Contribution ID: **58** Type: **Poster**

Structure of 68Ni: new insights on the low-lying 0+ and 2+ states from two-neutron transfer on 66Ni and beta-decay of 68Co

The region around the nucleus 68Ni, with a shell closure at Z = 28 and a sub-shell closure at N = 40, is the source of considerable interest in nuclear-structure studies. Despite a significant set of experimental and theoretical information available on 68Ni [1-5], the origin of its structure is still being questioned. A recent clarification of the energy and spin assignment of several low-lying 0+ and 2+ states [6-9] and state-of-the-art shell model calculations [5,10] hinted to the possibility of triple shape coexistence and highlighted the need of additional experimental investigation.

To better understand the structure of 68Ni, two complementary experiments: the two-neutron transfer reactions on 66Ni at 2.85 MeV/u and the beta-decay of 68Co were performed at ISOLDE.

On one hand, the 66Ni(t,p)68Ni reaction represents a unique tool to probe the nature of 0+ states in 68Ni. Coincidences between the outgoing light charged particles and gamma-rays were detected using the combined MINIBALL [11] gamma-ray spectrometer and the T-REX particle detection array [12]. Results of such coincidence analysis together with the reconstruction of angular distributions of the reaction products, revealing the most populated states, will be presented. An interpretation based on calculations within the Distorted-Wave Born Approximation (DWBA) and shell model two-nucleon amplitudes will be discussed.

On the other hand, the measurement of the beta-decay of the low spin isomer in 68Co selectively produced in the decay chain of 68Mn allowed us to build a revised decay scheme to 68Ni based on the clear identification of beta-gamma-E0 delayed coincidences. A strong emphasis will be put on the connections between the three lowest lying 0+ and 2+ determined from observed transitions and upper limits.

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