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NEWS BULLETIN

SPRING 2004 EDITION

Letter From IUPAP President Yves Petroff

I am presenting here a rather long summary of the Vancouver Council and Commission Chairs Meeting to show the large variety of topics that IUPAP has to deal with. Complete minutes with attachments can be found at <http://www.iupap.org/03minutes-canada.html>. At the meeting, I asked the commissions to review their activity and see whether we need any changes in the structure or emphasis of Commissions. Do we need new commissions? How do we integrate new emerging fields, such as nanoscience and the merging of atomic and solid state physics with the production of cold atoms? If you have any ideas of these topics, please send them to the IUPAP Secretariat at beamon@aps.org.

In the same spirit, I asked the chairs of the commissions to send us short contributions on the exciting developments in their fields during the year 2003. To avoid making the newsletter too long, we have decided to publish about half of the contributions; the other half will contribute next year.

A few months ago, Elisa Molinari resigned her position as Associate Secretary General for personal reasons. To help us, Robert Barber has accepted to serve as Interim Associate Secretary General. He can be reached at barber@physics.umanitoba.ca.

At the General Assembly in Berlin(2002), we decided to move from the Swiss franc to the Euro as the official currency for IUPAP dues. Due to large variations in the exchange rate during the last 2 years, we recognize and regret that some delegations could have to deal with a increase of 15-20 % in their membership dues.

IUPAP Council & Commission Chairs Meeting, Vancouver, Canada October 10-11, 2003

1. Report from the President

Petroff reported on key issues that emerged since the previous meeting:

- (i) Activity of the working groups. (See below)
- (ii) Visibility of IUPAP. Some actions are needed: (ii.1) Improve the website and keep it updated: Commissions are invited to send input; (ii.2) Ask national societies (possibly through liaison committees) to include a link to the IUPAP website in their websites; (ii.3) Ask Commissions and conference organizers to make sure that IUPAP is briefly presented at the beginning of the IUPAP sponsored Conferences;
- (iii) Commissions: it may be time to review their activity and see whether we need any change in the structure or emphasis of Commissions (if so, decisions could be made at the General Assembly); the Chairs of the Commissions are asked to send in put on this point.

2. Business matters

A. Financial report

Franz reviewed the 2003 Operating Budget and presented a proposal for the 2004 Operating Budget.

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Business matters,
continued from page 1

B. Member affairs

Franz informed the group that Senegal had joined IUPAP and paid its dues.

C. Selection of Gruber Prize Committee representative

Franz reminded that IUPAP was asked to nominate a member of the Gruber Prize Committee, which is a very important prize in cosmology. The recommendation of Prof. Simon White (Garching, Munich) to replace Virginia Trimble was received favorably.

3. Reports from the Commissions

The following issues proposed by Commissions lead to actions proposed for approval by the Council:

(i) **C2** Unified atomic mass unit. The Chair of C2-SUNAMCO, Sharma, reported that it has been suggested that the name and symbol of the “unified atomic mass unit” (abbreviation: u) be replaced with the name and symbol “dalton” (abbreviation: Da). SUNAMCO suggests that IUPAP endorse the use of both names and strongly recommends waiting for an extended period to see which name physicists and others prefer to use before making any further decision. It was proposed to accept the recommendation of SUNAMCO.

(ii) **C8** IUPAP Young Investigator Awards. The Chair of C8, Skolnick, reported that the fund for these Awards, that is managed by C8, has increased because the organizers of the previous International Conference for the Physics of Semiconductors (ICPS) held in Edinburgh could support the prizes within the conference budget. The intention of C8 is to take advantage of this to increase the number of Awards distributed at the next ICPS.

(iii) **C10** Working Group on Facilities in Condensed Matter. In the discussion, it was pointed out that the importance of IUPAP in high-energy physics is largely due to the activities of the working groups on facilities: it is desirable to do the same in condensed matter physics. The working group should be one of the main thrusts of C10. Petroff and Franz suggested advising the working group to focus on a report on High-Magnetic Field facilities.

(iv) **C12** Activities on International Collaborations. Nagamiya reported that C12 discussed the need of an International Working group on International Collaborations. This would differ from ICFA because it would concentrate on collaborations between existing facilities rather than new facilities. For the moment it is proposed as an internal activity of C12, but it could become a more formal IUPAP Working group.

(v) **C13** Participation from Developing Countries. The Chair of C13, Zingu, pointed out that C13 does not include enough members from developing countries. Franz proposed that Associate members could be added to solve this problem. C13 will have a liaison from each of the other commissions.

(vi) **C14** “Physics Now”. Tibell reported that “Physics Now” is ready: it is the new edition of “Physics 2000”, edited by Jon Ogborn with contributions from Commission Chairs. It will be an official IUPAP Publication with support to print it as a book. It is a collection of articles for non-specialists, discussing recent developments and the current state of the art in the major areas of physics as represented by the various IUPAP Commissions. This book is available for downloading from the following web site:

<http://web.phys.ksu.edu/icpe/Publications/PhysicsNowText-A4.pdf>

4. Discussion of associate members of Commissions

Franz reported the names of the new Associate Members proposed by the Commissions.

5. Proposal of a working group on medical physics

Franz reported on a proposal was initiate the formation of a new IUPAP Commission of Medical Physics. It was

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Officers of IUPAP

Yves Petroff, *President*

Alan Astbury, *President Designate*

Burton Richter, *Past President*

Judy Franz, *Secretary General*

Robert Barber, *Interim Associate Secretary General*

Proposal of a working group on medical physics, *continued from page 2*

recommended that the Council approve a small committee for this purpose.

6. Discussion and approval of conferences

Molinari mentioned that a general problem is that some conference proposals are not explicit about how they fulfill the criteria for sponsorship. The main critical aspects concern:

- (i) fee limit;
- (ii) diversity and participation of women in committees;
- (iii) underestimation of free circulation of scientists and Visa problems;
- (iv) proceedings.

Concerning proceedings, it was pointed out that on-line publication would be important to enhance access and reduce costs. Richter proposed that IUPAP should set up a web site to host proceedings. It was suggested that Tata Institute or other institutions in developing countries might be instrumental in helping to set up such web site in an efficient and cost-effective way. It was agreed that this or other possibilities will be explored before the next meeting.

7. New working group “International Committee on Ultrahigh Intensity Lasers”

Barty summarized key issues in the physics of ultrahigh intensity laser-matter interactions reminded the group of the proposal that had been approved at the previous meeting, to set up a new working group. In the last few months there have been intensive activities and contacts, which have led to finalize the proposed composition of the Working Group. The working group will have C16 as its major liaison to IUPAP and will interact strongly with C15 and C17. It was agreed that the proposal should be accepted, with the Chair of C16 as a statutory member, who will act as liaison to the Council.

8. Nanoscience

Molinari recalled that at the previous meeting the importance of nanoscience for IUPAP had been noted, and she had been invited to coordinate a small group of people to review the situation and suggest actions. The group asked each Commission to provide the information on how nanoscience affected its area.

As a result of the group discussion, Molinari proposed the following actions:

- (i) to strengthen nanoscience conferences within each Commission and encourage collaborations among commissions;
- (ii) to prepare a new section of the IUPAP Website (Nano@IUPAP) containing the Commissions' reports and other information about IUPAP activities in the nanosciences;
- (iii) to organize an International Conference on “Physics in the Nanosciences” within the 2005 World Year of Physics: the steering committee will involve representatives of Commissions; the meeting is provisionally planned to take place in Dublin;
- (iv) explore existing conference series in nanoscience and possibly ‘adopt’ one or more in the next years.

9. Ethics

Petroff reemphasized the need for an IUPAP contribution to the discussion on ethics and scientific misconduct in physics. He mentioned the IUPAP workshop on “Scientific Misconduct and the Role of Physics Journals in its Investigation and Prevention” that would take place on October 13-14, 2003. He proposed that, after the discussion in the meeting, an IUPAP statement on Ethics should be written.

[Note: The meeting took place at the Institute of Physics in London. It was organized by Roger Elliott, the incoming chair of the IUPAP working group on Communica-

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CONTACT INFORMATION FOR THE IUPAP SECRETARIAT:

**Jacquelyn Beamon-Kiene,
IUPAP Administrator
(Beamon@aps.org)**

c/o AMERICAN PHYSICAL SOCIETY
ONE PHYSICS ELLIPSE
COLLEGE PARK, MD 20740
(301) 209-3269 Phone
(301) 209-0865 Fax
www.iupap.org

Ethics.

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tions in Physics and Marty Blume (APS). In his introduction, Blume pointed out that misconduct in scientific publications is not new but public interest in it is. He hoped that the workshop discussion would form a basis for a document that IUPAP would be willing to adopt, outlining the responsibilities of the various parties involved in the physics research and publication enterprise. During the 2 days meeting various topics were discussed: plagiarism, duplicate submission/publication, authorship, responsibility of institutions, responsibility of journals to one another, referee misconduct, different international views of misconduct, possible punishment of offenders. The recommendations will be submitted at the next Council in October.]

10. Physics in Canada

Petroff invited two guests from the Canadian physics community to present talks on the situation and perspectives of physics in Canada. Dr. Poutissou presented a talk on "TRIUMF's and Canada's Subatomic Physics program: present and future" and Dr. Mark Freeman (U. Alberta) spoke about "Condensed Matter Physics in Canada".

11. World Year of Physics

Petroff mentioned the discussion within UNESCO on the 2005 World Year of Physics, and expressed hope that the approval would be finally awarded. Meanwhile the organization of activities for the World Year of Physics is continuing. Most of the activities will be at the national level. Franz presented a proposal for a major event entitled "World Conference on Physics and Sustainable Development" (WCPSD), which was prepared in collaboration with Zingu. The goal is to convince the governments all over the world, and especially in the developing world, that physics and science education are a priority. The Conference had already gained preliminary approval from UNESCO and ICTP. The conference is planned to take place in Durban, South Africa, in October 2005 in connection with the General Assembly. After extensive discussion on the scope, possible attendance and key topics of the meeting the proposal was approved.

All the IUPAP scientists are strongly encouraged to be involved in national events. In addition to the World

Conference, specific IUPAP activities will include an international two-day Conference to inaugurate the year is planned at UNESCO's headquarters in Paris in January 2005. Prominent lecturers, including some Nobel prize winners, will speak eloquently on the role of physics in society, the influence of Einstein in science in the 20th and 21st centuries, the interactions between physics and other disciplines, and the problems inherent to its teaching. Invitations will be issued to numerous personalities from the scientific world and to those who determine teaching and research policies in various countries. In addition, it is planned to attract ardent young science fans, notably the laureates of the Physics' Olympics.

12. Plans for IUPAP General Assembly

Franz and Zingu introduced the proposal to hold the General Assembly in South Africa.

13. US visa concerns

Petroff reported very serious concerns about the situation of US Visas and the major problems that are arising for the free circulation of scientists and the international character of conferences. Vera Luth presented a detailed report on the new procedures that were enforced for US visa applications and the impact that they had on the attendance at the International Symposium on Lepton-Photon interactions. Petroff reported about a letter sent by Prof. J. Dorfan (Chair of ICFA) pointing out that the situation is more general and concerns not only access to conferences, but also to international collaborative activities and large scale facilities. Molinari mentioned that other Conference organizers reported problems in the attendance of foreign scientists working in the US to Conferences held outside the US, owing to worries about re-entry visas. After extensive discussion, the group decided that IUPAP would not guarantee approval to any future Conference in the US unless the situation changes. This will also be true for other countries if similar situations should appear. The following actions were proposed:

- A. to prepare an official motion and send it to ICSU requesting the take action;
- B. to write to the science advisor at the US State Department, with copy to the National Academy of Sciences, and to other US and international bodies to inform them about the situation and the very serious implications for the development of science.

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US visa concerns,
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C. to include information on the situation on the IUPAP website, together with practical recommendations in order to help Conference organizers and individual scientists in facing this situation.

[Note: Petroff sent (03/12/2003) this letter to Dr John Marburger, Science Advisor to the US President with a copy to the science advisor at the US State Department. As yet, we have not received an answer.]

14. Reports from Working Groups

For a list of all of the IUPAP Working Groups and information about their members and activities; please see

<http://www.iupap.org/working.html>.

Lüth reported on the International Committee for Future Accelerators (ICFA).

Franz reported on the Working Group on Women in Physics. After the Paris conferences three projects are being carried out:

- (i) maintaining a very lively website;
- (ii) awarding travel grants to facilitate the participation of women from developing countries to conferences (2 competitions were held, each with grants to 20 women, using resources that remained from the Paris conference, a small grant from UNESCO, a small grant from L'OREAL and a small personal anonymous grant);
- (iii) working on a proposal for a Network of Women Physicists in Africa.

15. ICSU matters

Petroff, Richter and Franz reported on different aspects of ICSU activities.

- (i) Emerging issues. Petroff reported on the ICSU enquiry on emerging issues. IUPAP contributed by pointing out some important issues: Investment in Basic and Applied Sciences, Nanotechnology, Energy; other relevant issues were brought by other members.
- (ii) World Summit on the Information Society—the Scientific Input. Petroff and Richter reported about the World Science Information Society Summit that will take place in Geneva in December 2003, and the work that was made in preparation of this

meeting. The 'Principles and recommendations' elaborated in a joint preparatory meeting by ICSU, Codata and UNESCO can be found at www.icsu.org;

- (iii) ICSU Unions' Meeting. Petroff reported about the draft agenda of the February meeting, which Petroff and Astbury will attend. It is important to identify what IUPAP would like to obtain from ICSU and vice-versa. Richter pointed out that ICSU must recognize and emphasize that unions are those who have real connections to the scientific communities;
- (iv) ICSU Executive Board. Richter reported on the activity of the Board and the role that physicists can now have on topics like energy and environment, basic science;
- (v) ICSU Executive Board. Richter reported on the activity of the Board and the role that physicists can now have on topics like energy and environment, basic science.

16. Report on Claims for Discovery of Elements

Petroff summarized the detailed report of the IUPAC/IUPAP Joint Working Party on the claims for discovery of elements 110, 111, 112, 114, 116, and 118. This committee determined that the claim by Hoffmann concerning element 110 (proposed name: Darmstadtium) and element 111 fulfilled the criteria, but more data are needed before a conclusive statement on the other elements. Petroff suggested to endorse the proposal of the committee, which was then unanimously approved.

17. Science Education and ICTP

Franz mentioned a very preliminary draft proposal that is currently being discussed at UNESCO on science education and a possible institution to be started in Trieste. The existing Trieste institutions including ICTP could offer the location. The goal would be to train people who teach teachers. Franz mentioned that a possible pilot program of 1-month courses could start: IUPAP could propose to start with physics because of the background that already exists in Trieste. It was agreed to follow the future developments and possibly contribute with ideas for pilot initiatives.

18. New business

The next meeting will be held in India on 15-16 October 2004. The next General Assembly will be on 25-28 October 2005 in South Africa.

News From The Commission

C4: COMMISSION ON COSMIC RAYS

(K. P. WENZEL)

Cosmic-ray physics, in both its dual aspects of non-accelerator particle physics and particle astronomy, is continuing to make significant contributions to our understanding of the universe. Probably the most important contribution to particle physics in recent years has been the discovery of the phenomenon of neutrino oscillations, i.e. the transformation of a type (or flavour) of neutrinos into another. Using natural fluxes of neutrinos, these transitions have been observed, both for solar neutrinos, produced in thermonuclear reactions inside the Sun, and for atmospheric neutrinos, produced in cosmic-ray interactions in the Earth's atmosphere. The results obtained give important constraints on the neutrino masses; the average mass is determined to be larger than a lower bound of 15 milli-electronvolts (meV). Within the last year, the results on the flavour transitions have been confirmed in studies using man-made neutrinos and identified the exact mechanism. Two pioneers of neutrino detection, Ray Davis and Masatoshi Koshiba, were among the 2002 Physics Nobel Laureates.

The last decade has seen a remarkable technological breakthrough with the introduction of sophisticated imaging systems on optical telescopes, which register the Cherenkov light from air showers due to cosmic gamma rays. This has led to a new field of TeV gamma-ray astronomy. Following the initial discovery from the Crab Nebula, TeV emission from several galactic sources has been detected, most importantly from three shell-type supernova remnants (SN1006, RX J1713-3946, and Cassiopeia A). In addition, one has found strong and rapidly varying emission from two nearby blazars, thought to be galaxies with active nuclei (powered by accretion onto a central, super-massive black hole). During outbursts the power registered in the TeV region from these objects exceeds that at all other wavelengths. Full understanding of the origin of this TeV emission may be a key to finding out whether supernova remnants are indeed the sources of the bulk of the cosmic rays. For more complete report from C4, please see (www.iupap.org/news-items.html).

C5: COMMISSION ON LOW TEMPERATURE PHYSICS (H. FUKUYAMA)

The greatest news not only in C5 but also in various area of condensed matter physics is that the 2003 Nobel Prize

in Physics has been awarded to Alexei A. Abrikosov, Vitaly L. Ginzburg and Anthony J. Leggett for their pioneering theoretical contributions to the understanding of superconductivity and superfluidity. Ginzburg proposed with Landau the GL phenomenological theory for superconductivity several years before the microscopic theory of Bardeen, Cooper and Schrieffer (BCS). This theoretical framework called GL theory is now the basis for phenomenological description of phase transition in solids in most cases. Abrikosov found the possibility of the vortex structure in superconductors in the presence of magnetic field based on this GL theory, which is an important feature of superconductors especially in the application. Leggett developed a theory of Nuclear Magnetic Resonance (NMR) for superfluid He3 leading to the clear identification of the spin-triplet state in contrast to the singlet state considered in the original paper by BCS. The triplet superconductivity is now observed in metals also.

By now there are many examples of realization of BEC (Bose-Einstein Condensation) in atoms. Last year the 8-th in the series but a new type with spin-singlet state has been observed on Yb atoms, which might open ways to very precise atomic clocks and optical frequency standard on one hand and studies for possible violation of time-reversal symmetry and parity on the other hand. For more complete report from C5, please see (www.iupap.org/news-items.html).

C11-COMMISSION ON PARTICLE PHYSICS AND FIELDS (V. LÜTH)

The principal goals of particle physics have been and will be precision tests of and searches for deviations from the well established theory of electroweak and strong interactions. Though this standard model has worked extremely well up to now it fails to explain particle masses and it predicts nonsensical results at energies slightly higher than currently available. A mechanism which gives mass to the particles requires the existence of a new particle, the Higgs boson. Beyond that, new concepts are being proposed: supersymmetry and string theories might not only overcome the break down of the standard model, but also lead to a unification of all fundamental interactions, including gravity.

In recent years, the most important results have come from neutrino experiments, primarily SuperKamiokande in Japan and the Sudbury Neutrino Observatory in Canada.

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C11-Commission on particle physics and fields **(V. LÜTH)**

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There is clear evidence that neutrinos from several generations undergo quantum mechanical mixing and therefore neutrinos are not massless. The solar neutrino problem, i.e. the observation that only about one third of the neutrinos produced by solar fusion survive as electron-type, is now understood, both in terms of experimental observation and predictions of the model for fusion reactions at the core of the sun. Future neutrino experiments using large volumes of sea water or Antarctic ice as detectors for atmospheric or cosmological neutrinos as well as detectors placed at various distances from accelerators or reactors will further explore the nature of these elusive particles. For more complete report from C11, please see (www.iupap.org/news-items.html).

C12: COMMISSION ON NUCLEAR PHYSICS **(W. T. H. VAN OERS)**

Two-proton Decay. Starting with a stable nucleus and increasing either the number of neutrons or the number of protons will result in instability. For the lighter proton rich nuclei with an odd number of protons, proton emission was observed for the first time in the 1980s. According to theoretical predictions, simultaneous two-proton emission should occur for nuclei with an even number of protons. Such a decay is only observable if sequential emission of two protons is energetically forbidden. Simultaneous two-proton decay has recently been observed in the decay of iron-45 at two laboratories:—at GSI (Darmstadt, Germany) and at GANIL (Caen, France).

The Quest for the Superheavy Elements. Elements heavier than uranium (with 92 protons) are not found in nature. The shell model of the nucleus reproduces the so called magic numbers of protons and neutrons for which nuclei become significantly more stable. A recent report has detailed the discovery of four atoms of the element with 115 protons at the Joint Institute for Nuclear Research (JINR). The four atoms were created by bombarding americium-243 with a beam of calcium-48 ions at an energy of 248 MeV. In previous experiments the same experimental group also has reported evidence for elements 114 and 116. If confirmed independently, these results give great weight to the existence of the island of stability at the (man-made) end of the periodic table.

The Spin of the Nucleon. The nucleon consists of three so called valence quarks (two 'up' quarks and a 'down' quark for the proton and the reverse for the neutron), fleetingly existing quark-antiquark pairs through creation and subsequent annihilation, and gluons responsible for the strong interaction. The nucleon carries a spin 1/2. In principle there are contributions to the spin of the nucleon from the quarks (fermions), the gluons (bosons), and the orbital angular momenta involved. A Jefferson Laboratory experiment studied the contributions of the valence quarks to the neutron's spin. Combining these data with existing proton data, it was found that the nucleon's two like valence quarks have their spins aligned parallel to the overall nucleon spin, but the same cannot be stated for the nucleon's valence unlike quark.

The Pentaquark. In nature there appear to exist only colorless three quark systems (the nucleons) and colorless quark-antiquark systems (the mesons). In principle six quark systems could also exist. But so far one has been able only to establish upper limits. There existed a similar situation with regard to the five quark systems consisting of three quarks plus a quark-antiquark pair. However, after some 30 years of research there are now observations made in at least five different experiments of an unusual particle composed of five quarks, a 'pentaquark'. please see (www.iupap.org/news-items.html).

C19-COMMISSION ON ASTROPHYSICS **(V. TRIMBLE)**

Astrophysics ranges from the moon to the most distant reaches of the universe, and the advances of even one year defy condensation. For details of the following items, and more than 100 others, please take a look at V. Trimble & M. Aschwanden "Astrophysics in 2003", Publications of the Astronomical Society of the Pacific, 116, 187-205 (2004)

Cosmology (the large scale structure and evolution of the universe. Results from the Wilkinson Microwave Anisotropy Probe have reinforced previous understanding of the inventory of the universe. It is about 4% baryons (like us), 0.5% neutrinos, 23% dark matter, and 73% dark energy (with positive energy density but negative pressure). There are several well-motivated candidates for the dark matter, including axions and WIMPS but no compelling candidates for the dark energy. A new item from WMAP is that stars and quasars began to reionize the universe as early as a redshift of 20.

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C19-Commission on Astrophysics (V. Trimble),
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Extra-solar-system planets. A decade ago there were none. Now there are more than 100, most found because they impose small fluctuations on the measured radial velocities of their host stars. All have masses close to that of Jupiter and shortish orbit periods (both observational selection effects). A new discovery process, when a star with a planet gravitationally lenses a background star, has just scored its first success. This technique can be pushed to reveal planets as small as earth without having to leave home. For more complete report from C19, please see (www.iupap.org/news-items.html)

C20-COMMISSION ON COMPUTATIONAL PHYSICS (T. TAKADA)

GRID is expected to be a new HPC environment for simulations, since GRID provides us with computational resources just by plugging PCs in the internet. This will definitely change our styles of computations and programming.

To realize such simulations, structures of codes need to be changed from SPMD (Single Program Multiple Data) to MPMD (Multiple Program Multiple Data) which are more suitable to the GRID architectures. That is, component oriented architecture by hybridizing those units is a key for it. At GGF (Global Grid Forum: <http://www.ggf.org/>), interfaces for grid computing have been discussed for Particle and Nuclear Physics, Astronomy, Life Science and so on. There are many activities and national projects to utilize GRID for fundamental and industrial researches such as TERAGRID (<http://www.teragrid.org/>), EuroGrid (<http://www.eurogrid.org/>), DataGrid (<http://eu-datagrid.web.cern.ch/eu-datagrid/>) and e-science (<http://www.escience-grid.org.uk/>). These projects seem to lead each simulation scheme to so called multi scale

simulations in which natural phenomena are analyzed from both microscopic and macroscopic points of view. This is a present goal of computational physics.

AC.2 INTERNATIONAL COMMISSION ON GENERAL RELATIVITY AND GRAVITATION (R. WALD)

2003 was a watershed year for cosmology and for gravitational physics. In a development designated by Science magazine as “breakthrough of the year”, NASA reported on the first year of operation of its satellite WMAP (Wilkinson Microwave Anisotropy Project). The cosmic microwave radiation exhibits very small variations of its temperature with angle in the sky, a signature of sound waves at the recombination epoch when the universe was just 400,000 years old. Analysis of these fluctuations, which are being measured with exquisite precision by WMAP, allows accurate estimation of basic cosmological parameters. Further refinements will come with the launch of ESA’s satellite Planck in 2006.

The results, which confirm and sharpen previous high-altitude balloon measurements, mark the coming of age of cosmology as a precision science. They reveal a universe which is 13.7 billion years old, spatially flat, and comprised by 4% ordinary (baryonic) matter, 23% exotic dark matter (exact nature still unknown), and—most mysteriously—73% so-called dark energy that is uniformly distributed (i.e., not clustered with galaxies) and characterized by negative pressure, which produces a speed-up in the Hubble expansion. The speed-up of the Hubble expansion accords with evidence from observations of distant type Ia supernovae.

This picture differs radically from what would have thought credible only a decade ago, and has sent theorists scrambling for explanations, so far without notable success. For more complete report from AC.2, please see (www.iupap.org/news-items.html)