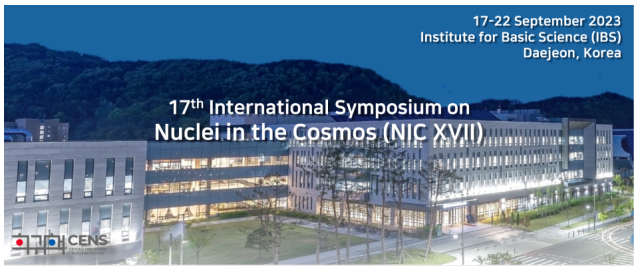

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The Newly Regulated NiCu and GeAs Cycles with the Most Constrained 22Mg(α,p)25Al, 56Ni(p,γ)57Cu, 57Cu(p,γ)58Zn, 64Ge(p,γ)65As, and 65As(p,γ)66Se Reaction Rates for the Accreting Neutron Stars with Periodic and Photospheric Radius Expansion Type I X-Ray Bursts

We use the type-I X-ray burst models, constructed by the one-dimensional multi-zone hydrodynamic KEPLER code [1], and complying with the burst light curves and recurrence times of the observed GS 1826−24 clocked bursts and SAX J1808.4−3658 photospheric radius expansion (PRE) bursts to investigate the combined impact of the latest 22Mg(α,p)25Al [2], 56Ni(p,γ)57Cu [3], 57Cu(p,γ)58Zn [4], 65As(p,γ)66Se [5], and 64Ge(p,γ)65As reaction rates. The latter reaction rate is newly determined for this work. We discuss the implications of these new reaction rates on the respective neutron star compactness, redshift and distance factors, burst fluence, burst peak, recurrence time, Eddington flux, persistent flux, and the extent of nucleosynthesis. We present the impact on the burst frequency of SAX J1808.4−3658 PRE bursts (epoch Oct 2002) based on the pioneering PRE model [6,7], these new rates, and discuss our latest sensitivity study. Photospheric radius expansion bursts have the potential to contribute a significant portion to select light nuclei that may be relevant to galactic chemical evolution due to wind-powered ejection.

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