^{30}S alpha Resonant Elastic Scattering to Investigate the Astrophysical ^{30}S(alpha,*p*) Reaction Rate

Daid Kahl
The University of Tokyo

Type I x-ray bursts are the most frequent thermonuclear explosions in the galaxy. Owing to their recurrence from known astronomical objects, burst morphology is extensively documented, and they are modeled very successfully as neutron-deficient, thermonuclear runaway on the surface of accreting neutron stars. While reaction networks include hundreds of isotopes and thousands of nuclear processes, only a small subset appear to play a pivotal role. One such reaction is the ^{30}S(alpha,p) reaction, which is believed to be a crucial link in the explosive helium burning that is responsible for the large energy flux. However, very little experimental information is available concerning the reaction rate itself, nor the ^{34}Ar compound nucleus at the relevant energies. We performed the first study of the entrance channel via ^{30}S alpha resonant elastic scattering using a state-of-the-art, low-energy, ^{30}S radioactive ion beam. The measurement was performed in inverse kinematics using a newly-developed active target. An R-matrix analysis of the excitation function reveals previously unknown resonances, including their quantum properties of spin, parity, width, and energy. I then present a newly calculated astrophysical reaction rate.