Heavy Ion Physics and Accelerator Mass Spectrometry

The Heavy Ion Physics and Accelerator Mass Spectrometry group is devoted to the study of basic aspects of nuclear physics at low energy (nuclear reactions as well as nuclear spectroscopy) and to applied research in connection with the analytical technique known as accelerator mass spectrometry (AMS). Even though the subjects covered by these two lines are very different, they share similar instrumental and methodological requirements as far as the performance of the actual experiments is concerned.

Highlights of the nuclear physics activities are:

- Search for chaotic behaviour in nuclear reactions: Theoretical studies predict that, under certain conditions, nuclear scattering might exhibit peculiar behavior associated with the quantum manifestation of chaotic phenomena. Therefore, we continue our study of the $^{16}O + ^{28}Si$ system for which a chaotic behaviour in certain energy-range has been suggested. Previous experimental results have been compared with the theoretical two-dimensional patterns obtained for the elastic and inelastic cross sections as a function of the energy and the scattering angle for that system. Although they seem to agree with the theoretical predicitions, an unambiguous confirmation is still lacking. Therefore, continuing our collaboration with the LBN Laboratory, new experiments were performed in order to improve several experimental aspects by the use of a large efficiency heavy ion counter detector combined with the multidetector array Gammasphere. Otained data are under currently evaluation.
- Subcoulomb fusion barrier distributions: Fusion cross sections at energies close to or below the Coulomb barrier present behaviours which are related to various structural aspects of the nuclei involved in the collision. These features become particularly noticeable when the results are analyzsed in terms of the so called “barrier distributions”. We are investigating several reaction systems with the aim of identifying the effect of the inelastic and transfer channels in the barrier distributions obtained from the measurement of quasi-elastic excitation functions at backward angles.
- The nuclear spectroscopy line encloses research on *shape coexistence* phenomena in the mass region $A \approx 70$-90 and on the nature and behavior of band crossing in blocked odd systems.

The other research line has a more applied character and it is related to the use of the Tandar particle accelerator as an extremely sensitive mass spectrometer. (AMS). In the last year we continue our study of multiple ionization processes, in particular using chlorine beams. In addition, we pursued our collaboration with the Technical University of Munich, Germany aimed to the measurement of low astrophysical cross sections using this technique.