

## Introduction

This report presents a summary of progress in research carried out at the Physics Department during 2003. The main activity has taken place in the areas of nuclear physics, condensed matter, astrophysics, solar energy, microelectromechanical systems, biomedical research using the heavy-ion accelerator TANDAR, chaos and complex systems. More detailed information is reported throughout each of the sections, thus this introduction will focus on a few points that are probably worth emphasizing at this stage.

The heavy-ion accelerator TANDAR has continued its operation related to basic and applied research projects. The project related to Boron Neutron Capture Therapy (BNCT) based on accelerators has continued its progress. The microbeam facility has been successfully applied to the production of microelectromechanical devices, taking advantage of the precise micrometrical spatial precision and of the localized energy deposition characteristic of heavy ions. Considerable progress has been made in the determination of extremely low nuclear cross sections of astrophysical interest using Accelerator Mass Spectrometry (AMS) techniques.

Condensed Matter research projects have made important progress along different lines. Among them it is worth mentioning the study of anomalous electric and magnetic properties of manganese oxides associated to the coexistence of phases with different properties in materials exhibiting the colossal magnetoresistance effect. In the framework of this work, it should be mentioned the introduction of novel hybrid techniques for the synthesis of hollow nanostructures. The study of hard amorphous-carbon films has greatly benefited from the recent availability of a locally designed and constructed equipment for the production of this kind of coatings on different substrates, characterized by currents of up to 100 mA which permit high growth velocities.

The Solar Panels Project for space applications, related to the Argentine Space Agency (CONAE), had a very satisfactory development during 2003. In particular, the laboratory for panel integration has been completed, and significant progress has been made in various fronts such as the development, elaboration and testing techniques, elaboration of the engineering module and simulation of the satellite power subsystem. A new facility for the evaluation of radiation damage using the Tandar accelerator is under construction.

The construction of the the southern-hemisphere observatory of the Pierre Auger Project in the province of Mendoza, in which personnel from the Physics Department has continued to be closely involved, has proceeded at firm pace. This includes the continuation of tank deployment on the site, and associated tasks such as the production of the tank liners, data storage, detector calibrations, and the design of muon detectors.

Besides the direct involvement of our research staff, all this work has been possible thanks to the assistance of the various technical and administrative sectors of the Department. Our researchers have been actively involved in teaching activities at various levels. Approximately twenty-five graduate students have continued their thesis, three of which have obtained their doctoral degree during the year. At the graduate level, about thirty other

students have worked on special assignments required in advanced physics courses. Technical training and special courses aimed at senior high-school students have also been very active.

Finally, our Physics Department is very proud of a very important international prize awarded to one of its senior scientists; the L'Oréal-UNESCO Award for Women in Science 2003 in the field of Material Sciences to Dr. Mariana Weissmann, for her invaluable contribution to the understanding of quantum solids in the evolution from a qualitative view to quantitative predictions. An international workshop named "*In the Frontiers of Condensed Matter*" (which is expected to be the first of a series) in celebration of Dr. Weissmann fruitful trajectory has taken place with the participation of scientists from around the world.

I would like to express my deep recognition to all the members of the Physics Department who have contributed with their hard work to the results achieved in the present period, that this report intends to reflect.

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