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New Experimental Approaches for Constraining Neutron Capture Cross Sections in Exotic Nuclei

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The synthesis of heavy elements via the r-process involves extremely neutron-rich nuclei. Compared to light nuclei, our understanding of the properties of heavy, neutron-rich nuclei is sparse. The next-generation radioactive ion beam facilities, like ARIEL (TRIUMF), FAIR (GSI), CARIBU(ANL) and FRIB will offer unique possibilities to probe such nuclei.

I will give an overview about our current and future nuclear astrophysics program with reaccelerated beams at TRIUMF. The new TI-STAR silicon tracker detector, under development at the University of Guelph and TRIUMF, is designed for experiments with heavy, exotic beams at the future ARIEL facility. TI-STAR coupled to the TIGRESS array of HPGe detectors and the new EMMA recoil separator will offer constraining neutron-capture rates in the A=130 key region of r-process nucleosynthesis.

The extraction of neutron capture rates relies on a more model-independent determination of the nuclear level density in heavy nuclei. I present the newly developed "Shape Method" and present new data from an experiment at Argonne National Laboratory using the SuN Total Absorption Spectrometer. I show that we are able to extract a model-independent absolute partial nuclear level density for the short-lived unstable nucleus Kr-88, for the first time. This is an important step towards more reliable neutron capture rate data in exotic nuclei.
This work has been done in collaboration with TRIUMF, MSU, ANL and the "Oslo" group.

email address

dmuecher@triumf.ca

Please select: Experiment or Theory

Experiment

Primary author(s) : Prof. MUECHER , Dennis (University of Guelph)

Presenter(s) : Prof. MUECHER , Dennis (University of Guelph)