XXXIII Symposium on Nuclear Physics

Hacienda Cocoyoc, Morelos, México
January 5-8, 2010

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In the present volume of *Journal of Physics: Conference Series* we publish the proceedings of the “XXXIII Symposium on Nuclear Physics”, that was held from January 5-8, 2010 at the Hacienda Cocoyoc, Morelos, Mexico. The proceedings contain the plenary talks that were presented during the conference. The abstracts of all contributions, plenary talks and posters, were published in the Conference Handbook.

The Symposium on Nuclear Physics has a long and distinguished history. From the beginning it was intended to be a relatively small meeting designed to bring together some of the leading nuclear scientists in the field. Its most distinctive feature is to provide a forum for specialists in different areas of nuclear physics, both theorists and experimentalists, students, postdocs and senior scientists, in a relaxed and informal environment providing them with a unique opportunity to exchange ideas. After the first meeting in Oaxtepec in 1978, the Symposium was organized every year without interruption which makes the present one the 33rd in a row.

This year’s meeting was dedicated to the memory of Marcos Moshinsky, who passed away on April 1, 2009. Dr. Moshinsky was the most distinguished pioneer and promoter of nuclear physics in Mexico and Latin America and holds the record of 31 (out of 32) participations at the Symposium. In the inaugural session, Alejandro Frank (ICN-UNAM), Peter Hess (ICN-UNAM) and Jorge Flores (IF-UNAM) spoke in his honor and recalled the virtues that characterized him as a teacher, scientist, founder of schools and academic institutions, colleague and friend. His generosity, excellence and honesty were emphasized as the personal qualities that characterized both his personal and academic life.

Marcos Moshinsky (1921-2009)
The scientific program consisted of 26 invited talks and 20 posters on a wide variety of hot topics in contemporary nuclear physics, ranging from the traditional fields of nuclear structure and reactions to radioactive beams, nuclear astrophysics, hadronic physics, fundamental symmetries, ultrarelativistic heavy ions, cosmic rays and quantum chaos. The high quality of the talks, the prestige of the speakers and the broad spectrum of subjects covered in the meeting, shows that nuclear physics is a very active area at the frontier of scientific research which establishes bridges between many different disciplines.

One of the exciting new areas in nuclear physics is that of radioactive beams. It provides a powerful tool not only to study exotic nuclei close to the proton and neutron drip lines to obtain important information about the nature of the nucleon-nucleon interaction in stable and unstable nuclei, but also to address questions of fundamental importance in nuclear astrophysics as well as in various applications like mass spectroscopy, the production of radioactive isotopes and medical applications (Galindo-Uribarri). There was a presentation on the FRIB project which is currently under construction in the USA and its relevance for nuclear astrophysics and the limits of stability (Sherrill and Schatz). In the session on nuclear structure, there were several talks on the nucleon-nucleon interaction in nuclei close to the proton and neutron drip lines, like neutron-proton pairing in nuclei with an equal number of protons and neutrons (Pittel), and studies of stable and unstable neutron-rich nuclei near the closed shells $N = 82$ and $N = 50$ using $(d, p)$ transfer reactions and Coulomb excitation by means of radioactive beams (Cizewski and Padilla-Rodal). There were several talks on the importance of reaction rates for the excitation of spin-isospin resonances (Sakai), massive star evolution (Klapp) and nuclear synthesis and stellar evolution (Rolfs). In another presentation, the importance of rare isotopes for astrophysical processes was highlighted (Schatz).

In addition, there were discussions about the importance of the Pauli exclusion principle and phase transitions in nuclear cluster models (Cseh and Hess) and an analysis of elastic scattering close to the Coulomb barrier in the framework of the optical model (Gómez-Camacho).

Another important area is that of hadronic physics, the study of nucleons as composite systems of strongly interacting quarks and gluons. This field is situated on the borderline between nuclear and particle physics and presents a formidable challenge since the scale of the energies involved prohibits the use of the methods of perturbative QCD. In the session on hadronic physics, there were talks on chiral symmetry in non-perturbative QCD (Bietenholz), the structure of the nucleon in an unquenched quark model (Bijker), quark and meson degrees of freedom in Deeply Virtual Compton Scattering (Szczepaniak) and studies of hadronic structure by means of neutrino-induced pion production (Mariano).

At ultrarelativistic energies, one can study the phase transition between hadronic matter and a new state of nuclear matter, the quark-gluon plasma. The Organizing Committee is proud to mention that the Cocoyoc 2010 meeting was one of first international conferences where the first scientific results from LHC were presented by the ALICE collaboration on proton-proton collisions at an energy of 900 GeV (Paic).

In the session on cosmic rays, there was a talk on the origin of ultra high-energy cosmic rays ($100 \text{ EeV} = 10^{20} \text{ eV}$) as observed by the Pierre Auger Observatory (Medina-Tanco). Furthermore, there was a presentation of the project NuMoon which proposes to use the Moon’s surface to detect cosmic rays that are out of the range of the Auger Observatory (Scholten). In addition, there was a review of the advances of the Mexican project HAWC, an observatory under construction in the Sierra Negra of Puebla (Sandoval) to study some of the most violent
phenomena in the Universe through the detection of gamma rays with energies between hundreds of GeV and hundreds of TeV.

At the other extreme of the energy scale is the field of the study of fundamental symmetries with novel experiments with ultra-cold neutrons. In this session, there were proposals by the NPDGamma collaboration (Gillis) and the abBA collaboration (Barrón-Palos) to use polarized neutrons to study the weak hadronic interaction and neutron beta-decay, respectively. In another talk, there was a discussion on the measurement of the electric dipole moment of the neutron which is of fundamental importance to the standard model (Crawford).

Finally, there was a session dedicated to quantum chaos where various proposals were discussed to identify chaotic behaviour in quantum systems, such as spectral fluctuations, time series and $1/f$ noise (Molina). Applications were presented to many-body systems in nuclear physics (Stránský) and the dripping-laser system as a quantum realization of the dripping faucet, one of the paradigms of classical chaos (Fossion).

Many of the participants spent the free afternoon in the “magic village” of Tepoztlán to visit the arts and crafts market, the church, the convent or just to enjoy the good food. The most daring persons climbed the nearby cliff Tepozteco and the pyramid built on top of it to contemplate the spectacular view over the valley. As always, some of the participants of the conference prolonged their stay in Mexico to establish, to develop or to consolidate their collaborations with the local nuclear physics community.

At the annual reunion of the Nuclear Physics Division which was held during the meeting, there was a long discussion on the future of the Symposium and, more generally, of the field of nuclear physics in Mexico and Latin America. Libertad Barrón Palos, Roelof Bijker, Ruben Fossion and David Lizcano were re-elected as members of the Local Organizing Committee of the next Symposium which will be held at the Hacienda Cocoyoc from January 4-7, 2011, but now with Libertad as Chair.

Libertad Barrón-Palos
Roelof Bijker
Ruben Fossion
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XXXIII SYMPOSIUM ON NUCLEAR PHYSICS
JANUARY TUESDAY 5 - FRIDAY 8, 2010
COCOYOC MORELOS, MÉXICO.
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INVITED TALKS

- Rafael Molina (Madrid)
  Applications of $1/f$ noise to spectral statistics
- Ruben Fossion (ICN-UNAM)
  The dripping laser: quantum chaos and $1/f$ noise in a phase transition in light
- Pavel Stránský (ICN-UNAM)
  Chaotic dynamics in collective models of nuclei
- Gustavo Medina-Tanco (ICN-UNAM)
  New developments in the area of ultra-high energy cosmic rays
- Olaf Scholten (KVI)
  High-energy cosmic rays
- Andrés Sandoval (IF-UNAM)
  Title: HAWC, a High Energy Gamma Ray Observatory in Mexico
- Hendrik Schatz (MSU)
  Nuclear astrophysics with rare isotope beams
- Claus Rolfs (Bochum)
  Heavy-ion burning in stars
- Jaime Klapp (ININ)
  On the influence of opacity and nuclear reaction rates on the numerical evolution of massive stars
- Peter Hess (ICN-UNAM)
  Phase transitions in nuclear cluster models
- Jozsef Cseh (ATOMKI)
  Quasi-dynamical SU(3) symmetry and nuclear clusterization
- Jolie Cizewski (Rutgers)
  Single-particle structure of neutron rich nuclei
- Stuart Pittel (Bartol)
  Proton-neutron pairing in the nuclear shell model
- Roelof Bijker (ICN-UNAM)
  Symmetries of the unquenched quark model
- Alejandro Mariano (La Plata)
  Neutral current neutrino-nucleon interaction and the isobar $\Delta(1232)$
- Adam Szczepaniak (Indiana)
  Nucleon structure as seen by Deeply Virtual Compton Scattering
- Wolfgang Bietenholz (ICN-UNAM)
  Chirality and Operator Product Expansion in non-perturbative QCD
- Christopher Crawford (Kentucky)
  The neutron EDM experiment at the SNS
- Chad Gillis (Indiana)
  The NPDGamma experiment
- Libertad Barrón-Palos (IF-UNAM)
  Measurement of the correlation parameters in the decay of free polarized neutrons: the abBA experiment
- Guy Paic (ICN-UNAM)
  The first ALICE results with pp collisions at 900 GeV
• Brad Sherrill (MSU)  
  Search for the origins and limits of nuclei using the Facility for Rare Isotope Beams

• Elizabeth Padilla-Rodal (ICN-UNAM)  
  The use of radioactive ion beams in the $A \sim 80$ region

• Alfredo Galindo-Uribarri (ORNL)  
  Applications with unstable nuclei

• Arturo Gómez-Camacho (ININ)  
  The threshold anomaly of weakly bound projectiles from recent elastic scattering measurements around the Coulomb barrier

• Hideyuki Sakai (Tokyo)  
  Exothermic heavy-ion charge-exchange reactions with unstable beams and the high resolution magnetic spectrometer SHARAQ
Posters

- Armando Barrañón (UAM-A)  
  Non-monoticity of scaled invariance in heavy-ion collisions via Latino model

- Tatyana Belyaeva (UAEM), E.F. Aguilera (ININ), E. Martínez-Quiroz (ININ), A.M. Moro (Sevilla, Spain) and J.J. Kolata (Notre Dame, USA)  
  Astrophysical $S_{17}$ factor extraction from breakup of $^8B$ on $^{58}\text{Ni}$ at energies around the Coulomb barrier

- Judit Darai (ATOMKI)  
  Elongated shape isomers and clusterization of atomic nuclei

- Paul Fraser (ICN-UNAM), K. Amos (Melbourne, Australia), L. Canton, G. Pisent (Padova, Italy), S. Karataglidis (Rhodes, South Africa), J.P. Svenne (Manitoba, Winnipeg), D. van der Kniff (Melbourne, Australia)  
  Coupled-channel evaluations of cross sections for scattering involving particle-unstable resonances

- Hugo García Tecocoatzi (ICN-UNAM)  
  Systematics of nuclear masses and the shell model

- Araceli Ibañez-Sandoval (ESIME-IPN), V. Velázquez (FC-UNAM), M.E. Ortiz (IF-UNAM), A. Frank (ICN-UNAM) and C. Vargas (UV)  
  Quantum chaos evolution from shell model calculations

- Miguel Ángel Juárez-Rosete (IF-UNAM)  
  Precision neutron polarimetry

- Emmanuel Landa, R. Fossion, P. Stránský, I. Morales, J.C. López-Vieyra, A. Frank (ICN-UNAM) and V. Velázquez (FC-UNAM)  
  Scale invariance in chaotic time series: classical and quantum examples

- Sergio Lerma (UV)  
  The wave function of the isovectorial and isoscalar pairing Hamiltonian from a Bethe-Ansatz approach

- David Lizcano (ININ)  
  Alpha-particles from $^6\text{Li} + ^{58}\text{Ni}$

- Ruslán Idelfonso Magaña Vsevolodovna (ICN-UNAM)  
  Correlations between nucleon transfer reactions in nuclear supersymmetry

- Marissa Maldonado Velázquez (ININ)  
  Resonant elastic scattering of $^{12}\text{C} + ^4\text{He}$

- Daniel José Marín Lámbarri, Libertad Barrn Palos, Quíela Marina Curiel García, Efraín Rafael Chávez Lomelí, Arcadio Huerta Hernández, Miguel Ángel Juárez Rosete, María Esther Ortiz Salazar, Penélope Rodríguez Zamora, José Francisco Favela Pérez (IF-UNAM), Ghiraldo Murillo Olayo, Rafael Policroniades Rueda, Armando Varela González (ININ)  
  Development of an adiabatic spin flipper for slow neutrons

- Jossellin Nayelly Martínez-García (UNAM)  
  Development of radioactive beams using a Tandem Accelerator

- Enrique Martínez-Quiroz, E.F. Aguilera, A. Gómez-Camacho, D. Lizcano, P. Rosales, A. Ruiz-Sánchez (ININ), J.J. Kolata (Notre Dame, USA)  
  Fusion measurements through evaporated particles

- Joel Mendoza Temis (ICN-UNAM)  
  The anatomy of the simplest Duflo-Zuker mass formula

- Jorge Arturo Rojas-Santana and T.L. Belyaeva (UAEM)  
  Schrödinger soliton scattering on the linear potential: exactly integrable models
• Antonio Ruiz Sánchez (ININ, FC-UAEM)
  *Optical model analysis of the system $^7$Be + $^{58}$Ni at energies around the Coulomb barrier*
• Leonid Serkin (ICN-UNAM)
  *Jet Physics at ALICE*
• Tochtli Cuauhtli Yépez Martínez (ICN-UNAM)
  *A solvable model for many quarks systems in QCD Hamiltonians*