THERMONUCLEAR BURSTS FROM MILLISECOND PULSARS: MATCHING OBSERVATIONS WITH MODELS

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Accretion powered millisecond pulsars are neutron stars with weak magnetic fields that are accreting matter from a low mass companion star. These systems are typically transient X-ray sources, and are observed to exhibit coherent X-ray pulsations as well as type I thermonuclear bursts periodically. Observations and numerical models of type I thermonuclear bursts provide crucial information about the conditions required for unstable burning of accreted fuel to occur on the surface of the neutron star that causes these energetic bursts. The most well studied low mass X-ray binary systems that exhibit type I thermonuclear bursts provide crucial test-cases for numerical models of thermonuclear bursts and can be used as standard cases in modeling studies.
We have developed a method to match *Rossi X-ray Timing Explorer (RXTE)* observations of X-Ray sources in outburst with a numerical ignition model to determine best-fit parameters of the system, such as distance/inclination, accretion rate and fuel composition. Our method uses a Python implementation of Markov Chain Monte Carlo (MCMC) to determine the posterior distributions of the parameters of interest and a reference catalogue of standard cases is currently being developed. Once observations are matched with models in detail for many sources, we will be able to explore the underlying nuclear physics of type I thermonuclear bursts, such as assessing the influence of separate nuclear reactions under different conditions.