Sezioni di Milano e Milano-Bicocca

Lectures

16/3/2015, Sez. Milano, Via Celoria 16, Aula Consiglio, ore 14.30
18/3/2015, Sez. Mi-Bicocca, P.za della Scienza 4, edificio U4, aula 07, ore 14.30
20/3/2015, Sez. Milano, Via Celoria 16, Aula Consiglio, ore 14.30

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Nuclei: Quantum Finite Many-body System

an overview of nuclear structure and the role of the isospin quantum number

Prerequisites: Basic understanding of Quantum Mechanics and very Basic Nuclear Physics

Abstract: We seek to re-construct the basic understanding of nuclear structure physics from a broad view point by combining the knowledge on particle physics, nuclear physics and nuclear astrophysics that you may already have.
Nuclei can be defined as "Quantum Finite Many-body Systems of Fermions" in which Strong, Electromagnetic and Weak interactions are active. We try to understand the very basic properties of this unique system in which these three fundamental interactions play important roles. We know that they are mostly responsible for "nuclear excitations and particle decay," "Coulomb excitations and gamma decay" and "neutrino-induced reactions and beta decay", respectively.
In addition, the interplay of the three interactions leads to a large variety of phenomena; In order to understand and connect them, the concept of "isospin" and "isospin symmetry" is important. The concept of isospin originates from the two fermionic degrees of freedom in nuclei, i.e., protons and neutrons. As a result, we can categorize the nuclear excitations in terms of isospin as well as spin, where the latter is also a unique degree of freedom in nuclei.
We shall consider in detail the Gamow-Teller excitation as an important example of nuclear excitation of spin-isospintype, discussing its important role in the fields of nuclear structure, of nuclear astrophysics and of neutrino induced reactions.

References:

Y. Fujita, B. Rubio and W. Gelletly, Progress in Particle and Nuclear Physics 66 (2011) 549-606.
Y. Fujita Proceedings of Science, ENAS 6 (2011) 031.

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