

Abstract Submitted
for the APR15 Meeting of
The American Physical Society

Fanning the Flames: X-ray Burst Probes of Nuclear Burning

SIMIN MAHMOODIFAR, TOD STROHMAYER, X-ray Astrophysics Laboratory, NASA/GSFC, Greenbelt, MD 20771, USA — Type I X-ray bursts are thermonuclear explosions observed in many accreting neutron stars (NSs) that result from rapid unstable burning of hydrogen and helium accreted onto the surface of the star. During an X-ray burst the X-ray flux rapidly rises by a factor of 10-20 in a couple of seconds and then decays on a longer timescale as the surface of the star cools. Oscillations have been detected during the rise and/or decay of some of these X-ray bursts that have frequencies within a few Hz of the stellar spin frequency and must be due to nonuniform emission from the stellar surface. Here I discuss the results of simulations of the rise and decay of a typical X-ray burst light curve and the evolution of their fractional oscillation amplitudes. We generate light curves using a physical model for a spreading hot spot, taking into account the effect of the Coriolis force (latitude-dependent flame spreading speed), as well as relativistic effects. I will explain how the combination of the light curve and fractional amplitude evolution can constrain the properties of the flame spreading, such as ignition latitude, which would be important for measuring NSs masses and radii using X-ray burst oscillations. I discuss the prospects for future X-ray missions such as ESA's LOFT in this area.

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Date submitted: 09 Jan 2015

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