International Nuclear Physics Conference INPC2013: 2-7 June 2013, Firenze, Italy

Neutron single-particle energies near ^{78}Ni: low-lying states in ^{79}Zn studied via single-nucleon transfer

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Single-particle properties of nuclei neighbouring shell closures constitute one of the most sensitive tests of our understanding of nuclear structure. Especially away from the line of beta stability, the properties and excitations of exotic isotopes provide essential data to refine the current models and interactions, as well as to assess their predictive power. The region of nuclei near ^{78}Ni, the doubly-magic nucleus with the largest N/Z ratio, is the focus of considerable experimental and theoretical interest. To date, scarce or no information is available on ^{78}Ni or any of its immediate neighbours. Whether ^{78}Ni can be considered a doubly-magic spherical nucleus depends on the size of the Z=28 and N=50 shell gaps and the amount of deformation-driving correlations, and contrasting predictions have been proposed [1][2].

^{79}Zn is the even-Z, N=49 isotone lying closest to ^{78}Ni. Low-lying excited states in ^{79}Zn were populated at REX-Isolde via the ^{78}Zn(d,p) reaction at 2.83 MeV/u, in inverse kinematics. This reaction yields important information about the N=50 shell gap, since the neutron can be transferred to orbits lying both below and above the gap. The coincident detection of charged particles and gamma rays, permitted by the coupling of the T-REX and Miniball arrays, was of paramount importance for the interpretation of the observed states, most of them populated for the first time. Results on ^{79}Zn level scheme and their implications on the size of the N=50 gap will be presented.
*** This work was supported by the European Union Seventh Framework Programme through ENSAR, contract no. 262010, by the project MEC Consolider - Ingenio 2010; CDS2007-00042 and by the European Commission through the Marie Curie Actions call FP7-PEOPLE-2011-IEF under Contract No. 300096.

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