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Neutron-proton pairing in the self-conjugate unstable nuclei ^{56}Ni and ^{52}Fe through transfer reactions

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Neutron-proton pairing is the only pairing that can occur in the T=0 and the T=1 isospin channels. T=1 particle-like pairing (n-n or p-p) has been extensively studied unlike T=0 neutron-proton pairing. The over-binding of N=Z nuclei could be one of its manifestation.
Neutron-proton pairing can be studied by spectroscopy as in ref.[1].We have studied it through transfer reactions in order to get more insight into the relative intensities of the two aforementioned channels. Indeed, the cross-section of np pair transfer is expected to be enhanced if the number of pairs contributing to the populated channel is important.
Neutron-proton pairing is predicted to be more important in N=Z nuclei with high J orbitals so that the best nuclei would belong to the g9/2 shell [2]. However, considering the beam intensities in this region, we have focussed on fp shell nuclei (^{56}Ni and ^{52}Fe).
The measurement was performed at GANIL with radioactive beams produced by fragmentation of a 75A MeV ^{58}Ni beam on a 185 mg.cm-2 Be target purified by the LISE spectrometer. An efficient set-up based on the coupling of the MUST2 and TIARA Silicon arrays for charged particle detection with the EXOGAM gamma-ray detector was used.
Measuring both ^{52}Fe (N=Z=26) which is a partially occupied 0f7/2 shell nucleus and ^{56}Ni (N=Z=28) which has a fully occupied 0f7/2 shell will allow us to study np pairing according to shell occupancy.
First results on the nature of the n-p pairing will be discussed based on the relative intensities of the 0+ and 1+ states populated in the ^{56}Ni(p,^{3}He)^{54}Co and ^{52}Fe(p,^{3}He)^{50}Mn reactions and on the angular distributions compared with DWBA calculations.

[1] B. Cederwall et al, Nature 469 (2011) 469.

[2] P. van Isäcker et al, Phys. Rev. Lett. 94 (2005) 162502.

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