Contribution ID: **15** Type: **Invited**

First experimental signature of the giant pairing vibration in ^{14}C and ^{15}C nuclei (Invited)

Wednesday, 13 July 2016 11:00 (25 minutes)

D.Carbone[1], F.Cappuzzello[1,2], M.Cavallaro[1], M.Bondì[1], C.Agodi[1], F.Azaiez[3], A.Bonaccorso[4], A.Cunsolo[1], L.Fortunato[5,6], A.Foti[2,7], S.Franchoo[3], E.Khan[3], R.Linares[8], J.Lubian[8], J.A.Scarpaci[9], A.Vitturi[6,7]

[1]INFN-Laboratori Nazionali del Sud, Catania, Italy

[2]Dipartimento di Fisica e Astronomia, Università di Catania, Catania, Italy

[3]Institut de Physique Nucleaire, Universitè Paris-Sud, Orsay, France

[4]INFN-Sezione di Pisa, Pisa, Italy

[5]Dipartimento di Fisica e Astronomia, Università di Padova, Padova, Italy

[6]INFN-Sezione di Padova, Padova, Italy

[7]INFN-Sezione di Catania, Catania, Italy

[8]Instituto de Fisica, Universidade Federal Fluminense, Niteroi, Brazil

[9]Centre de Sciences Nucleaires et de Sciences de Matieres, Universitè Paris-Sud, Orsay, France

In 1977 Broglia and Bes predicted the existence of an elementary excitation mode, called Giant Pairing Vibration (GPV) [1]. Afterwards, many other theoretical papers were focused on the definition of the GPV, which is done in analogy with the Giant Resonances (GR) observed in almost all nuclei. The link between GPV and GR is the symmetry between particles and holes single particle states. Both of them are collective states, manifestation of a coherence mechanism of the particle-hole (GR) or particle-particle/hole-hole (GPV) excitations connecting major shell of the harmonic-oscillator-like mean field. The excitation of the GPV should be induced by two-nucleon transfer reactions with L = 0 angular momentum transfer. Despite the strong theoretical indications in favour of the existence of the GPV and many experimental attempts, a clear signature of it has been achieved only recently [2].

In this context, an experimental campaign was pursued at the Catania INFN-LNS laboratory by the (^{18}O,^{16}O) two-neutron transfer reaction at 84 MeV on different targets (^{12}C,^{13}C,^{9}Be,^{11}B,^{16}O). One of the qualifying aspects was the use of the MAGNEX spectrometer to detect the ejectiles. Indeed, thanks to its high resolution and large acceptance, high quality inclusive spectra were obtained, even in the region above the two-neutron emission threshold in the residual nucleus [3]. New phenomena appeared, such as the dominance of the direct one-step transfer of the two neutrons [4] and the presence of broad resonances at high excitation energy in the ^{14}C and ^{15}C spectra. The latter are associated with the first experimental indication of the GPV [2]. In the ^{14}C nucleus it is identified at an excitation energy of 19.9 MeV with respect to the target ground state and in the ^{15}C one at 20.4 MeV, values compatible with the GPV theoretical predictions by state-of-the-art cQRPA calculations on light nuclei [5]. The L = 0 nature of the transition to these resonances is suggested by model independent analysis of the measured cross section angular distributions by CRC calculations. Moreover, in a recent experiment, which explores the same ^{12,13}C(^{18}O,^{16}O)^{14,15}C reactions at 270 MeV incident energy, the observation of the GPV mode is confirmed with the same centroid and width.

[1] R. A. Broglia and D. R. Bes, Phys. Lett. B 69, 129 (1977).

[2] F. Cappuzzello et al., Nat. Commun. 6:6743 doi:10.1038/ncomms7743 (2015).

[3] M. Cavallaro et al., J. Phys.: Conf. Ser. 381, 012094 (2012).

[4] D. Carbone et al., J. Phys.: Conf. Ser. 312, 082016 (2011).

[5] E. Khan et al., Phys. Rev. C 69, 014314 (2004).

Primary author: Dr CARBONE, Diana (INFN - LNS)

Presenter: Dr CARBONE, Diana (INFN - LNS)