PHYSICS AND ASTRONOMY COLLOQUIUM

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Direct measurement of 38K(p,g)39Ca at DRAGON

The 38K(p,g)39Ca reaction has been identified as a key reaction in oxygen-neon (ONe) novae, whose nucleosynthesis is thought to end at mass 40. However, there are observations of Ca in nova spectra which deviate significantly from the solar abundance. Currently, it is not known whether this deviation is due to uncertainties in nova modeling or nuclear uncertainties in the Ar-K-Ca region.

The astrophysical rate of 38K(p,g)39Ca is currently estimated from statistical model calculations, with uncertainties of 10^4. In order to reduce these uncertainties, we have measured the strength of three low-lying 5/2+ resonances within the Gamow window. This measurement was performed in inverse kinematics using a radioactive 38K beam from the ISAC-I facility at TRIUMF, with the DRAGON recoil mass separator used to tag 39Ca recoils in coincidence with gamma-rays. This experiment represents a major technical achievement, setting a world record as the highest-mass radiative capture experiment ever performed using a radioactive beam. In this talk, I will present an overview of the experiment and its analysis and show preliminary results on the measured resonance strengths and resonance energies. I will also discuss the astrophysical implications of our results and plans to incorporate them into nova reaction network calculations.

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