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Study of the Neutron Capture Rate on ^{80}Ge for the r-Process

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The rapid neutron capture process (r-process), which occurs in astrophysical environments with extremely high temperatures and neutron densities, is believed to be responsible for producing roughly half of the elements heavier than iron. During the freeze-out phase of the r-process when temperatures decline and the equilibrium between neutron capture and photodisintegration breaks, individual neutron capture reactions on abundant nuclei becomes crucial, influencing the final nuclear abundance pattern. Sensitivity studies by R. Surman et al. have highlighted that nuclei near closed neutron shells, such as ^{80}Ge, play a pivotal role in determining the abundances in the (A ~ 80) region of the solar abundance pattern.

To reduce uncertainties in the neutron capture rate on ^{80}Ge, the ^{80}Ge(d,p)^{81}Ge neutron transfer reaction in inverse kinematics was measured at Oak Ridge National Laboratory. This experiment provided new spin assignments and spectroscopic factors for low-lying states in ^{81}Ge, resulting in more accurate reaction rate inputs for r-process simulations. As a continuation, lifetime measurements of excited states in both ^{81}Ge and ^{79}Zn have been approved at the RIKEN Nishina Center for Accelerator-Based Science (RNC), Japan. This study aim to measure the properties of low-lying intruder states in N = 49 isotones, enhancing our understanding of nuclear structure in this mass region. Further details on the experimental setup, analysis results, and future plans will be presented in the talk.

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