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Spectroscopy of the 67,68Fe isotopes by direct reactions on a LH2 target

68Ni and neighbor nuclei have been extensively studied since, in the nuclear shell-model, a sizeable effect was expected for the addition of the ⊠f7/2 proton shell closure Z=28 and the νf5/2 neutron subshell closure N=40. While the energy of the first 2+ state for Ni isotopes reaches a maximum for 68Ni, the evolution of the two neutron separation energy S2n is not significant of a major shell effect. Moreover, the 2+ energy of the neighboring 64,66Fe is quite small with indications of a prolate deformation while only two protons are removed from the spherical 68Ni.
While the first SEASTAR campaign at RIBF was focused on the study of 78Ni, data was also taken around 68Fe, which gave the opportunity to study the spectroscopy of the neutron rich Mn, Fe and Co isotopes subject to pairing and neutron-proton interactions. 67,68Fe in the vicinity of 68Ni have been studied with the help of nucleon removal reactions, mainly (p,2p) and (p,pn) in inverse kinematics with radioactive beams. In addition, the inelastic scattering channel (p,p') was also used to provide different selectivity of the final states. In-beam gamma measurement was performed with the DALI2 spectrometer surrounding the MINOS set-up, consisting in a 10 cm long LH2 target and a TPC for detection of charged particles and reconstruction of the reaction vertex in the target.
New transitions were observed with a tentative assignment of a new intruder band in 68Fe. They will be compared to shell model and Hartree-Fock-Bogoliubov calculations, consistent with a sizeable quadrupolar deformation.

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