Carlotta GIUSTI

1975-1981 Research Fellow (Pavia University)

1981-1996 Researcher of Theoretical Physics (Pavia University)

1996-now Associate Professor of Nuclear Physics (Pavia University)

Teaching activity:

1975-1988 Teaching assistant for courses of General Physics and Quantum Mechanics for undergraduate students. Lectures on Theoretical Nuclear Physics for graduate students

1989-1996 Course on Nuclear Reactions Theory for undergraduate students. Lectures on Theoretical Nuclear Physics for graduate students

1996-today Courses on Nuclear Reactions Theory, Nuclear Physics, Introductory Nuclear Physics (undergraduate students). Advances in Nuclear Physics, Complements of Theoretical physics (graduate students).

Main research interests: electroweak reactions on nuclei, exclusive electron and photo-induced reactions with direct emission (knockout) of one or two nucleons, inclusive quasielastic electron scattering, charged-current and neutral-current neutrino-nucleus quasielastic scattering.

The aim of the research activity is to study in the above reactions nuclear effects, the behavior of nucleons embedded in the nuclear medium, interactions and correlations between nucleons. In order to extract this information from the experimental data, reliable numerical predictions are needed and theoretical models where all the theoretical ingredients are treated as accurately as possible. To this aim, theoretical models have been developed and numerical programs have been written. In the models, with different and successive approximations, the nuclear wave functions are treated either with a mean field approximation or including different types of correlations; final-state interactions, that represent an important ingredient of the model and have large effects on the measurable quantities, are consistently treated in the different reaction processes that have been studied; the nuclear current includes a one-body part and a two-body part, due to the exchange of mesons

between nucleons. Nonrelativistic models, where some relativistic effects can be included, and fully relativistic models have been developed and compared. The computer programs built from the models give numerical predictions for cross sections and polarization observables. The numerical results have been widely and successfully compared with the available experimental data. They have been used both for the analysis and the interpretation of data and to determine the most suitable experimental conditions able to point out specific effects, thereby for the proposal of new experiments.

The research work has been accomplished in many collaborations with Italian and foreign scientists, with both theorists and experimentalists. The collaboration with experimental groups is of particular interest for a theorist. Such collaborations have been challenging and fruitful and have produced several joint publications. These collaborations have been encouraging and helpful to improve, in successive steps, the theoretical models and to envisage the most suitable experimental conditions able to study effects of particular physical interest.

The experience acquired in the study of nuclear reactions with exclusive and inclusive electron-nucleus scattering has been exploited in recent years to treat nuclear effects in quasi-elastic charged-current and neutral-current neutrino-nucleus scattering. The analogies between electron-nucleus and neutrino-nucleus scattering suggested to extend to neutrino-nucleus scattering the models developed for the different processes with electron-nucleus scattering and widely and successfully tested in comparison with electron-scattering data. Reliable predictions of neutrino-nucleus cross sections, where all nuclear effects are well under control, are crucial for a proper analysis of ongoing and future neutrino oscillation experiments, which use medium and heavy nuclei as targets. The results of the models have been successfully compared with the quasielastic neutrino cross sections recently measured by the MiniBooNE collaboration at Fermilab.

The problem of nucleon structure has also been studied, in particular the possible strange quark contribution to the nucleon form factors, that can be investigated with neutral-current neutrino scattering and polarized electron scattering on nucleons and nuclei.

Recently, a new line of research has started concerning the evolution of nuclear properties with respect to the asymmetry between the number of neutrons and protons. As a first step, the ground state properties and the properties of bound protons in some spherical isotopes far from the stability line have been investigated with models which are able to describe successfully the experimental data in the case of the stable isotopes.

Publications: 104 papers in international refereed journals, 66 contribu-

tions to proceedings of international conferences. A large part of the past activity in the field of nuclear reactions induced by an electromagnetic probe has been reviewed in a book, entitled "Electromagnetic Response of Atomic Nuclei", written in collaboration with S. Boffi, F.D. Pacati and M. Radici, and published by Oxford University Press in 1996. The book places in the context of the international research the main and important results achieved in the theory of electromagnetic reactions with one and two-nucleon emission in terms of spectral density and its application to situations of interest for the experimental groups in Saclay (France), NIKHEF (the Netherlands), MAMI (Germany) and Jefferson Laboratory (USA), with which fruitful collaborations have been developed.

120 contributions to international and national conferences, workshops, schools, 60 of them are invited talks that have been personally presented.

Referee: Physical Review C, Physical Review D, Physical Review Letters, Nuclear Physics A, Physics Letters B, European Physical Journal A.