Introduction

This report summarizes the activities of the Physics Department in the year 2000. Most of our effort has been devoted to the development of research projects in Nuclear Physics, Condensed Matter, Astrophysics, Solar Energy and Applications of Analytical Techniques using the Heavy-Ion Accelerator TANDAR. Other related topics with strong involvement of our research staff include chaos and complex systems, intermediate energies, surface physics, diamond-like coatings and micro-electromechanical systems. All of these activities rely on the technical support provided by a number of auxiliary laboratories in the fields of electronics, high-vacuum, target and thin-foil production, mechanical workshop, and computers and networks.

As usual, during the reported period research work has been complemented with a strong involvement of our staff in teaching activities both as professors at local universities and within the framework of our postgraduate program. Nineteen graduate students have continued their PhD thesis work at our laboratories under the supervision of local researchers; four of these students have obtained their degrees during this year.

Despite the negative environment created by continued budgetary constraints as well as by the implementation of governmental programmes aimed at staff reduction via induced early-retirement, the overall scientific production and the accomplishment of important goals have been once again a distinctive characteristic of this period. A few among the most conspicuous facts in the different areas are the following:

Condensed Matter

- Synthesis and structural determination of two novel species of sulphur oxoanion complexes with unprecedented properties.

- Study of the coexistency between ferromagnetism and superconductivity.

- Theoretical prediction of new phases of fullerites with very low compressibilities (and thus, high hardness) through first-principle molecular dynamics calculations.

- The experimental control of the relative volume of antiferromagnetic and ferromagnetic phases in a manganese oxide, which shows the relation between giant magnetorresistence and phase coexistence.

TANDAR accelerator and aplications

- The accelerator has operated during the year 2000 providing beams of ions in a relatively wide range of energies. It is particularly noticeable the lowest terminal voltage of 0.8 MV at which the machine was able to operate in a stable condition. The total beamtime available for experiments was of 5356 hours, a number susbtantially higher than those of the last few years.

- Among the applications, research on BNCT devoted an important effort to the optimisation of different nuclear reactions for neutron production. A simplified production-target prototype and the complete neutron-moderation device has been implemented. Other biological and biomedical applications include the production of external proton and lithium beams for the irradiation of biological material. A new experimental line was mounted and the radiological effects (RBE factors) were determined for several beams on normal and tumoral tissues.

- A new time-of-flight facility has been used for the first time for the detection and mass identification of the evaporation products in heavy-ion fusion reactions. This detection system is being optimised for the detection of ^{129}I in AMS measurements.

Solar Energy

Most of the activity of the group was related to the design of solar cells and panels in connection with the argentine space program. In this respect:

- Data analysis form the experimental cells mounted in the satellite mission SAC-A was completed. The overall performance was found to be very good and the electrical characteristics measured during the mission were found to be in very good agreement with the estimates based on previous laboratory measurements.

- A new probe to test mechanical fatigue in connectors for solar cells intended for space use has been developed and used.

Related to other applications, the Solar Energy group provided low-cost solarimeters for the National Weather Service (Servicio Meteorológico Nacional) which will be installed in portable weather stations located in remote areas of the country.

Astrophysics

The Physics Department has continued its strong involvement in the Pierre Auger Project, an international effort to make a detailed study of cosmic rays at the highest energies. A Memorandum of Understanding between the International Collaboration and Comisión Nacional de Energía Atómica (CNEA) describing the activities by the personnel of CNEA to the Pierre Auger Project and the contributions to the design and construction of the observatory has been signed.

The construction of the southern-hemisphere observatory located at Pampa Amarilla in the province of Mendoza has proceeded according to schedule. In particular the Central Station in the town of Malargue and the building of one telescope (out of a total of four) located in Cerro Los Leones have been almost completed.

The activities of our Physics Department has been supported mainly by our home institution, CNEA, although we must also acknowledge important contributions from other agencies such as the National Research Council (CONICET), the National Agency for Science and Technology (ANPCyT), and Fundación Antorchas.

For the first time this Progress Report is being published in its electronic version only. Unlike previous versions, it covers a shorter period (one year instead of two or three), which we hope will contibute to make it more valuable and more representative of our current interests and projects. I would like to thank M.E. Spina, G. Mastrogiacomo and R. De Luca who contributed with their hard work towards the implementation of these changes.

Alberto J. Pacheco
August 2000