Neutron star parameter estimation using large grids of multizone X-ray burst models

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In recent years, multizone simulations have been used to successfully model various observed features of thermonuclear X-ray bursts on neutron stars (NS), including recurrence times, burst energies, and lightcurve profiles. Although previous multizone studies have explored the dependence of burst properties on system parameters, and compared individual models with observations, no large-scale parameter estimation has yet been performed. This is a crucial step if burst simulations are to be used for constraining neutron star system parameters. We present a framework for creating large grids of burst models with the KEPLER code, and then iterating over the results with Markov chain Monte Carlo (MCMC) methods. Although multizone models are generally too expensive to calculate "in situ", we can overcome this by pre-computing a grid of simulations, and interpolating the outputs. We present preliminary results using this method to model the famous "clocked burster" GS 1826-24, to obtain constraints on system parameters such as accretion rate, fuel composition, crustal heating, and the NS mass and radius.