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Exploring the *ap*-Process with High Precision (p,t) Reactions

Type 1 X-ray Bursts are identified as thermonuclear explosions on the surface of accreting neutron stars. These bursts can be observed and characterized through their bolometric luminosity curves. In a small number of type 1 X-ray bursts, a double peak structure in the light curve has been observed. This double peak structure lead Fisker et al to propose a nuclear waiting point impedance in the thermonuclear reaction flow of the α p-process, and conclude that uncertainties in (α ,p) reactions rates on these potential waiting points can be directly observed in the structure of X-ray burst light curves [1]. (α ,p) reaction rates on two possible waiting point nuclei, $\langle sup > 26 \langle /sup > Si$ and $\langle sup > 34 \langle /sup > Ar$, were examined by investigating the level structure in the respective compound nucleus, $\langle sup > 30 \langle /sup > S$ and $\langle sup > 38 \langle /sup > Ca$. This was done through high-precision measurements of $\langle sup > 32 \langle /sup > S(p,t) \langle sup > 30 \langle /sup > S$ and $\langle sup > 40 \langle /sup > Ca(p,t) \langle sup > 38 \langle /sup > Ca reactions utilizing the high energy-resolution zero-degree techniques with the K600 spectrometer at iThemba LABS [2]. States above the <math>\alpha$ -threshold have been identified and precise excitation energies were determined. These excitation energies, along with calculated level parameters were then used to determine the reaction rates for the $\langle sup > 26 \langle /sup > Si(\alpha,p)$ and $\langle sup > 34 \langle /sup > Ar(\alpha,p)$ reaction over stellar temperature ranges. Experimental excitation energies along with calculated reactions rates will be presented.

Ref.

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