Contribution ID : **38** Type : **Oral contribution**

Pygmy dipole states in deformed nuclei

Thursday, 7 June 2018 16:18 (18)

In the last years special attention has been devoted to the study of the dipole strength at low excitation energy in neutron-rich nuclei, the so called Pygmy Dipole Resonance (PDR). This mode carries few per cent of the isovector EWSR, and it is present in many stable and unstable isotopes with a consistent neutron excess.

It is possible to study these low lying dipole states by using an isoscalar probe in addition to the conventional isovector one due to the fact that their transition densities show a strong mixing of their isoscalar and isovector components. Indeed, the combined use of real and virtual phonons and experiments employing (α,α γ) as well as (17O, 17O' γ), for the investigation of the PDR states has unveiled a new feature of these states. Namely, the peak of these low-lying dipole states can be separated in two parts: the part lying at low energy is excited by both the isoscalar and isovector interactions while the high energy part is populated only by the electromagnetic probes.

Recently, the interest has moved on deformed nuclei. In these nuclei the Giant Dipole Resonance (GDR) peak is separated in two parts. Each of them corresponds, in the hydro-dynamical model, to an out-of-phase oscillation of neutron against pro- tons along the symmetry and its perpendicular axes. These modes are characterized by two quantum number K = 0− and K = 1− that give rise to two separated bands in the laboratory frame. If it is true that the pygmy states are generated by the out-of-phase oscillation of the neutron excess against a proton plus neutron core, then the same mechanism producing the splitting of the GDR should be valid also for the low lying dipole states. Therefore one should expect as well to observe a separation of the pygmy dipole peak in two bumps.

Calculations done within a simple macroscopic model show that the transition densities of the low lying dipole states have the same typical behaviour of the non- deformed nuclei namely a strong isoscalar-isovector mixing at the nuclear surface. These results are corroborated by some microscopic calculations performed by using a relativistic Hartee-Bogoliubov mean field plus a relativistic quasi-particle random phase approximation.

Therefore a suitable way to investigate the pygmy states in deformed prolate nuclei is through the use of isoscalar probes. Measurement of the pygmy dipole states excitations along an isotope chain with increasing deformation may enlighten and give new perspectives about these novel excitation modes.

Summary

Primary author(s) : Dr LANZA, Edoardo G. (INFN - Sezione di Catania)

Presenter(s) : Dr LANZA, Edoardo G. (INFN - Sezione di Catania)

Session Classification : Session 14