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Spectroscopic study on 39-Ca using the 40-Ca(d,t)39-Ca reaction for classical nova endpoint nucleosynthesis

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In classical nova nucleosythesis repeated proton capture reactions and beta-decays produce proton-rich isotopes and the endpoint of this nucleosynthesis typically occurs in nuclei close to A ~ 40. There is currently a discrepancy between the observed and predicted isotopic abundances in this mass region. One particular reaction, 38-K(p,g)39-Ca is important in this regard. Nova simulations show that this reaction can alter the isotopic abundances of 38-Ar, 39-Ar, and 40-Ca significantly when the reaction rate is varied by its maximum uncertainty. Thus, it is important to constrain uncertainties of this reaction rate to accurately predict isotopic abundances.

Although a recent direct measurement has reduced the reaction rate uncertainty, further work is needed to constrain this reaction rate. Specifically, additional measurements to precisely probe the low energy resonances within the Gamow window. To that end, I will present the preliminary results measuring these astrophysically important levels in 39-Ca using the reaction 40-Ca(d,t)39-Ca. The experiment was carried out at the Maier-Leibnitz-Laboratory (MLL) using the 14 MV MP-Tandem accelerator and Quadrupole 3-Dipole (Q3D) magnetic spectrograph.

Primary authors: Dr CHEN, Alan (McMaster University); LIANG, Johnson (McMaster University)

Co-authors: Mr PSALTIS, Athanasios (McMaster University); Mrs FRY, Cathleen (Michigan State University); Dr WREDE, Christopher (Michigan State University); Dr SEILER, Dominik (Technical University Munich); Dr WIRTH, Hans-Friedrich (Ludwig-Maximilians-University Munich); Mr ANGER, Marius (Techinical University Munich); Mr TIWARI, Pranjal (Michigan State University); Dr HERTENBERGER, Ralf (Ludwig-Maximilians-University Munich); Dr BISHOP, Shawn (Technical University Munich); Dr FAESTERMANN, Thomas (Technical University Munich)

Presenter: LIANG, Johnson (McMaster University)

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