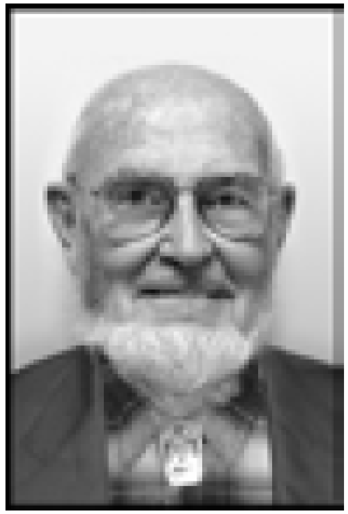
HIGHLIGHTS FROM PAC05

Knoxville, Tennessee, USA, May 16-20, 2005

Elias Métral

ACCELERATOR PRIZES (1/4)

- **2005 APS Robert R. Wilson Prize**



Awarded to: **Keith Randolph Symon,** University of Wisconsin

"For fundamental contributions to accelerator science including the FFAG concept and the invention of the RF phase manipulation technique that was essential to the success of the ISR and all subsequent hadron colliders."

- **APS Award for Outstanding Doctoral Thesis Research in Beam Physics**

Awarded to: **Dr. Eduard Pozdeyev**, Thomas Jefferson National Accelerator Facility/ Michigan State University

"For pioneering research on space charge effects of beams in the isochronous regime, including simulations and experimental verification following the design and construction of the Small Isochronous Ring."

ACCELERATOR PRIZES (2/4)

- **IEEE NPSS Particle Accelerator Science and Technology Award**

Awarded to: **Ronald Davidson**, Plasma Physics Laboratory, Princeton University

"For pioneering contributions to the theory of charged particle beams with intense self fields, including fundamental studies of nonlinear dynamics and collective processes."

Awarded to: **Thomas Roser**, Brookhaven National Laboratory

"For pioneering scientific work and introduction of new technology in the acceleration, storage and collision of polarized protons in the high energy collider RHIC."

ACCELERATOR PRIZES (3/4)

- **U.S. Particle Accelerator Scholl Prize for Achievement in Accelerator Physics and Technology**

Awarded to: **Wim Leemans**, Lawrence Berkeley National Laboratory

"For his contributions to the developments of laser wakefield accelerators, in particular the guiding of high-intensity laser beams and acceleration to high-energy of high-quality electron beams."

Awarded to: **Anton Piwinski**, Deutsches Elektronen Synchrotron

"For his fundamental contribution to the understanding of charged particle beams in circular accelerators, in particular of intra-beam scattering, beam-beam effects and synchro-betatron resonances."

ACCELERATOR PRIZES (4/4)

- **Newly Elected APS/DPB Fellows**

$\Longrightarrow$ **Several people and…**

Frank Zimmermann, European Organization for Nuclear Research

"For many theoretical and experimental contributions to accelerator physics including the study of beam-ion and beam-electron cloud interactions, collective instabilities, nonlinear optics, and beam measurements."

SPECIAL SESSION ON WEDNESDAY (1/3)

Oral Session WOPB–Special Session: Einstein and the World Year of Physics,
Ballrooms D-G @ 15:00
Chair: W. Madia (Battelle)

15:00 Introduction: Einstein's Legacy in Charged Particle Acceleration
S. Chattopadhyay (JLab)

15:15 WOPB001—Einstein and Cosmic Acceleration
Michael Turner (NSF)

15:55 WOPB002—Symmetries and Einstein
Makoto Kobayashi (KEK)
After brief survey of influence of Einstein on current particle physics, fundamental symmetry between particles and antipaticles will be discussed. Existence of antiparticles is an important outcome of special relativity and quantum mechanics and disappearance of antiparticles from the present universe is one of the mysteries in Big Bang cosmology based on the Einstein equation. Remarkable progress has been made recently in the studies on the violation of symmetry between particles and antiparticles with the use of a new type of accelerator. Some of their achievements will be reported.

SPECIAL SESSION ON WEDNESDAY (2/3)

16:35 WOPB003—Neutrinos and Einstein
Yoichiro Suzuki (Univ. of Tokyo)
A tiny neutrino mass is a clue to the physics beyond the standard model of elementary particle physics. The primary cosmic rays, mostly protons, are created and accelerated to the relativistic energy in supernova remnants. They traverse the universe and reach the earth. The incoming primary cosmic rays interact with the earth's atmosphere to produce secondary particles, which subsequently decay into neutrinos, called atmospheric neutrinos. The atmospheric neutrinos have shown the evidence of the finite neutrino masses through the phenomena called neutrino oscillations. Neutrinos are detected by large detectors underground like, for example, Super-Kamiokande, SNO and KamLAND. Those detectors use large photomultiplier tubes, which make use of the photo-electric effect to convert photons created by the interaction of neutrinos to electrons to form electric pulses.

There has been a revolution in the last decade in neutrino physics (long way since Pauli predicted in 1932 that neutrinos will never be seen!)

SPECIAL SESSION ON WEDNESDAY (3/3)

Neutrinos are therefore created and detected by "Einstein" and have step forward beyond the current physics. Neutrinos may also carry a hit to the origin of the dark energy, the Einstein's Cosmological Constant.

17:15 WOPB004—The Quest for Dark Matter
Carlo Rubbia (CERN)
Recent experiments have brought for the first time under a strong experimental basis that the total density of the Universe is Ũ$_{o}$ = 1.02 ± 0.02. We have for the first time a cosmic agreement, namely matter density Ù$_{i}$ = 0.27 ± 0.04 and dark energy density Ù$_{Ë}$ = 0.73 ± 0.04 add up precisely to Ù$_{o}$ ≈ Ù$_{i}$ + Ù$_{Ë}$. On the other hand ordinary hadronic matter (quarks and leptons) determined by the Big Bang Nucleo-synthesis (BBN) is also firmly set to Ù$_{BBN}$ = 0.044 ± 0.004. About 100 years after Einstein's birth we know *experimentally* the identity of less than 5% of what the Universe is made of, the remaining > 95% escaping to us completely. An enormous effort is being made at LHC in order to discover SUSY particles. SUSY is an "almost necessity" of elementary particle physics. The fact that such particles may also account for the observed non baryonic dark matter is either a big coincidence or a big hint. If such SUSY particles indeed exist, they must have been produced abundantly at the time of the Big Bang and should be detectable underground as some form of Cold Dark Matter (CDM). Indeed one of the main hopes of SUSY is to become the key to the CDM problem: this cannot be achieved unless some kind of relic neutral particles exists (WIMP). Therefore the a priori chance of detecting SUSY underground at the LNGS first should not be underestimated. We should also remark that SUSY is only one of the many candidates for WIMP: other kinds of massive relic particles may exist, which may have weak-like interaction properties and therefore detectable underground.

I. Hofmann, Benchmark for Montague Resonance

- **New experiments to be done at CERN PS**
  - **Octupole OFF $\Longrightarrow$ Already done**
  - **Octupole ON $\Longrightarrow$ Positive and negative values, which enhances and cancels (for a certain moment and then very fast equalization) the effect of SC**
  - **Dynamic crossing data from 2003 are for 40 000 turns $\Longrightarrow$ We should repeat this experiment in 10 000 turns (it will then be easier to compare to simulations)**

M. Blaskiewicz, Stochastic cooling for bunched beams

- For ion beams in RHIC, stochastic cooling is feasible (coherent signals are understood and can be dealt with)

W. Nazarewicz, Science of Rare Isotope Accelerator (RIA) and the Project Status

- **Will open a new window in the femtosecond world (The heart of the project is a superpowerful proton linac, with a cost of ~1000M$)**