

Transfer reactions induced with ^{56}Ni : np pairing and $N=28$ shell closure

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Transfer reactions have been proven to be a powerful tool to understand nuclear structure. Two different physical aspects are being investigated with the use of transfer reactions on ^{56}Ni , which is a $N = Z$ unstable doubly magic nucleus.

i) To probe the gap of $N = 28$, we study the spectroscopy of the $N = 29$ and $N = 27$ isotones by the (d, t) , (p, d) and (d, p) one nucleon transfer reactions on ^{56}Ni ($N = 28$ isotone) and extract information on the single-particle configuration around the Fermi surface.

ii) To study the np pairing in the self-conjugate nucleus ^{56}Ni , we have measured the two-nucleon transfer reactions $^{56}\text{Ni}(p, ^3\text{He})^{54}\text{Co}$ and $^{56}\text{Ni}(d,)^{54}\text{Co}$. In the $(p, ^3\text{He})$ reaction, the ratio of the population of the $T = 0$ and $T = 1$ states indicates a predominance of $T = 1$ pairing. The selectivity of the $(d,)$ reaction enables the investigation of the $T = 0$ channel with better precision.

During spring 2014 the experiment aiming to these studies took place at GANIL-Caen, France. The radioactive beam of ^{56}Ni at $30\text{MeV}/u$ was produced by fragmentation of ^{58}Ni and purification. Measurements were performed in inverse kinematics on CH_2 and CD_2 targets. The experiment included a 4π coverage for the study of the charged projectiles with the MUST2 and TIARA detectors, while 4 clovers of EXOGAM were also used for γ -particle coincidences in order to identify the populated state of the residue. The analysis of the $^{56}\text{Ni}(d, t)^{55}\text{Ni}$ and $^{56}\text{Ni}(d, p)^{57}\text{Ni}$ reactions yield the differential cross-section for transfer reaction to the ground state and the excited states of ^{55}Ni and ^{57}Ni giving information about the shell closure and depicting the Fermi surface of ^{56}Ni . I will present the angular distribution and compare with the results for the (p, d) , (d, t) and (d, p) reactions, as well as with DWBA calculations. The results for the transfer reaction $^{56}\text{Ni}(d,)^{54}\text{Co}$ will be also presented, completing the information about the strength of the isoscalar np pairing in the closure of the fp shell.

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