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Determination of ^{44,46}Ar(n,γ) reaction using ^{44,46}Ar(d,p) transfer reaction*

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In astrophysical processes involving neutron rich nuclei most of the nuclear physics inputs are taken from theoretical calculations. This fact is mainly due to the lack of experimental data available for neutron rich nuclei far from stability. Recent development in radioactive beams allow access to nuclear structure informations and reaction cross sections, of great importance for modeling astrophysical processes associated with regions of neutron-rich nuclei. In the vicinity of magic numbers, the neutron Direct Capture (DC) cross sections are expected to be important. The DC component, being more important than resonant one, can even dominate the total neutron capture cross section. Nuclear structure information obtained by performing a (d,p) transfer reaction is necessary to determine the DC (n,γ) cross sections.
Guided by these motivations, the ^{44,46}Ar(d,p) reactions were performed at GANIL using the ^{44,46}Ar beams delivered by the SPIRAL facility at 11 MeV/A. The protons were detected at backward angles using the highly segmented Si detector MUST. The transfer-like products ^{45,47}Ar were selected by the SPEG spectrometer and identified through their position, energy loss and time of flight at the focal plane of the spectrometer. From proton energy and angular spectra, the energies, spin values and spectroscopic factors of bound and unbound states in ^{45,47}Ar have been determined for the first time. These nuclides lie on either side of the N=28 shell closure. Therefore, this spectroscopic information will be used to examine the evolution of the N=28 shell closure below the doubly magic nucleus ^{48}Ca. Shell model calculations nicely agree with the observed p-state levels, which give confidence to the description of the shell erosion phenomenon observed in the S isotopes. This spectroscopic information will be used to determine the DC rates around the N=28 shell closure, which are of great importance in understanding the large ^{48}Ca/^{46}Ca abundance ratio in certain inclusions of meteorites.
~~Test of the magicity at N=28, direct capture ^{44,46}Ar(n,γ) cross section estimations~~

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