existence of a new fundamental force of Nature, called Quantum ChromoDynamics.

In order to reach this new frontier of our knowledge, new Laboratories were established all over the world, in Europe, in USA and in the former Soviet Union, with thousands of physicists, engineers and specialists in the most advanced technologies, engaged in the implementation of new experiments of ever increasing complexity. At present the most advanced Laboratory in the world is CERN where experiments are being performed with the Large Hadron Collider (LHC), the most powerful collider in the world, which is able to reach the highest energies possible in this satellite of the Sun, called Earth. To understand the laws governing the Space-Time intervals in the range of  $10^{-17}$  cm and  $10^{-23}$  sec will allow our form of living matter endowed with Reason to open new horizons in our knowledge.



# Subnuclear Physics: Past, Present and Future

## PROGRAMME

**SUNDAY, 30 OCTOBER 2011**

9:00 Arrivals

13:30 Lunch at the Casina Pio IV

### SESSION N. 1

15:00 *Welcome*

**W. Arber**, President of the Pontifical Academy of Sciences

**M. Sánchez Sorondo**, Chancellor of the Pontifical Academy of Sciences

15:10 Opening Lecture: *The Reasons for this Symposium on Past, Present and Future of Subnuclear Physics*  
**A. Zichichi**

15:40 *Remarks on the History of String Theory and Supersymmetry*  
**J.H. Schwarz**

16:10 *Achievements in Subnuclear Physics at Fermi-Lab*  
**P.J. Oddone**

### SESSION N. 2

16:40 *The Origin of LEP and LHC*  
**R. Aymar**

17:10 *The Results Obtained with the First (pp) Collider ISR*  
**P. Darriulat**

17:40 *From Nonlinear Statistical Mechanics to Nonlinear Quantum Mechanics – Concepts and Applications*  
**C. Tsallis**

18:10 *The Cosmological Constant Problem and the Landscape of String Theory*  
**R. Bousso**

18:40 End of Session n. 2

### Cultural Event (19:30-22:30)

20:00 • **Visit to Michelangelo's Italian State Basilica Santa Maria degli Angeli e dei Martiri (\*)**  
• **Visit to the Galilei Divine Man Exhibit (\*\*)**

21:00 Dinner at the State Basilica Santa Maria degli Angeli e dei Martiri

21:45 Concert of the *Organ* at the State Basilica

(\*) The Basilica of St Mary of the Angels and Martyrs contains the following works of art by major contemporary artists: *Altar with Deposition* by Umberto Mastroianni (author of the Erice Monument), *The Angel of Light* by Ernesto Lamagna (author of the doors of the Papal Basilica of San Vito dei Normanni which enshrine the words of HH John Paul II: “*Voluntary Science is one of the noblest expressions of love for one's fellow men*”), *Skylight* by Narcissus Quagliata (engraved with the sentence by HH John Paul II: “*Science has its roots in the Immanent but leads man towards the Transcendent*”), *Angels' Gates* by Igor Mitoraj (dedicated to HH John Paul II), *Altar Pieces of Mary Magdalene* by Piero Guccione (illustrator of Galileo Galilei's book “*Discourses and Mathematical Demonstrations Relating to Two New Sciences*” with a foreword by HH John Paul II), *Ambo* by Giuseppe Gallo (author of the pendulum placed in the nave of the Basilica for the exhibition “*Galilei divine man*”).

(\*\*) You can admire the bronze statue of *Galileo Galilei Divine Man* designed by the most famous Chinese physicist Tsung Dao Lee (former pupil of Enrico Fermi), Nobel laureate and Director of the prestigious CCAST (Chinese Center of Advanced Science and Technology). The statue is a gift by the CCAST scientists to the Italian State Basilica.



**MONDAY, 31 OCTOBER 2011**

**SESSION N. 3**

- 9:00 *The High Energy Frontier: Past, Present and Future*  
**R.-D. Heuer**
- 9:30 *Highlights from RHIC*  
**M.J. Tannenbaum**
- 10:00 *The Birth of the First (pp) Collider*  
**K. Hubner**
- 10:30 *The INFN Contribution to Subnuclear Physics in Europe*  
**E. Iarocci**
- 11:00 *From Antideuterons to Antimatter-Clusters and Hyperclusters*  
**H. Stoecker**

**SESSION N. 4**

- 11:30 *The Mystery of Neutrino Mixings*  
**G. Altarelli**
- 12:00 *Hot Topics in QCD*  
**S. Brodsky**
- 12:30 *Subnuclear Technology to Study Climate Problems*  
**J. Kirkby**
- 13:00 *Black Holes in the Superworld*  
**S. Ferrara**

13:30 Lunch at the Casina Pio IV

**SESSION N. 5**

- 15:00 *Highlights from ATLAS*  
**P. Jenni**
- 15:30 *The Quark Model and QCD*  
**F. Close**
- 16:00 *Composite Weak Bosons at the LHC*  
**H. Fritzsche**
- 16:30 *The Origin and the Results Obtained at HERA*  
**A. Wagner**

**SESSION N. 6**

- 17:00 *New Physics without New Energy Scale*  
**M. Shaposhnikov**
- 17:30 *Results From The Xenon100 Dark Matter Search Experiment*  
**L. Baudis**
- 18:00 Cultural Event  
• **Visit to the world-famous Vatican Museums**
- 21:30 Dinner at the Casina Pio IV



**TUESDAY, 1 NOVEMBER 2011**

SESSION N. 7

- 9:00 *Origin and Status of the Gran Sasso Lab*  
**L. Votano**
- 9:30 *OPERA Results on Neutrinos from CERN*  
**Y. Déclays**
- 10:00 *Neutrino Beam to Gran Sasso*  
**L. Evans**
- 10:30 *Is there a Neutrino Speed Anomaly?*  
**J. Knobloch**

11:00 Coffee Break

SESSION N. 8

- 11:30 *The Origin and Status of the Third Neutrino*  
**A. Bettini**
- 12:00 *Status and Results of the LVD Experiment*  
**P. Giusti**
- 12:30 *Origin and Status of Luna at Gran Sasso*  
**C. Brogгинi**
- 13:00 *The Origin and Status of SBS (Spontaneously Broken Symmetries)*  
**F. Englert**

13:30 Lunch at the Casina Pio IV

SESSION N. 9

- 15:00 *Study of the Low Energy Neutrinos from Sun and Earth with Borexino*  
**G. Bellini**
- 15:30 *The Little Bang in the Laboratory*  
**P. Giubellino**
- 16:00 *An Interesting Result at 7 TeV*  
**L. Cifarelli**
- 16:30 *Perturbative Quantum Gravity from Gauge Theory*  
**Z. Bern**

17:00 Coffee Break

SESSION N. 10

- 17:30 *Subnuclear Physics – Technology to Benefit Humanity*  
**H. Newman**
- 18:00 *Blueprints of the No-Scale Multiverse at the LHC*  
**D.V. Nanopoulos**
- 18:30 *Black Holes and Qubits*  
**M.J. Duff**
- 19:00 *Mass Hierarchies in String Theory and Experimental Predictions*  
**I. Antoniadis**

20:30 Dinner at the Casina Pio IV

**WEDNESDAY, 2 NOVEMBER 2011**

SESSION N. 11

- 9:00 *The LAA Project and the Consequences on LHC*  
**H. Wenninger**
- 9:30 *The Lattice Fields in the LHC Era*  
**R.D. Kenway**
- 10:00 *The Large Hadron Collider of CERN and the Roadmap Toward Higher Performance*  
**L. Rossi**
- 10:30 *Latest Results from MRPC Time Resolution*  
**C. Williams**

11:00 Coffee Break

SESSION N. 12

- 11:30 *Highlights from CMS*  
**T. Virdee**
- 12:00 *Search for Nuclear Antimatter in Space*  
**S.C.C. Ting**
- 12:30 General Discussion
- 13:00 *Conclusions*  
**A. Zichichi**

13:30 Lunch at the Casina Pio IV

14:30 Departure



# *Subnuclear Physics: Past, Present and Future*

## LIST OF PARTICIPANTS



**Prof. Werner Arber**  
President of the Pontifical Academy of Sciences  
Biozentrum, Department of Microbiology,  
University of Basel  
Basel (Switzerland)



**Prof. Alessandro Bettini**  
INFN and University of Padua (Italy) and  
Canfranc Underground Laboratory,  
Canfranc (Spain)



**H.E. Msgr. Marcelo Sánchez Sorondo**  
Chancellor  
The Pontifical Academy of Sciences  
(Vatican City)



**Prof. Raphael Bousso**  
Center for Theoretical Physics and Department  
of Physics  
University of California  
Berkeley, CA (USA)



**Prof. Guido Altarelli**  
Physics Department  
University of Roma Tre  
Rome (Italy)



**Prof. Stanley J. Brodsky**  
SLAC National Accelerator Laboratory  
Stanford University, CA (USA)  
and Southern Denmark University  
Odense (Denmark)



**Prof. Ignatios Antoniadis**  
Centre de Physique Théorique  
École Polytechnique  
Palaiseau (France)



**Prof. Carlo Broggin**  
University of Padoa and INFN  
Padua (Italy)



**Prof. Robert Aymar**  
CERN  
Geneva (Switzerland)



**Prof. Luisa Cifarelli**  
University of Bologna and INFN  
Bologna (Italy)



**Prof. Rinaldo Baldini Ferroli**  
Enrico Fermi Centre  
Rome (Italy)



**Prof. Frank Close**  
Rudolf Peierls Centre for Theoretical Physics  
University of Oxford  
Oxford (UK)



**Prof. Laura Baudis**  
University of Zürich  
Zürich (Switzerland)



**Prof. Eugenio Coccia**  
INFN and Department of Physics  
Tor Vergata University  
Roma (Italy)



**Prof. Gianpaolo Bellini**  
Physics Department  
Milan University  
Milan (Italy)



**Prof. Michael J. Creutz**  
Brookhaven National Laboratory (BNL)  
Upton, NY (USA)



**Prof. Zvi Bern**  
University of California at Los Angeles – UCLA  
Los Angeles, CA (USA)



**Prof. Pierre Darriulat**  
Vietnam Auger Training Laboratory  
Institute for Nuclear Science & Technology  
Hanoi (Vietnam)



**Prof. Sergio Bertolucci**  
CERN – Research Director  
Geneva (Switzerland)



**Prof. Yves Déclais**  
IPNL/IN2P3/CNRS/Lyon University  
Domaine Scientifique de la Doua  
Villeurbanne Cedex (France)





**Prof. Dmitri Denisov**  
Fermilab  
Batavia, IL (USA)



**Prof. Enzo Iarocci**  
La Sapienza University  
Rome (Italy)



**Prof. Michael James Duff**  
Imperial College London  
London (UK)



**Prof. Adam Włodzimierz Jacholkowski**  
CERN  
Geneva (Switzerland)



**Prof. François Englert**  
Université Libre de Bruxelles  
Brussels (Belgium)



**Prof. Peter Jenni**  
CERN, PH Department  
Geneva (Switzerland)



**Prof. Lyn Evans**  
CERN  
Geneva (Switzerland)



**Prof. Richard D. Kenway**  
University of Edinburgh  
Edinburgh, Scotland (UK)



**Prof. Sergio Ferrara**  
CERN  
Geneva (Switzerland) and  
LNF-INFN  
Frascati (Italy)



**Prof. Jasper Kirkby**  
CERN, PH Department  
Geneva (Switzerland)



**Prof. Harald Fritzsch**  
Ludwig-Maximilians-Universitaet  
Munich (Germany)



**Prof. Juergen Knobloch**  
CERN, PH Department  
Geneva (Switzerland)



**Prof. Piero Galeotti**  
Department of Physics  
University of Torino  
Turin (Italy)



**Prof. Antonio Masiero**  
Direttore INFN Sezione di Padova  
Padua (Italy)



**Prof. Paolo Giubellino**  
Università degli Studi di Torino  
Turin (Italy)



**Prof. Dimitri V. Nanopoulos**  
Texas A&M University  
College Station, TX (USA)



**Prof. Paolo Giusti**  
University of Bologna and INFN  
Bologna (Italy)



**Prof. Harvey Newman**  
California Institute of Technology (Caltech)  
Pasadena, CA (USA)



**Prof. Rolf-Dieter Heuer**  
DG CERN  
Geneva (Switzerland)



**Prof. Piermaria J. Oddone**  
Director Fermi National Accelerator Lab  
Batavia, IL (USA)



**Prof. Kurt Hübner**  
CERN  
Geneva (Switzerland)



**Prof. Lucio Rossi**  
CERN  
Geneva (Switzerland)





**Prof. John Henry Schwarz**  
C.C. Laritsen Lab of High Energy Physics  
CALTECH  
Pasadena, CA (USA)



**Prof. Constantino Tsallis**  
Head, Department of Theoretical Physics  
Centro Brasileiro de Pesquisas Físicas *and*  
Head, National Inst. of Science and Technology  
for Complex Systems, Rio de Janeiro (Brazil)



**Prof. Michael Shaposhnikov**  
Ecole Polytechnique Federale de Lausanne  
(EPFL); Institute of Theoretical Physics  
Laboratory for Particle Physics and Cosmology  
Lausanne (Switzerland)



**Prof. Tejinder Virdee**  
Department of Physics  
Imperial College, London, UK *and*  
CERN  
Geneva (Switzerland)



**Prof. Graham M. Shore**  
University of Wales  
Swansea (UK)



**Prof. Lucia Votano**  
Director LNGS  
L'Aquila (Italy)



**Prof. Horst Stöcker**  
GSI  
Darmstadt (Germany)



**Prof. Albrecht Wagner**  
DESY  
Hamburg (Germany)



**Prof. Michael J. Tannenbaum**  
Brookhaven National Laboratory  
Upton, NY (USA)



**Prof. Horst Wenninger**  
CERN  
Geneva (Switzerland)



**Prof. Thomas Taylor**  
CERN  
Geneva (Switzerland)



**Dr. Crispin Williams**  
CERN  
Geneva (Switzerland)



**Prof. Samuel C.C. Ting**  
Thomas Dudley Cabot Professor of Physics  
Massachusetts Institute of Technology  
Cambridge, MA (USA)



**Prof. Antonino Zichichi**  
CERN, Geneva (Switzerland) *and*  
INFN and University of Bologna (Italy) *and*  
President Enrico Fermi Centre, Rome (Italy)

PAS Academicians



# *Subnuclear Physics: Past, Present and Future*

## **BIOGRAPHIES OF PARTICIPANTS**

**Guido Altarelli** is Full Professor of Theoretical Physics at the University of Roma Tre since 1992. In 1987-06 he was Senior Staff Physicist at the Theory Division of CERN where he held the position of Theory Division Leader in 2000-04. Before this he had various appointments at several Universities. These included the University of Florence (65-68), New York University (68-69), the Rockefeller University (New York, 69-70), "La Sapienza" University in Rome (70-92), l'Ecole Normale Supérieure in Paris (76-77, 81) and Boston University (85-86). He was Director of the Rome Section of the INFN (85-87). At different times he was also a member of the physics advisory committees at DESY, CERN and the SSC (Dallas, USA), of the HEPP Board of the European Physical Society, of the Advisory Board of many International Conferences. He is Supervisory Editor of Nuclear Physics B and of the Journal of High Energy Physics (JHEP). His research achievements (he is author or coauthor of more than 200 scientific papers) cover a broad range of problems in the phenomenology of particle interactions within and beyond the Standard Model, in close connection with experiment. In particular he has contributed to: QCD (corrections to the weak non-leptonic effective Hamiltonian, parton evolution equations, theory of Drell-Yan processes, polarized parton densities, structure functions at small  $x$ ...); the electroweak interactions (precision tests, epsilon parameters, weak decays, theoretical bounds on the Higgs mass...); Neutrino masses and mixings, Grand Unified Theories, Physics beyond the SM.... At CERN he had a leading role in the interpretation of SpS results, in the preparation of LEP and the LHC and in the theoretical analysis of LEP results.

**Ignatios Antoniadis** (December 2, 1955, Chios, Greece). Education: Degree in Mathematics, Univ. of Athens (1977); DEA de Physique Théorique, Paris (1978); Thèse de 3e cycle, Ecole Normale Supérieure, Paris (1980); Thèse d'Etat, Ecole Polytechnique, Paris (EP) (1983). Academic positions: Attaché de Recherches in CNRS, EP (1982-6); Research Associate at SLAC, Stanford, California (1983-6); Chargé de Recherches in CNRS (1986-92); Fellow at CERN, Geneva (1986-8); Directeur de Recherches in CNRS, EP (1992-); Scientific Associate at CERN, Geneva (1996-7); Professeur chargé des cours, EP (part time) (1997-); Senior Staff Member at CERN (2000-). Administrative positions: Coordinator of European Networks (1992-); Physics Panels in European Commission (1999-); Particle Physics Group leader, EP (1999-00); CNRS Commission for Theoretical Physics (2000-1); Invited Editor of the 'Comptes Rendus' of the French Academy of Sciences (2000-); Evaluation panels (German DFG, Uppsala U) (2001); Specialists Committee in University Paris 6 (2004-8); Greece-CERN cooperation national committee (2005-); Senior jury of Institut Universitaire de France (2007-9); TH-unit Head (2000-). Academic prizes: Scientific Price of Bodossaki Foundation on Particle Physics, Greece (1995); 'Honoris Causa' Degree from Ioannina University, Greece (1995); Médaille d'argent of CNRS (2000); Prix special of the French Physical Society (SFP) (2002); ERC Advanced Award, European Commission (2008).

**Robert Aymar** Born in 1936, R. Aymar studied at the Ecole Polytechnique (Paris). Following his secondment to the CEA (French Atomic Energy Commission) in 1959, R. Aymar's career has been focused on fundamental research in plasma physics and its application in controlled thermonuclear fusion research. In 1977, R. Aymar was appointed Head of the Tore Supra Project, a large facility dedicated to magnetic fusion research, to be built at Cadarache (France). He directed the Project from its conceptual design throughout its construction up to its operation in 1988, when he became Head of Department of Fusion Research. In 1990, R. Aymar was appointed Director of the Division of Fundamental Research in Natural Sciences of the CEA. In this position,

he directed a wide range of basic research programmes, including astrophysics, particle and nuclear physics, condensed matter, climatology, as well as thermonuclear fusion. R. Aymar served on many Committees and Councils, either as Delegate from France or in his personal capacity. In 1994, R. Aymar was appointed ITER Director by the ITER Council to direct the international research programme to prepare for the ITER construction. R. Aymar was appointed Director-General of CERN as of 1<sup>st</sup> January 2004 for a period of five years during which the large experiment (the LHC) was built and started to operate. In 2008, R. Aymar was appointed Member of ERAB, a Committee of 22 independent personalities advising the European Commission on research with a long term vision and Member of a Committee advising the Japanese Government on WPI (supervision of six very innovative new research institutes). From January 2009, R. Aymar is "Senior Scientific Advisor to the Administrateur Général (CEO) of the CEA.

**Rinaldo Baldini Ferroli.** 1964: Degree in Physics at Rome La Sapienza University with 110/110 cum laude. 1967: Researcher of the Comitato Nazionale per l'Energia Nucleare (CNEN) at Laboratori Nazionali di Frascati (LNF); Meson photoproduction at the LNF Electrosynchrotron. QED tests and multihadronic production experiment ( $\gamma\gamma 1$ ), at the LNF electron-positron storage ring ADONE. QED tests and multihadronic production experiment ( $\gamma\gamma 2$ ), at the LNF electron-positron storage ring ADONE. 1973: Researcher of the Istituto Nazionale di Fisica Nucleare (INFN) at the LNF till today as Research Director. Charm photoproduction (FRAMM), at CERN in Geneva. 1981-1982: Leave of absence at the Laboratoire de l'Accélérateur Lineaire (LAL) at Orsay (FRANCE); Multihadronic production experiment (DM2), at the LAL electron-positron storage ring DCI. ALEPH at the CERN electron-positron storage ring LEP. Neutron Time-like Form Factors (FENICE) at the renewed LNF electron-positron storage ring ADONE. 1990-1993: LNF Research Division Director. LNF  $\phi$ -Factory DA $\phi$ NE and the KLOE experiment at the LNF. 1995-2001: Leave of Absence at the B-Factory PEP-II and the BaBar experiment at SLAC(USA), as Responsible of the Muon detector. 2002-2011: Director of the Museo Storico della Fisica e Centro Studi e Ricerche Enrico Fermi in Rome. 2008 till today: collaboration (BESIII) at the tau/charm Factory BEPCII at IHEP (CHINA).

**Laura Baudis'** research interests lie at the intersection of particle physics and astrophysics. She builds detectors to discover dark matter particles and to reveal fundamental properties of neutrinos. Baudis received her Ph.D. from the University of Heidelberg in 1999 and went on to become a postdoctoral fellow at Stanford University. She moved to the University of Florida, Gainesville, in 2004, as an assistant professor. In 2006 she was awarded the Lichtenberg Professorship for Astroparticle Physics at the RWTH Aachen University. In 2007 she joined the Physics Institute of the University of Zurich, where she is professor of experimental physics.

**Gianpaolo Bellini.** Full professor of Physics at the University of Milan, he held various positions at the Italian National Institute of Nuclear Physics (INFN), up to vice-president, and in various European and Italian national Institutions (some continuing until now). He is co-editor of EJPplus and referee of several international journals. Experimental researcher of Elementary Particle Physics, he carried out and is still carrying out many experiments (most of them as spokesman) at CERN, Serphukov Laboratory, Fermilab at Chicago, Gran Sasso Laboratory. A few mentions of his discoveries and original contributions are: – the *coherent production on complex nuclei* and its ability in selecting the produced states; the "tunnel effect" in nuclear matter; the first and second radial excitations of the pion; – in the study of *heavy*

*flavours*, the first lifetime or the first high precision lifetime measurements of all charmed mesons and baryons, obtained thanks to the first active Silicon target and the first Silicon micro-vertex detector built by the Bellini's group; – with the Borexino detector, unique for the unprecedented very high radiopurity, measurement for the first time of all the solar neutrino fluxes (not yet from pp), producing important insights in the *neutrino physics* and in the Sun physics; – development of new techniques in the Silicon detectors and in high level radio-purification and related measurements. G. Bellini has received several awards and appreciations for his scientific activity. He is the author of 130 scientific publications on international journals with referees, of 49 papers on Conference Proceedings and the editor of 9 volumes on Particle Physics. He has always been very active in promoting seminars, workshops and discussions on the relation between Science, Culture and Faith. He is also the author of publications on the subject.

**Zvi Bern** is currently Professor of Physics at the University of California at Los Angeles. He received undergraduate degrees in physics and mathematics from the Massachusetts Institute of Technology and a PhD in theoretical particle physics from the University of California at Berkeley. He held positions at the Niels Bohr Institute, Los Alamos National Laboratory and the University of Pittsburgh prior to joining the faculty at UCLA. He is widely known in theoretical physics for research into improved ways of calculating Feynman diagrams without using Feynman diagrams, offering new insights into quantum gravity and into experiments to be carried out at the Large Hadron Collider at CERN. Recently he was co-organizer of a three-month workshop at the Kavli Institute for Theoretical Physics at Santa Barbara on recent breakthroughs in our understanding of scattering processes involving elementary particles. A short video outlining his research can be found at <http://tedxcaltech.com/speakers/zvi-bern>. He has won a Sloan Foundation Award and an Outstanding Junior Investigator Award from the U.S. Department of Energy.

**Sergio Bertolucci**. Born in La Spezia, Italy on 1/1/1950. Degree in Physics *summa cum laude* at the University of Pisa. He has been working in the field of experimental Particle Physics, mostly at DESY in Hamburg, at Fermi National Laboratory in Chicago and at the Laboratori Nazionali di Frascati (LNF) of the Istituto Nazionale di Fisica Nucleare (INFN). He has held key roles in the design, construction and exploitation of important experiments and particle accelerators (e.g. CDF and KLOE experiments, DAFNE collider). Among the most outstanding scientific achievements obtained by these experiments is the discovery of the Top quark. He has designed and built innovative detectors, which are still state-of-the-art. He is co-author of more than 370 papers on refereed journals. He has been Director of the LNF in the years 2002-2004. He has been chairing the LHC Committee (LHCC) of CERN in the years 2004-2007. He is a member of the CERN Research Board and of the Scientific Policy Committee. He is a member of the Restricted Panel of the European Committee for Future Accelerators (RECF). He has been Italian Delegate to the Program Committee for the Research Infrastructures of the EU FP6. He served/serves in several international panels (DESY PRC, ESFRI, ILCSC, CERN Council Strategy Group, SLAC, JPARC). He has been Vice President of INFN in the years 2005-2008. He is currently Director of Research and Scientific Computing at CERN.

**Alessandro Bettini**. Emeritus Professor, Padua University (Italy). INFN, Padua Section. Director General Canfranc Underground Laboratory (Huesca, Spain). A. Bettini graduated in Physics from the University of Padua, Italy where he also obtained a doctorate in the same subject. He has been teaching experimental, general and particle physics in this same University since 1966. He works as an experimentalist in subnuclear physics at the Italian National Institute for Nuclear Physics (INFN) and is presently the Director of the Canfranc Underground Laboratory in Spain. He is the author of over 150 scientific articles in international journals. He contributed to hadronic spectroscopy discovering the first scalar meson and measuring angular momenta and parities. He was a leader of the European Hybrid Spectrometer that lead to the measurement of charm mesons lifetimes and one of the

group leaders in the Rubbia-led UA1 experiment. He contributed to high-resolution tracking devices and to the liquid argon time projection chamber. He is presently engaged in the search for double beta decay, which, if discovered, would prove that neutrinos and antineutrinos are the same particle. He was the Director of the Padua Section of the INFN and of the Gran Sasso National Laboratory and vice-president of the INFN. He is presently vice-president of the Italian Physical Society and of the OECD Global Science Forum. He is the author of four textbooks on Physics.

**Raphael Bousso** is recognized for discovering the general relation between the curved geometry of space-time and its information content, known as the “holographic principle”. This principle is believed to underlie the unification of quantum theory and Einstein’s theory of gravity. Bousso is also one of the discoverers of the landscape of string theory, which explains the small but non-vanishing value of the cosmological constant (or “dark energy”). His work has led to a novel view of cosmology, the multiverse of string theory. Raphael Bousso received his Ph.D. from Cambridge University in 1998 and went on to become a Post-doc at Stanford University. He also worked at the Kavli Institute for Theoretical Physics in Santa Barbara. In 2002/03 he was a fellow at the Harvard University physics department and the Radcliffe Institute for Advanced Study. In July 2003 he joined the physics department at the University of California, Berkeley, where he is a professor in the Berkeley Center for Theoretical Physics.

**Stanley Brodsky** received his Bachelor of Physics degree in 1961 and his Ph.D. in 1964 from the University of Minnesota. Brodsky’s thesis was on the higher order QED radiative corrections to the hydrogen hyperfine splitting. His first academic position was a research associateship in theoretical physics with Professor T.D. Lee at Columbia University in 1964-1966. In 1966 he joined the Stanford Linear Accelerator Center as a research associate in Professor Sidney Drell’s theoretical physics group. Brodsky became a permanent staff member at SLAC in 1968, and in 1976 he was promoted to Professor at the SLAC National Accelerator Laboratory and Stanford University. Brodsky has held a number of visiting faculty positions, including the AVCO Professorship at Cornell University, the Institute of Advanced Study, the Yang Institute of Theoretical Physics at the State University of New York in Stony Brook, and the Institute for Particle Physics Phenomenology in Durham, England. He was recently appointed as the Hans Christian Andersen Professor at Southern Denmark University in 2010-2011. In 1987, Brodsky was awarded the Senior U.S. Distinguished Scientist Award from the Alexander von Humboldt Foundation. He is a Fellow of the American Physical Society. In 2003 he was appointed to be the first Nathan Isgur Distinguished Fellow at the Thomas Jefferson Laboratory. He was awarded the J.J. Sakurai Prize in high energy theoretical physics from the American Physical Society in 2007. Brodsky has been on the scientific and program advisory committees for many laboratories and universities. He is a co-founder and former president of the International Light-Cone Advisory Committee (ILCAC) and was elected in 2008 as Vice-Chair of the Hadron Physics Group (GHP) of the American Physical Society and was Chair of the GHP in 2009. Brodsky’s research areas span many areas of high-energy and nuclear theoretical physics, especially the quark-gluon structure of hadrons and novel effects in quantum chromodynamics; fundamental problems in atomic, nuclear, and high energy physics; precision tests of quantum electrodynamics, light-front quantization; nonperturbative and perturbative methods in quantum field theory, QCD counting rules, and two-photon-processes. Brodsky and G.P. Lepage derived the theory of hard exclusive processes in QCD, including factorization theorems and evolution equations for meson and baryon distribution amplitudes. Brodsky and his collaborators have also developed the theory underlying novel QCD properties such as color transparency, hidden color, reduced nuclear amplitudes, and intrinsic charm; theoretical tools such as light-front wavefunctions, commensurate scale relations, renormalization scale-setting, and direct processes. More recently, he has been collaborating with Guy F. de Téramond on the insights into the QCD which can be obtained from light-front holography and the AdS/CFT correspondence. He has contributed to over 530 scientific articles with over 31000 citations.

**Carlo Broggin** graduated from the University of Milan working on the proton decay experiment in the Mont Blanc tunnel and he has a PhD in physics from the University of Neuchâtel. During his thesis he studied deep inelastic muon scattering in the NMC Collaboration at CERN. He is now Research Director at INFN in Padua. He has carried out experimental research mainly in two fields: neutrino physics and underground nuclear astrophysics. At the beginning of the nineties he was among the proponents of the Munu experiment in Bugey. The purpose was to search for the neutrino magnetic moment by measuring the neutrino-electron cross section with a TPC placed below the core of a nuclear reactor. He has been working in the laboratory for underground nuclear astrophysics in Gran Sasso since the beginning of Luna and was been the spokesperson of the collaboration during the years 2002-2007. Outstanding results have been the cross section measurement of thermo-nuclear reactions at the energy of the fusion inside the Sun, with significant consequences on the study of the neutrino properties, the solar composition and the age of the Universe.

**Luisa Cifarelli** has been Full Professor of Experimental Physics in Italian Universities since 1991. She is now based at the University of Bologna. Her research interests have always been in the domain of very high energy subnuclear physics, in the framework of international collaboration experiments at major European laboratories such as CERN and DESY, and partially also in the domain of astroparticle physics at INFN LNGS. In the last ten years she has been involved in the design, construction and running of the huge time-of-flight detector of ALICE (A Large Ion Collider Experiment) at CERN LHC (Large Hadron Collider). The experiment is meant to study proton-proton and nucleus-nucleus (Pb-Pb) collisions, at extreme energies where fascinating phenomena, such as the deconfinement of quarks and gluons (in Pb-Pb), could be investigated and where unexpected discoveries could be made. She has served in several councils, committees and commissions, she has been a member of the CERN Council and the INFN Board of Directors. She is President of both the European Physical Society (EPS) and the Italian Physical Society (SIF), Fellow of the Institute of Physics (IOP), and a member of the Committee of International Scientific Affairs (CISA) of the American Physical Society (APS). She is a member of the Scientific Committee of the *Centro Majorana* and has very recently been appointed President of *Centro Fermi*.

**Frank Close** OBE. Over the course of a distinguished scientific career, Frank Close has been Head of the Theoretical Physics Division at the Rutherford Appleton Laboratory and Head of Communications and Public Education at CERN in Switzerland, home of the Large Hadron Collider. He's a former vice-president of the British Science Association and in 2000 he was awarded the OBE for his research and science communication. He was one of the UK pioneers of research into quarks, the fundamental particles which make up the nucleus of an atom and he's now Professor of Physics at Oxford University. But perhaps his greatest achievement is bringing particle physics to a wider audience. From *The Cosmic Onion, Antimatter, Neutrino and The Particle Explosion to Nothing: A Very Short Introduction*, Frank has written a series of popular science books which take some of the deepest concepts in physics and make them accessible and even entertaining. He is the only physicist to have twice won the Association of British Science Writers award, in face of competition from professional journalists. In 2002 this was for "the best science writing in a National Newspaper", for his article "Dark Side of the Moon" (Guardian, Aug 9, 2001); and in 2007 for "the best science writing in a non-scientific context" for his obituary of the physicist Ray Davis (Guardian, June 19, 2006). Among his many radio and television appearances, he presented the Royal Institution Christmas Lectures on BBC2 in 1993. He was the voice of particle physics on the BBC World Service for 25 years, a regular contributor to The Guardian for 20 years and has made frequent radio and television appearances worldwide. He has lectured on physics in every continent apart from Antarctica.

**Eugenio Coccia** (Italy, 1956) is full professor of physics at the University of Rome "Tor Vergata". He is an experimental physicist with expertise in astroparticle physics, with a focus on experiments for the detection

of gravitational waves, and interest on neutrinos and cosmic rays detectors. He is recognized for the development of ultracryogenic detectors of gravitational waves. He graduated in physics, cum laude, from the University of Rome "La Sapienza" in 1980. He has been Fellow at CERN (1981-1985), research scientist (1985-1987) and associate professor (1988-1999) at Rome "Tor Vergata". He participates to the large interferometer experiment VIRGO in Pisa; he has been the Principal Investigator of the Explorer experiment at CERN (1998-2010) and is Principal Investigator of the Nautilus experiment at the INFN Frascati Labs. This gravitational wave detector has three world records: it has the best displacement sensitivity for space-time perturbation, it has been the first to acoustically detect cosmic rays and it is the largest detector cooled to millikelvin temperature. He has been the director of the INFN Gran Sasso Laboratory (2003-2009), Chair of the INFN Scientific Committee on Astroparticle Physics (2002-2003) and President of the Italian Society of General Relativity and Gravitational Physics (2000-2004). At present, he is the Chair of the Gravitational Wave International Committee, and member of the Council of the European Physical Society. He is the author of more than 200 scientific articles in international journals and of six books in the field of astroparticle physics.

**Michael Creutz**, born in Los Alamos, NM, USA in 1944, received his undergraduate degree in physics from Caltech in 1966 and his PhD from Stanford in 1970. After spending two years as a fellow of the Center for Theoretical Physics at the University of Maryland, he moved to Brookhaven National Laboratory in 1972, where he is currently a Senior Physicist. His research in elementary particle physics has concentrated on non-perturbative field theory and lattice gauge theory. In 2000 he was awarded the Aneesur Rahman Prize for Computational Physics, in 2008 he received the Gian Carlo Wick Gold Medal, and in 2009 he received a Humboldt Research Award which is being spent on several extended visits to the University of Mainz, Germany.

**Pierre Darriulat**, professor at Hanoi University of Sciences and head of VATLY, astrophysics laboratory in Hanoi (Vietnam) Born 1938, PhD in physics 1965 (Nuclear physics) – Nuclear physics from 1961 to 1966, Saclay and Berkeley (alpha particle scattering) – Particle physics from 1967 to 1999, CERN (CP violation in  $K^0$  physics, hadronic interactions, large transverse momentum jets, weak bosons) – Superconductivity research from 1995 to 1999 (radiofrequency in niobium films) – Astrophysics from 2000 til present (ultra high energy cosmic rays, radio astronomy, teaching), Hanoi, Vietnam. Chevalier de la légion d'honneur; Membre correspondant de l'Académie des sciences (France). Prizes: Joliot Curie, Grand Prix de l'Académie des sciences (Commissariat de l'énergie atomique), Lagarrigue.

**Yves Déclais**, is currently Emeritus Research Director from the CNRS, member of the IPN CNRS/IN2P3 laboratory in the university of Lyon. Ph. D. Thesis in Particle Physics at the University of Caen in 1976 (France) based on the work performed at CERN in studying the KN system. Then involved in the European Muon Collaboration (1976-1983) as staff member of the LAPP. Moved in the field of the neutrino physics since 1982: search for neutrino oscillations at nuclear reactors Bugey & Chooz (1982-1998), OPERA program with the CNGS at the underground laboratory of the Gran Sasso (1999 till now), member of the T2K collaboration. Award from the French Physical Society in 2001. Member of various Scientific committee: SPSC (1998-2001), LS-Modane (1998-2006), GANIL (2003-2004), Canfranc (2007-2008). Member of scientific panels: Helmholtz society (2004), PAC Fermi Lab for the neutrino program (2004). Head of the IPNL laboratory (1999-2003). Spokesperson of the Bugey & Chooz collaboration and of the OPERA collaboration (2002-2008).

**Dmitri Denisov** is the spokesperson of the DZero experiment, which is performing studies of subnuclear particles at the world highest-energy proton-antiproton collider Tevatron at Fermilab, a national laboratory of the U.S. Department of Energy. He graduated from the well-known Moscow Physical Technical Institute in 1984 and joined the Institute for High Energy Physics, the largest subnuclear physics laboratory in Soviet Union. There he performed a series of experiments at the 70-

GeV proton accelerator for his Ph.D. research. These experiments examined proton-nuclei collisions and led to important results on the production of the  $J/\Psi$  particle, the bound state of a charm and anti-charm quark, as well as to strict limits on the existence of di-baryon resonances and in-depth studies of cumulative particle production. He became a worldwide expert on the development of new particle detectors for subnuclear physics experiments, including fast coordinate detectors and calorimeters based on liquid Argon. Denisov joined the DZero collaboration in 1987 and helped build a large, complex particle detector to study the world's highest-energy collisions of protons and antiprotons at the Tevatron. In 1995, he played major role in Tevatron's discovery of the top quark, the heaviest elementary particle ever observed. In the late 1990s, his research led to the precise measurements of bottom-quark production across a wide kinematic region, which led to advances in the theoretical explanation of this process. Denisov oversaw a major part of the upgrade of the DZero detector in time for the start of Tevatron's second run, which began in 2001. He led successful commissioning of the DZero experiment and readied it for physics data collection. From 2004 to 2006, he was the leader of the electroweak physics group of the experiment, leading studies of the production and properties of electroweak force carriers known as W and Z bosons. In 2006, Denisov was elected spokesperson of the DZero collaboration, which comprises over 500 physicists from 20 countries. He has led the collaboration to many exciting scientific results, including the discovery of new heavy baryons containing bottom quarks, the highest-precision measurements of the W boson and top quark masses, searches for a wide spectrum of new subatomic phenomena predicted by theoretical models, the first observation of hints of new physics in the oscillations of B mesons, and strict limits on the mass of the Higgs boson. The DZero collaboration published more than 200 papers during his term. Denisov received the Medal for achievements in high energy physics and development of international cooperation from Czech Technical University in 2008, and he was elected Fellow of the American Physical Society in 2010 for his numerous contributions to the development of experimental high energy physics.

**Michael Duff** gained his PhD in theoretical physics in 1972 at Imperial College, London, under Nobel Laureate Abdus Salam. After postdoctoral fellowships in Trieste, Oxford, King's College London, Queen Mary College London and Brandeis, he returned to Imperial College in 1979 as a faculty member. He took leave of absence to visit the Theory Division in CERN, from 1984 to 1987 when he became Senior Physicist. He has also held Visiting Professorships and Fellowships at the University of Texas, Austin; the University of California, Santa Barbara, the University of Kyoto and the Isaac Newton Institute, University of Cambridge. He took up his professorship at Texas A&M in 1988 and was appointed Distinguished Professor in 1992. In September 1999 he moved to the University of Michigan, where he was Oskar Klein Professor of Physics. In 2001, he was elected first Director of the Michigan Center for Theoretical Physics and was re-elected in 2004. In 2005 he returned once more to Imperial as Professor of Physics and Principal of the Faculty of Physical Sciences. He was appointed Abdus Salam Professor of Theoretical Physics in 2006. Michael Duff's interests lie in unified theories of the elementary particles, quantum gravity, supergravity, Kaluza-Klein theory, superstrings, supermembranes and M-theory. He is a Fellow of the Royal Society, a Fellow of the American Physical Society, a Fellow of the Institute of Physics, a Fellow of the Royal Society for the Arts and Recipient of the 2004 Meeting Gold Medal, El Colegio Nacional, Mexico.

**François Englert** was born in 1932 in Belgium. He graduated in Engineering and then in Physics at the Université Libre de Bruxelles (ULB), where he got his PhD in Physical Sciences in 1959. He went to Cornell University (Ithaca, NY) to work with Robert Brout as Research Associate and then, in 1960, as Assistant Professor. François and Robert became lifelong collaborators and friends. They went together back to Belgium in 1961 where François and Robert eventually co-directed the Theoretical Physics Group at the ULB. In 1998 he became emeritus; he got an Honoris Causa Degree from the University of Mons-Hainaut in 2004 and from the Vrije Universiteit Brussel in 2005. François Englert

contributed extensively to condensed matter physics, statistical mechanics, quantum field theory, general relativity and cosmology. He was awarded the A. Wetrems Prize in Mathematical and Physical Sciences by the Royal Belgium Academy in 1977. He obtained the First Award of the International Gravity Contest in 1978 with Robert Brout and Edgard Gunzig for the essay "The Causal Universe" where the idea of inflation was introduced and related to a quantum emergence of the Universe itself. He received the Francqui Prize in 1982. With Robert Brout, he introduced in 1964 the mechanism of spontaneous symmetry breaking in Yang-Mills theory. This mechanism became the cornerstone of the electroweak theory, initiated a modern view of unified laws of nature and was essential in motivating the construction of the Large Hadron Collider. It was honored with prestigious prizes: the High Energy and Particle Physics Prize of the European Physical Society in 1997 and the Wolf Prize in 2004, both with Robert Brout and Peter Higgs, and the J.J.Sakurai Prize of the American Physical Society in 2010, with Robert Brout, Gerald Guralnik, Carl Hagen, Peter Higgs and Tom Kibble.

**Lyn Evans** has spent his whole career in the field of high-energy physics and particle accelerators, participating in all the great projects of the European Laboratory for Particle Physics (CERN). He joined the "300 GeV" project in 1971, participating in the construction of the SPS which today accelerates the proton beams producing neutrinos for Gran Sasso. In the late 1970s and early 80s he worked on the Proton-Antiproton collider. Since 1993 he has led the team that designed, built and commissioned the Large Hadron Collider. He is presently a visiting professor at Imperial College, London. Among his many honors, he is a Fellow of the American Physical Society and a Fellow of the Royal Society.

**Sergio Ferrara** was born in Rome in 1945 and graduated from the University of Rome in 1968. He worked as a CNEN and INFN researcher in Frascati, at CNRS in Paris and at CERN, Geneva. In 1980 he became full professor of theoretical physics in Italy, a member of the Theory Division at CERN in 1981 and professor of physics at the University of California, Los Angeles, in 1985. He was a Miller Professor at the University of California, Berkeley in 2008. Since 2009, he is the Principal Investigator of a European Research grant with CERN as host institution and INFN second beneficiary. Dr. Ferrara has written over 300 publications in peer-reviewed journals, books and conference proceedings with an overall number of citations of approximately 26000.

**Harald Fritzsch** has a PhD in physics from the Technical University in Munich, Germany. His research focuses on particle physics. From 1970 until 1976 he collaborated with Murray Gell-Mann at the California Institute of Technology. In 1972 they proposed the theory of Quantum Chromodynamics, which turned out to be the correct theory of the strong interactions. In 1975 he formulated together with Peter Minkowski the theory of Grand Unification, based on the gauge group  $SO(10)$ . In 1979 he introduced specific mass matrices for the quarks to describe the flavor mixing of the quarks. Recently he applied similar methods to describe the mixing of the neutrinos. In 1977 he became full professor at the new university in Wuppertal, Germany, and in 1979 professor of theoretical physics at the university in Bern, Switzerland. Since 1980 he holds the chair of theoretical physics at the Ludwig-Maximilians-University in Munich. He has published about 250 research papers in the field of particle physics. He was president of the Society of German scientists and physicians from 2003 until 2005. He has written eight books for the general public. In 1985 he produced the television series "Microcosmos" with the television station in Cologne. He received the medal for science publishing in 1994 and the Dirac medal of 2008.

**Piero Galeotti**. Nato a Torino nel 1942, mi sono laureato in Fisica all'Università di Torino nel 1965. Ho svolto attività didattica e di ricerca all'Università di Torino, al CNR e all'INFN; sono professore ordinario di Fisica Sperimentale all'Università di Torino, dove ho tenuto corsi di Fisica, Astrofisica, Fisica Sperimentale e Probabilità e Statistica. Sono associato a: Cern (*Centro Europeo Ricerche Nucleari*), Infn (*Istituto Nazionale di Fisica Nucleare*), Inaf (*Istituto Nazionale di Astrofi-*

sica); sono membro di *International Astronomical Union (IAU)*, *Società Astronomica Italiana (SAIt)*, *Società Italiana di Fisica (SIF)*. La mia attività scientifica è svolta nel campo della fisica astroparticellare, in particolare lo studio della radiazione cosmica a terra, sottoterra o dallo spazio. Da molti anni svolgo ricerche di astrofisica neutrinica (prima nel laboratorio del Monte Bianco e ora in quello del Gran Sasso) per studiare le fasi evolutive finali di stelle che possono esplodere come supernovae, un'esplosione verificatasi nel 1987. Altre mie ricerche riguardano lo studio dei raggi cosmici di altissima energia dalla Stazione Spaziale Internazionale (ISS) e in alta quota montana. Sono autore di alcuni libri e di numerose pubblicazioni scientifiche, la maggior parte delle quali su riviste internazionali o in atti di congressi internazionali. L'elenco delle mie pubblicazioni è riportato nei data base ADS della NASA (che elenca attualmente 286 pubblicazioni scientifiche) e SPIRES di SLAC (che ne elenca 245). Ho tenuto relazioni su invito a congressi nazionali e internazionali e seminari in Università e Istituti di ricerca italiani e stranieri. Mi occupo di divulgazione scientifica e di aggiornamento per insegnanti e studenti di scuole primarie e superiori. Sono Vice-Presidente del Planetario di Torino e Consulente Editoriale del mensile di cultura astronomica *Le stelle*. In riconoscimento della mia attività di ricerca, didattica e divulgativa l'Unione Astronomica Internazionale ha attribuito il mio nome al pianetino J134 (20451) scoperto il 15 maggio 1999.

**Paolo Giubellino**, after his studies at Torino University and University of California, Santa Cruz, has dedicated most of his scientific life to the Physics of High-Energy Heavy-Ion collisions, first in HELIOS, then in NA50 and finally in the ALICE experiment. He has been involved in ALICE from the very first feasibility studies, and has later carried a number of responsibilities in the experiment, including Project Leader for the Inner Tracking System, Chair of Conference Committee, Upgrade Coordinator and, for the past six years, Deputy Spokesperson. Since Jan 1<sup>st</sup> 2011, he is the Spokesperson of the ALICE Collaboration. He has been active in the development of silicon detectors and is a member of the ICFA Instrumentation Panel. He serves in many scientific committees and panels and is currently Chair of the G-PAC of GSI and member of the Conseil Scientifique of IN2P3. Author of over 300 scientific papers, he has been awarded the Medal of the Ukrainian Academy of Sciences and the Medal of the Particles and Fields section of the Mexican Physical Society. He is based at both INFN Torino and CERN.

**Paolo Giusti** started his research activity in Experimental Particle Physics as Research Assistant to the University of Bologna chair of Fisica Superiore in 1972. In 1974 he became a member of the Istituto Nazionale di Fisica Nucleare (INFN), Bologna Section. He was nominated First Level Researcher in 1989 and Director of Research in 1991. Having retired in 2010 he continues his activity as INFN Senior Associate. Paolo Giusti is co-author of more than 260 scientific publications and of more than 100 Conference contributions, Working Group reports, experiment proposals and Internal Notes. His activity has addressed the following main lines of research. Search for free fractional charge quarks in (pp) interactions at the CERN ISR and in high energy neutrino interactions at the CERN SPS. Study of universality features in multiparticle systems produced in (pp) and (ppbar) interactions at the CERN ISR. Study of open charm and beauty states production in (pp) interactions at the CERN ISR. Study of (ep) interactions, experiment ZEUS, at the DESY HERA. Study of cosmic rays and search for stellar gravitational collapses, experiment LVD, at INFN LNGS. Study of (pp) interactions at CERN LHC energies, experiment ATLAS. Paolo Giusti has coordinated the Bologna team engaged in ZEUS (1988-1994), in LVD (2001-2011) and in ATLAS/RPC (2005-2009).

**Kurt Hübner** Dipl.Ing. in mechanical engineering; Dr.techn. of Technical University of Vienna (1965), thesis work in nuclear physics; CERN Fellow (1964) in the Accelerator Research Division; from 1966 CERN Staff member in ISR, LEP and PS Division; Leader CERN Proton Synchrotron Division (1991-1993). CERN Director of Accelerators (1994-2001). Scientific activities: Intersecting Storage Rings (ISR), CERN Linear Collider Study (CLIC), Large Electron Positron Ring (LEP), Neutrino Beam to Gran Sasso at CERN (CNGS); SPEAR at SLAC; PETRA at DESY.

Former Member of European Committee for Future Accelerators (ECFA) and of Scientific Advisory Boards (LAL in Orsay, ELETTRA in Trieste; DESY in Hamburg, KEK in Tsukuba); Former Member of Review Committees of Helmholtz Society Germany; Member of International Linear Collider Technical Review Committee (2001-2003), OECD Global Science Forum Consultative Group on High-Energy Physics (2001-2004) and European Linear Collider Steering Group (2002-2003). Chairman Technical Advisory Committee of MedAustron since 2007; Fellow of the European Physical Society, Honorary Staff Member CERN.

**Enzo Iarocci** was born in Rome in 1941. 1965 Physics degree, University "La Sapienza", Rome; 1967-87 Researcher of the Frascati National Laboratories of INFN. Since 1987, Professor of Physics, Engineering Faculty, "La Sapienza" University, Rome. He has carried out experimental research in sub-nuclear physics, in the fields of particle detectors, astro-particle physics and  $e^+e^-$  interactions. At the end of the 1970s, he developed the streamer tubes, a new particle detector used worldwide in particle and astro-particle physics experiments. After the participation in the proton decay experiment in the Mont Blanc tunnel in the early 1980s, he coordinated the Italian participation in the Macro experiment, for the search for magnetic monopoles, in the Gran Sasso Laboratory. He has studied and is studying  $e^+e^-$  interactions at the Frascati colliders, Adone and Daphne respectively. He was Director of the Frascati Laboratories (1990-96), President of INFN (1998-04) and President of CERN Council (2004-06). He was awarded the Gold Medal Benemerito della Scienza e della Cultura, Presidency of the Italian Republic (2000).

**Adam Jacholkowski**. Born 1945 in Grojec (Poland) near Warsaw. 1968 – graduated from Warsaw University in theoretical nuclear physics, same year joined the Institute of Experimental Physics of Warsaw University as an assistant. 1974 – PhD in experimental high energy nuclear physics, based on analysis of collisions of relativistic deuterons with emulsion nuclei (JINR – Dubna experiment). 1974-1976 visiting scientist (postdoc) at Laboratoire de l'Accélérateur Lineaire (Orsay-France), participation in the CERN experiment studying baryon exchange reactions in  $\pi$ -proton collisions with the Omega Spectrometer. 1977-1982 work in the Serpukhov experiment RISK exploring hadron-nucleus collisions. In the same period of time lecturer (general physics) at the Pedagogical Institute of Warsaw. 1983-1985 invited associate professor at Université Paris VI, work on analysis of the CERN experiment WA72 ( $\pi$  – nucleus collisions), proposed previously by the Warsaw group. Since 1986 a member of CERN, contributing to the long series of experiments, mainly at the Omega Spectrometer, covering a wide range of topics of the nuclear and sub-nuclear physics (WA76, WA77, WA82, WA85, WA91, WA94, WA97, and WA102). 1991-1992 member of the working group studying feasibility of building a high energy heavy ions experiment at the LHC collider. 1995 – Development and testing of the novel pixel detector technology (RD19), used for the first time, on a large scale, in the heavy ion experiment WA97. 1998-2005 experiment NA57, a continuation of WA97, testing and developing of the new DAQ system called DATE in view of the ALICE experiment. Since 2005 a member of the ALICE experiment contributing to a wide variety of topics going from detector alignment (co-organizer of the LHC Alignment Workshop) to searches of exotic phenomena at this new energy frontier. 2009 – one of the first Period Run Coordinators in ALICE preparing (using cosmic rays), a successful start of the experiment with colliding initially p-p and then Pb-Pb beams. Since beginning of work at CERN, collaboration with several Italian laboratories (Bologna, Bari, Padova, Catania), giving on occasion of visiting them lectures and seminars. The topics of them being, in general, related to the current experimental activity, one exception was done with a series of lectures dedicated to the emerging science of complexity (Bari 2002). Since 2004 member of the teaching team of the Physics Doctoral School in Catania. Co-author of about 270 publications in referenced journals and conference proceedings, numerous presentations of the CERN experiments and their results at the most important international conferences on nuclear and sub-nuclear physics.

**Peter Jenni**, Swiss, born in 1948, obtained his Physics Diploma at the University of Berne in 1973 and his Doctorate at the Swiss Federal

Institute of Technology in Zürich (ETHZ) in 1976. Peter Jenni participated in CERN experiments at the Synchro-Cyclotron (SC, 1972/3), at the Proton Synchrotron (PS, 1974/6), and as ETHZ Research Associate at the Intersecting Storage Rings (ISR, 1976/7). During 1978/9, he was a Research Associate at the Stanford Linear Accelerator Centre (SLAC), USA, participating in the MARK II experiment at the  $e^+e^-$  storage ring SPEAR. He became a CERN staff member in 1980 with the UA2 experiment at the SPS collider (major involvement in the discoveries of jets and the W/Z bosons). His strong interest was with the Large Hadron Collider (LHC) since the beginning in 1984. From 1991 his main activities concentrated on tasks related to the spokespersonship first of a proto-Collaboration (Expression of Interest, 1992), and then, on the shared spokespersonship with F. Dyak of the ATLAS Collaboration (Letter of Intent 1992, Technical Proposal 1994). In 1995 he was elected Spokesperson of ATLAS which today comprises some 3000 scientists representing 174 Institutions from 38 countries. He was re-elected several times and retired from this duty in February 2009, retaining a strong involvement in the operation and physics of the experiment. He has served on, and still is member of, numerous international science advisory committees.

**Richard Kenway** was appointed to the Tait Chair of Mathematical Physics at the University of Edinburgh in 1994. His research explores non-perturbative aspects of theories of elementary particles using computer simulation of lattice gauge theories, particularly the strong interactions of quarks and gluons described by Quantum Chromodynamics (QCD). He led UK participation in the QCDOC project to build a 10 teraflops computer to simulate QCD, jointly with the USA and Japan, and three of these machines operated successfully from 2004 to 2009. He currently leads UK participation in a follow-on project to build a petascale computer by the end of 2011. In 2002, he initiated the International Lattice Data Grid project, which provides a global infrastructure for sharing simulation data. As Vice-Principal, Professor Kenway is responsible for the UK's High-Performance Computing Service, National e-Science Centre and for promoting advanced computing technology to benefit academia and industry. In the Queen's 2008 Birthday Honours, Professor Kenway was awarded an OBE for services to science. Since 2008, he has been Head of the School of Physics and Astronomy. Currently, he chairs the Scientific Steering Committee of the Partnership for Advanced Computing in Europe (PRACE).

**Jasper Kirkby** is an experimental particle physicist at CERN, Switzerland. After completing his degrees at the Universities of Oxford and London, he spent 12 years at Stanford Linear Accelerator Center in California before joining CERN in 1984. He has built detectors and carried out experiments at accelerators in the United States (BNL AGS, SLAC Linac, SPEAR, and PEP) and Europe (CERN PS, LEP, PSI and RAL). He originated the idea for a new accelerator known as the Tau-Charm Factory, which eventually led to BEPCII in Beijing. He has conceived of and led several large experiments at accelerators: the DELCO detector at SPEAR; the DELCO detector at PEP; the FAST experiment at PSI; and the CLOUD experiment at CERN. The first results from CLOUD on the role of galactic cosmic rays in atmospheric aerosol nucleation have recently been published in *Nature* (Kirkby *et al.*, *Nature* 476, 2011).

**Jürgen Knobloch** is Senior Physicist at the European Organization for Nuclear Research (CERN). From 1969 to 1976 he participated in particle physics experiments at DESY. The PhD thesis topic was deep inelastic electron scattering in a streamer chamber. Since 1976 he was research physicist in the experiments CDHS, ALEPH and ATLAS at CERN (co-) authoring some 250 scientific articles. He joined the CDHS neutrino experiment in 1976. The physics topics covered ranged from understanding previously reported anomalies ("High- $\gamma$  Anomaly"), over nucleon structure functions, a precise measurement of the electroweak parameters, to the measurement of elements of the Cabibbo-Kobayashi-Maskawa matrix. In the ALEPH experiment at the electron-positron collider LEP he participated in the design of the detector and led the development of the reconstruction and analysis software. In ALEPH and later in the ATLAS experiment at the Large Hadron Collider (LHC) with its more

than 2000 scientists he was nominated Computing Coordinator overseeing the software development and the computing infrastructure. Since 2000 he headed groups in CERN's IT-Department developing common physics analysis software systems for the experiments at CERN. From 2001 to 2010 he was member of scientific committees (SPSC, LHCC) at CERN. He prepared for the general computing infrastructure of the LHC experiments in the framework of European computing grid projects. In the LHC Computing Grid project he was the editor-in-chief of the LHC Computing Grid Technical Design Report published in 2005. Since 2007 he led the CERN participation in the European Grid Initiative (EGI) Design Study becoming the technical director of the project. He edited the "EGI-Blueprint" that was the basis of the now established EGI foundation. In recent years he had promoted and studied to apply algorithms developed for particle physics in other domains such as space exploration and medical applications e.g. in cancer therapy with particle beams. Since 2008 he is editor of the IEEE Transactions on Nuclear Science Journal.

**Antonio Masiero** was born in Vicenza (Italy) in 1955 and graduated from the University of Padova in 1978. He spent several years in various foreign institutions, with postdoctoral fellowships at the Univ. of Geneva (1979-1980), the Max Planck Institut in Munich (1980-1982), CERN (1983-1985) and as Assistant Professor at the New York University (1985-1987). He was researcher of the Istituto Nazionale Fisica Nucleare (INFN) in Padova in the period 1982 - 1994. In 1994 he became full professor of theoretical physics first at the University of Perugia and then at SISSA in Trieste. Since 2001 he is full professor of astroparticle physics at the University of Padova. In 2006 he became Director of the INFN Padova Section. He has contributed in various topics of particle physics and astroparticle phenomenology with particular attention to the unification of fundamental interactions, the prospects for new physics beyond the particle Standard Model and the interplay between particle physics and cosmology. He has written about 200 publications in peer-reviewed journals, books and conference proceedings with an overall number of almost 10000 citations.

**Dimitri V. Nanopoulos** was born in Athens on September 13, 1948. He studied Physics at the University of Athens and graduated in 1971. He continued his studies at the University of Sussex in England, where he received his Ph.D. in High Energy Physics in 1973. He has been a Research Fellow at the Center of European Nuclear Research (CERN) in Geneva, Switzerland and he has been a staff member for many years. He has also been a Research Fellow in École Normale Supérieure, in Paris, France and in Harvard University, Cambridge, USA. In 1989 he was appointed professor at the Department of Physics, at Texas A&M University and in 1992 he was appointed Distinguished Professor of Physics. Since 2002 he holds the Mitchell/Heep Chair in High Energy Physics endowed with an amount of \$1,5 Million. He is also Head of the Astroparticle Physics Group in Houston Advanced Research Center (HARC), in Houston, Texas, USA. In 1997 he was appointed regular member of the Academy of Athens. In 2005 he was appointed representative of Greece to the European Laboratory for Particle Physics (CERN). He was also President of the Greek National Council for Research and Technology from 2005 to 2009 and the National representative of Greece to the European Space Agency (ESA) from 2005 to 2006. He has made several contributions to particle physics and cosmology. He works in string unified theories, fundamentals of quantum theory, astroparticle physics and quantum-inspired models of brain function. He has written over 600 original papers, all published in peer-reviewed journals, with high impact factor, including 14 books. He has over 36.500 citations. Since 1988 he is Fellow of the American Physical Society and since 1992 a member of the Italian Physical Society. In 1996 he was awarded the Commander of the Order of Honour of the Greek State and in 2005 (100th anniversary of the Einstein's Relativity Theory), he received for the second time (first time was in 1999) the first place award from the Gravity Research Foundation (Massachusetts, USA). In 2006 he received the Onassis International Prize. In 2009 he was awarded the "Enrico Fermi" Prize of the Italian Physical Society (SIF) in recognition of his discoveries of fundamental phenomenological properties of grand unifications and superstring theories.



**Harvey Newman** (Sc. D, MIT 1974) is a Professor of Physics at the California Institute of Technology, and a faculty member at Caltech since 1982. He co-led the MARK J Collaboration that discovered the gluon at the DESY laboratory in Hamburg in 1979. His current activities include searches for the Higgs particles, supersymmetry, and other exotic new particles with the Compact Muon Solenoid (CMS) at CERN's Large Hadron Collider (LHC), and measurements of neutrino oscillations with the MINOS and NOvA experiments at Fermilab. Between 1998 and 2008 he served as the Chair of the Collaboration Board of the U.S. contingent of CMS. He now serves as Chair of the US LHC Users Organization, is a Fellow of the American Physical Society, and serves as Chair of the APS Forum on International Physics. In addition to his roles in physics discoveries over the last 40 years, Newman has had a leading role in the development and operation and management of international networks and collaborative systems, as well as the development of precision crystal detectors for High Energy Physics since 1982. He was awarded Doctor Honoris Causa degrees by the Politechnica University in Bucharest, Romania, and Pavel Jozef Safarik University in Kosice, Slovakia in 2007, and the "Jose Bonifacio" medal of the State University of Rio de Janeiro in 2009.

**Piermaria Oddone** was appointed Director of Fermi National Accelerator Laboratory July, 2005. Fermilab, a US Department of Energy Laboratory, is managed by Fermi Research Alliance (FRA), a partnership of the University of Chicago and the Universities Research Association (URA). Fermilab advances the understanding of matter, energy, space and time through the study of elementary particle physics. Fermilab provides cutting edge particle accelerators and detectors to qualified researchers to conduct basic research at the frontiers of particle physics and related disciplines. Fermilab also has a vital program in particle astrophysics and cosmology linking the physics of elementary particles to the evolution and fate of the Universe. He previously served as Deputy Director of the Lawrence Berkeley National Laboratory, with primary responsibility for the scientific development of the laboratory and its representation to the agencies. Oddone received the 2005 Panofsky Award of the American Physical Society for the invention of the Asymmetric B-Factor. He is a Fellow of the American Physical Society, and was elected as Fellow of the American Academy of Arts & Sciences in 2008. While in Perú he received a doctoral degree honoris causa from the Universidad Ricardo Palma, received a medal as the Embajador Científico y Tecnológico del Peru 2010 from the Red Internacional de Ciencia y Tecnología, was made a foreign member of the Academia Nacional de Ciencias, He was elected to the National Academy of Sciences in May 2011.

**Lucio Rossi** became doctor in Physics from the University of Milan in 1980 with a thesis on plasma physics. Then he carried out its research on applied superconductivity for particle accelerators in the Physics dept. of the University of Milan, becoming Professor of Experimental Physics in 1992. His main activities have been the design and construction of Superconducting Cyclotron (5 tesla, 40 MJ coils), now operating at the INFN-LNS in Catania, I; the design of the Al-stabilized thin SC (superconducting) solenoid of the ZEUS detector (HERA at Desy, Hamburg); the development in 1998 of record  $J_c$  Nb<sub>3</sub>Sn superconductor with Europa Metall, the construction of the first prototype of the LHC 9 T magnet dipole for CERN; the development of the super-stabilized superconductor and the first 25 m long superconducting coils for the Barrel Toroid SC magnet of LHC experiment ATLAS. From 2001 he joined CERN where he led until June 2011 the Magnet, Superconductor and Cryostat Group for the LHC Project (about 1700 large superconducting magnets operating in superfluid helium). From 2009 he is Technology Department Deputy Head and from 2010 he is the leader of the High Luminosity LHC, a project aimed at increasing by a factor 10 the luminosity performance of the LHC above its nominal value. The project includes the development of 13 T High Field SC Magnets, special SC RF Cavities (crab cavities), high current (200 kA) SC links and also the R&D for 16-20 T class dipoles in view of the High Energy LHC. Member since 2000 of the International Organizing Committee of the MT conferences (chair of MT-19), he has received the IEEE Council of Superconductivity Award for sustained contribution to Applied Superconductivity in August 2007. He is author of more than

140 publications on international journals and reviews and members of various international review committees. He is active in public outreach: he is founding member from 1985 of "Euresis", an association for the promotion of scientific culture established in Milan, and he frequently gives talks to general public on science and relation between science, technology, certainty and truth.

**John Schwarz**, the Harold Brown Professor of Theoretical Physics at the California Institute of Technology, did his undergraduate studies at Harvard and his graduate studies at U.C. Berkeley. He was a junior faculty member at Princeton University before moving to Caltech in 1972. Schwarz has been a visiting professor at the École Normale Supérieure in Paris, Queen Mary College in London, the Institute for Theoretical Physics in Santa Barbara, and Rutgers University. In addition, he has been a trustee and regular summer participant at the Aspen Center for Physics. Schwarz has worked on "superstring theory" for almost his entire professional career. He has coauthored two of the standard textbooks on this subject: The first, a two-volume monograph entitled "Superstring Theory", coauthored with Michael Green and Edward Witten, was published in 1987. The second, entitled "String Theory and M-Theory: A Modern Introduction", coauthored with Katrin Becker and Melanie Becker, was published in 2007. Schwarz's honors include a Guggenheim Fellowship, a MacArthur Fellowship, the Dirac Medal of the ICTP, and the Dannie Heineman Prize in Mathematical Physics of the American Physical Society. He is a Fellow of the American Physical Society, a Member of the National Academy of Sciences, and a Fellow of the American Academy of Arts and Sciences.

**Mikhail Shaposhnikov** was born in Sochi (Russia) in 1956. He studied at Moscow State University and got his PhD from the Institute for Nuclear Research of Russian Academy of Sciences (INR RAS) in 1982. From 1982 till 1991 he was a research scientist at INR RAS. During 1991-1998 he was a staff member at CERN Theory Division, Geneva. In 1998 he moved to the University of Lausanne, where he was a director of the Institute for Theoretical Physics. Since 2003 he is a Professor at Ecole Polytechnique Federale de Lausanne, leading the Laboratory for Particle Physics and Cosmology. He worked on the problem of baryon asymmetry of the universe, on phase transitions in gauge theories at high temperatures and their cosmological applications, on alternatives to compactification, on dark matter and cosmological constant and on neutrino physics. Prof. Shaposhnikov has written over 200 publications with an overall number of citations exceeding 13'000. Awards: Academician Markov Prize, 2005. Humboldt Research Award, 2008. Gold Sakharov Medal of Russian Academy of Sciences, 2011.

**Graham Shore** is Professor of Theoretical Physics at Swansea University in the U.K. He graduated from the University of Edinburgh in 1974, where he was awarded the Tait Medal. He received his PhD from the University of Cambridge in 1978. He has held research positions at Harvard and Cornell Universities, the Universities of Bern and Geneva, and Imperial College, London, and has spent seven years as a fellow and scientific associate at CERN, Geneva. He is currently Head of the Department of Physics in the College of Science at Swansea University and formerly Deputy Head of the School of Physical Sciences. He has published over 80 papers on quantum field theory, particle physics and gravity. His best known work, in collaboration with Professor G. Veneziano, is on anomalous symmetry in gauge theories and its role in polarized QCD phenomenology, particularly deep-inelastic scattering and the 'proton spin'. He has worked extensively on quantum field theory in curved spacetime, especially on curvature-induced symmetry breaking and the realization of causality, unitarity and analyticity in theories apparently exhibiting superluminal propagation. He has served on many research council panels in the U.K., and chaired the Education and Training committee of the Particle Physics and Astronomy Research Council from 2004-06, attending PPARC Council. He was elected a Fellow of the Learned Society of Wales in 2011.

**Horst Stöcker** is the Scientific Director of the GSI Helmholtz Centre for Heavy Ion Research in Darmstadt, Germany. He grew up in Oberursel

and studied physics in Frankfurt, Germany. After his PhD in 1979 he worked as a guest scientist for several renowned institutes. He was professor at the Michigan State University and at the National Superconducting Cyclotron Laboratory, Michigan, USA, before he accepted a professorship for theoretical physics at the Goethe-University Frankfurt in 1985. Since 2004 he holds the Judah M. Eisenberg professorship. Furthermore he is Senior Fellow and member of the board of directors of the Frankfurt Institute for Advanced Studies (FIAS). For many years he was vice president of the Goethe-University. Since 2008 he is vice president of the Helmholtz Association, the major German science organization. Horst Stöcker scientific publications amount to several hundred and he is one of the most cited scientists in his field of research. His studies involve relativistic ion and elementary particle physics as well as nuclear matter, neutron stars and black holes. He is a member of many renowned national and international boards, among them a fellowship at the Institute of Physics in London, a membership of the National Academy of Science and Engineering (acatech) in Munich and a membership of the Academia Europaea in London. He holds a honorary doctorate at the Russian Academy of Sciences in Moscow and at the University of Bucharest.

**Michael J. Tannenbaum** (March 1939, New York City, NY, USA) is a Senior Physicist at Brookhaven National Laboratory, Upton, NY, USA. Education: Bronx H.S. of Science, NYC (1955); A.B., Magna Cum Laude, Columbia College, New York City (1959); M.A. Physics, Columbia Univ, NYC (1960); PhD, Physics, Columbia Univ, NYC (1965). Thesis, 'Muon-Proton Elastic scattering with BeV Momentum Transfers', Advisor: Professor Leon M. Lederman. Professional Experience: Visiting Scientist, CERN, Geneva, Switzerland (1965-6); Assistant Professor of Physics, Harvard University, Cambridge, MA (1966-9); Associate Professor, Harvard University, Cambridge, MA (1969-71); Associate Professor, The Rockefeller University, New York, NY (1971-1980); Brookhaven National Laboratory, Upton, NY (1980-); Physicist, Head Planning & Analysis, Isabelle Magnet Division (1980-1); Head Superconductor procurement & magnet lamination physics (1981-2); Physicist, Omega Group, Physics Department (1982-7); Senior Physicist, Omega Group, Physics Department (1987-91); Senior Physicist, and a founding member, PHENIX Group (1991-); Deputy Group Leader, PHENIX Group, Physics Department (1998-2001); Group Leader for Scientific Staff, PHENIX Group (2001-8). Memberships: American Physical Society (DPF, DNP), Fellow (1970); American Association for the Advancement of Science, Fellow (1988); New York Academy of Sciences. Honors and Awards: Phi Beta Kappa, Sigma Xi (1959-); NSF Predoctoral Fellowship (1959-63); Ernest Kempton Adams Travelling Fellowship (Columbia) (1965-6); National Science Foundation Postdoctoral Fellowship (1966); Alfred P. Sloan Foundation Research Fellow (at Harvard) (1967-9). Research: Elementary Particle and Relativistic Heavy Ion Physics. Achievements include measurement of the statistics of the muon; discoveries in hard-scattering of quarks and gluons; jet-quenching in collisions of nuclei at the Relativistic Heavy Ion Collider. More than 300 scientific publications. Further Information: <http://www.phenix.bnl.gov/~sapin/>

**Thomas Taylor.** A graduate of London University he focused his post-graduate research on the development of microwave tubes. This provided a sound background for working in the field of accelerator science, and he moved to CERN in 1967 to collaborate on the construction of the Intersecting Storage Rings (ISR). Following an assignment at Brookhaven National Laboratory in 1974 to transfer superconducting technology to the ISR beam optics and magnet group, he concentrated his attention on the accelerator-experiment interface, working on the development and construction of spectrometer magnets and low-beta insertions, first for the ISR and later for LEP and the LHC. Up to 2000 he led the group responsible for the superconducting magnets for the insertions and matching sections of the LHC, as well as for the correctors and current leads. He provided CERN oversight for the activity on the LHC low-beta insertions that was performed by laboratories in the US and Japan as an in-kind contribution. From 1996 until 2002 he was deputy leader of the CERN Accelerator Technology division. During the same period he chaired the Magnet Advisory Group to the LHC Committee for the experiments, and served on the

editorial board of Nuclear Instruments and Methods (section A). Over the last years he has been called upon to serve in advisory and review committees in Europe Japan, Russia and the US, and as a visiting scientist at Columbia University and at KEK. He is presently a member of the Machine Advisory Committee for the FAIR project at GSI, a member of the MICE Oversight Group at RAL, and is providing technical assistance for ITER. At CERN he takes an active interest in the operation and development of the LHC and in ongoing accelerator R&D work, in particular with regard to the application of high temperature superconductors.

**Samuel C.C. Ting** (born in Ann Arbor, Michigan, on 27 January 1936) is an American physicist who received the Nobel Prize in 1976, with Burton Richter, for discovering the subatomic  $J/\psi$  particle. He received his elementary and secondary education in China, where he excelled in mathematics, science and history. In 1956 Ting returned to the United States to attend the University of Michigan as an engineering student, but he soon transferred his major to physics. In 1959, he was awarded a BSE (in physics) and BSE (in mathematics), both from the University of Michigan and in 1962 he was awarded a Ph.D. (in physics), also from the University of Michigan. After receiving his Ph.D., Ting went to CERN as a Ford Foundation postdoctoral scholar, then joined the faculty at Columbia University where he became interested in the physics of electron-positron pair production. In the spring of 1972 Ting, then on the faculty at the Massachusetts Institute of Technology, began experiments at the Brookhaven National Laboratory in New York, again involving electron-positron pairs. In August 1974 his experiments produced a surprising reading, which Ting immediately recognized as something very different from theoretical expectations. After several months of meticulous study of his data, Ting concluded he had evidence of a new elementary particle three times heavier than a proton and much longer-lived than anything physics currently knew of (where "long life" is often measured in minute fractions of a second). By November 1974, Ting announced his discovery of what he named the "J particle". At a meeting between Ting and Richter, who in the meantime had demonstrated the existence of the "psi particle", they both realized the particles they had each discovered were the same. Their dual discoveries provided the first experimental evidence for a fourth quark, "charm", that theoretical physicists had predicted. In 1976 Ting, only 40 years old, and Richter shared the Nobel Prize in Physics. Less than two years had passed since their dual discoveries, the shortest time span from a discovery to such recognition in Nobel history. In 1995 Ting proposed the Alpha Magnetic Spectrometer, a space-borne cosmic-ray detector. The proposal was accepted and he became the principal investigator and has been directing the development since then. A prototype, *AMS-01*, was flown and tested on Space Shuttle mission STS-91 in 1998. The main mission, *AMS-02* was successfully launched on Shuttle mission STS-134 on 16 May 2011 and was installed on the International Space Station on 19 May 2011.

**Constantino Tsallis** is a physicist in the area of statistical mechanics, head of the Department of Theoretical Physics of the Centro Brasileiro de Pesquisas Físicas, in Rio de Janeiro (Ministry of Science and Technology of Brazil), and also head of the National Institute of Science and Technology for Complex Systems of Brazil. He obtained his title of Docteur d'État ès Sciences Physiques from the University of Paris-France in 1974. He has worked in a variety of theoretical subjects in the areas of critical phenomena, chaos and nonlinear dynamics, economics, cognitive psychology, immunology, population evolution, among others. Since two decades, he is focusing on the entropy and the foundations of statistical mechanics, as well as on some of their scientific and technological applications. Indeed, he proposed in 1988 a generalization of Boltzmann-Gibbs entropy and statistical mechanics. This generalization is presently being actively studied around the world: a Bibliography containing more than 3,400 directly related articles, by over 5,300 scientists from 73 countries, is available at <http://tsallis.cat.cbpf.br/biblio.htm>. Prof. Tsallis' contributions have received nearly 11,000 ISI citations (over 2,400 of them for his 1988 paper), which currently makes him one among the most cited scientists

of all times in Latin America, following the path opened one century ago by Carlos Chagas. He has received many international and national distinctions (Guggenheim Foundation Award, Mexico Prize for Science and Technology, Rio de Janeiro Prize of Science and Technology, United Nations recognition, among several others), and has been given titles of Doctor Honoris Causa by Universities from Argentina (Córdoba), Brazil (Maringá, and Natal) and Greece (the Thesaloniki Aristotelian University). He is a member of the Academy of Sciences of Brazil, as well as of the Academy of Economical, Political and Social Sciences of Brazil. He is nominated for the 2012 Aristion Thetikon Epistimon (Excellency in Exact and Natural Sciences) of the Academy of Athens, originated by Plato. He is the main editor of *Physica A* – Elsevier (Amsterdam), and has supervised close to 40 Doctor and Master Thesis. He has given regular undergraduate and graduate courses in Physics in Brazil, Argentina, USA, France and Germany, and has delivered nearly 900 invited lectures around the world. In 2005 and 2006 he did basic research at the Santa Fe Institute, New Mexico, where he co-authored several papers with the Nobel laureate Murray Gell-Mann. Prof. Tsallis is presently an External Professor of the Santa Fe Institute.

**Tejinder (Jim) Virdee** is Professor of Physics at Imperial College, London. He did his graduate studies at Imperial College on an experiment conducted at the Stanford Linear Accelerator Centre, Stanford. He has worked on an experiment studying deep inelastic Compton scattering of photons off of quarks and then on the UA1 proton-antiproton collider experiment both at CERN. The UA1 experiment discovered the W and Z bosons. After the termination of UA1 (1990), Dr. Virdee concentrated on the physics of, and experimentation at, the next generation of hadron colliders. He is one of the founding members of the Compact Muon Solenoid Collaboration (CMS) at CERN-LHC. Dr. Virdee has played a major role in all phases of the experiment. These phases have lasted around 20 years and include the formation of CMS, the definition of the physics goals, checking performance against benchmark physics reactions, detector R&D, detector prototyping, construction and installation, commissioning, data-taking and the start of the extraction of science. He pioneered some of the techniques used in its calorimeters, crucial for the measurement of the energies of electrons, photons and jets. Dr. Virdee was the Spokesperson (leader) of the CMS Collaboration for three years, between 2007 to 2009, and was the Deputy Spokesperson of CMS from 1993 to 2006. Dr. Virdee's current work involves analysis of data to search for new physics including the Higgs boson, and to consider the improvements necessary to keep the CMS experiment operating over the next two decades, at rates of proton-proton collisions some ten times higher than anticipated in the original design. Dr. Virdee was awarded the 2009 James Chadwick Medal and Prize of the U. K. Institute of Physics for his crucial role in the design and construction of CMS.

**Lucia Votano** Born in Calabria, Italy, since September 2009 Lucia Votano is the Director of INFN Gran Sasso National Laboratory (LNGS), the largest underground facility for astroparticle physics in the world. She graduated with *summa cum laude* in Physics at University 'La Sapienza' (Roma) in 1971. She became staff research scientist at ENEA Frascati Laboratory in 1975, and at INFN Frascati National Laboratory (LNF) in 1976. She was appointed as Senior Researcher in 1988 and as Research Director of Istituto Nazionale di Fisica Nucleare (INFN) in 2000. In 1977 she was designated LNF coordinator in INFN GR II Scientific Committee. In 1997 she was appointed head of LNF Scientific Information Service. From 1999 through 2004 she was Director of LNF Research Division. She has been Professor designated of General Physics at Univ. of Urbino. She has been Member of ApPec Peer Review Committee and of ASPERA Roadmap Committee. She is currently member of ASPERA Scientific Advisory Committee

**Albrecht Wagner**, Born 13.2.1941, Germany. Experimental Particle Physicist. 1984-1991 Professor of Physics at the University of Heidelberg; 1991-2006 Professor of Physics at the University of Hamburg; Former Chairman of the Board of Directors, DESY, Hamburg (1999-2009); Former Chair, International Committee for Future Accelerators (ICFA); Former Chair, European Association of National Research Facilities Laboratories (ERF); Former Vice-President of the Helmholtz Association; Chair, Supervisory Board of the University of Hamburg (since 2008); Member of the Board of Curators of the Joachim Herz Foundation, Hamburg (since 2010). Honours: Federal Cross of Merit, Germany; Honorary Doctorates of Moscow State University, University Paris-Sud, and Slovak Academy of Sciences; Honorary Professor of the Siberian Branch of the Russian Academy of Sciences and of the Henryk Niewodniczański Institut for Nuclear Physics of the Polish Academy of Sciences; Member of Hamburg Academy of Sciences and Heidelberg Academy of Sciences, Foreign Member of Russian Academy of Sciences.

**Horst Wenninger**. Ph.D. thesis work in nuclear physics at University of Heidelberg (1965); Staff member CERN, Geneva, Switzerland Big European Bubble Chamber (BEBC) Project (1968); Leader of BEBC Group at CERN (1981); Leader of Experimental Facility Division (EF) at CERN (1984); Leader of Accelerator Technology Division (AT/LHC) at CERN (1990); LHC Deputy Project Leader at CERN (1993); Research/Technical Director at CERN (1994); R&D superconducting RF cavities CERN-DESY /CERN Future (2000-3); Member of various Boards (BMBF Bonn, DESY, GSI, Julich) (since 1982); Chairman Scientific Advisory Board Helsinki Institute of Physics (1997-2000); Member of Scientific Review Group for Norwegian Research Council (2000-4); Member of Technology Panel European Physical Society (2000-8); Facility for Antiproton Ion Research, GSI (2005-11). Activities: Nuclear physics spectroscopy, bubble chamber physics, neutrino physics, LEP physics experiments, particle physics detector and accelerator R&D.

**Crispin Williams**. In 1972, Crispin Williams started his particle physics career with the study of the reaction  $\pi p \rightarrow K^0 \Lambda^0$ . Since then, he designed many devices for various experiments located throughout the world (WA11, PEP-9, PS182, AMY). He joined the LAA project at CERN in 1988 as a member of the large area detector group and developed a device known as the 'gaseous pixel detector'. Following this, he invented the multigap resistive plate chamber (MRPC) in 1996. This detector has marked a turning point in the history of Time-of-flight detectors, and has been used in the ALICE, HARP, STAR and FOPI experiments. Subsequently, he proposed using the MRPC for the Extreme Energy Events (EEE) project. The idea is to equip many Italian high schools with muon telescopes, where the detector is built by the students themselves. The students can select air showers from highly energetic particles entering the earth's atmosphere by studying the coincidence in time of muons detected by neighbouring schools. He triggered another turning point for precise time measurement with the design a fast and low power ASIC, the 'NINO', for discriminating signals. This ASIC is now becoming widely used when precise timing is needed. For many years, he has been the director of the World Laboratory program for the training of young scientists from developing nations. Up to now, fellows from Peru, Columbia, China, Korea, Russia, Belarus and Iran have come and been trained under his guidance.

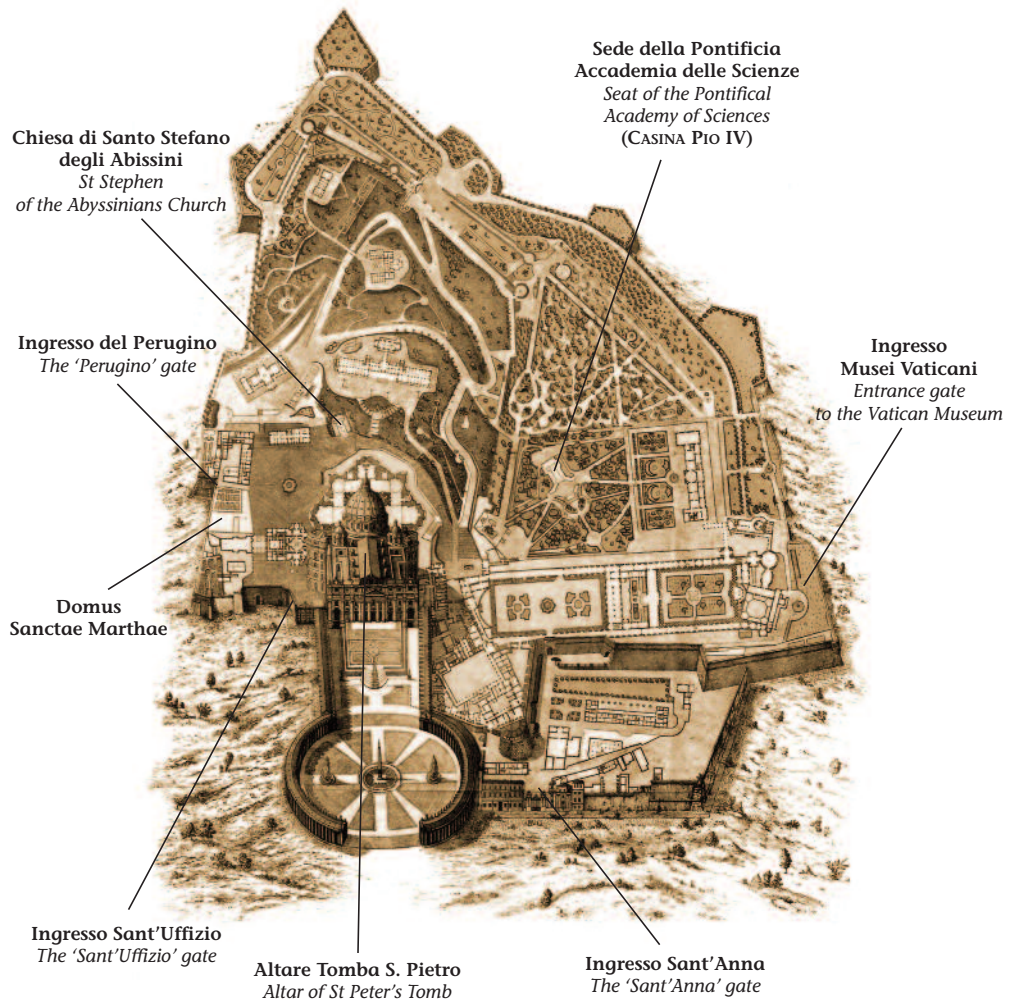
For the biographies of the Academicians of the PAS see [www.pas.va](http://www.pas.va)

## MEMORANDUM

- 1) On 30 October, 1 and 2 November a bus will leave the Domus Sanctae Marthae and the Residence Paolo VI for the Academy, 15 minutes before the beginning of the morning session (8:45 am). A bus will depart from the Academy after dinner to take participants back to the Domus Sanctae Marthae and to the Residence Paolo VI.
- 2) On Sunday 30 October a bus will leave the Casina Pio IV at 19:30 to drive the participants to the State Basilica S. Maria degli Angeli e dei Martiri and back after the events, at about 10:30 pm.
- 4) Lunch and dinner for the participants will be served at the Academy from 30 October to 2 November, except dinner on Sunday 30 October (served at the State Basilica S. Maria degli Angeli e dei Martiri).
- 5) Holy Mass in the Academy's Private Chapel will be celebrated at 8:15 am on Tuesday 1 November. A bus will be available for those who wish to attend, leaving the Domus Sanctae Marthae and the Residence Paolo VI 15 minutes before.
- 6) On Monday 31 October we have arranged a private visit to the Vatican Museums. A shuttle bus service will be available at the Casina Pio IV at 5:45 pm.

### Note

Please give your **form for the refunding of expenses** to the secretariat at least one day before your departure so that you can be refunded immediately.



THE PONTIFICAL ACADEMY OF SCIENCES • CASINA PIO IV • V-00120 VATICAN CITY  
Tel: +39 0669883451 • Fax: +39 0669885218 • pas@pas.va • www.pas.va