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Study of the weakly bound nucleus 26F

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Nuclear forces play a decisive role to account for the creation and modifications of shell gaps, to explain deformed nuclei, to permit the development of halo structures and to fix the limits of particle stability. The determination of nuclear forces inside the nucleus from bare forces is a tedious but important task. The neutron-rich 26F is a benchmark nucleus for studying proton-neutron interaction for different reasons. First, as its neutron binding energy amounts to only 0.80(12) MeV [i], its structure is likely to be influenced by drip-line phenomena. Second, it lies close to the 24O doubly magic nucleus [ii]. Therefore its nuclear structure at low excitation energy is expected to be rather simple. It is mainly provided by the interaction between a deeply proton d5/2 and an unbound neutron d3/2 on top of a closed 24O core, leading to J = 1, 2, 3, 4 positive parity states. The structure of this nucleus has been investigated at GANIL by means of the in-beam γ-ray spectroscopy technique using fragmentation reactions of a cocktail of radioactive nuclei, as by the study of its ground and isomeric beta decay to 26Ne. Combining these pieces of information, as well as those obtained from atomic mass measurement [i] and the discovery of unbound states in 26F [iii], we observe a reduction by about 30% of the proton-neutron forces as compared to those used in the USD interactions [iv] to account for structural evolution closer to the valley of stability. This pinpoints the need of more self-consistent methods to derive nuclear forces for nuclei close to the continuum.

i B. Jurado et al. Phys. Lett. B 649 (2007) 43
ii C. Hofmann et al. Phys. Lett. B 672 (2009) 17
iii N. Frank et al., Phys. Rev. C 84 (2011) 037302
iv B. A. Brown and B. H. Wildenthal, Ann. Rev. of Nucl. Part. Sci. 38, 29 (1988)

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