Contribution ID: **68**

Type: **Contributed Talk**

H-triggered X-ray Bursts on Slowly Accreting Neutron Stars

Thursday 19 June 2025 12:15 (15 minutes)

Many observed neutron stars are in binaries and accrete hydrogen-rich material from low-mass companions. The accumulating matter eventually triggers a thermonuclear runaway that results in an X-ray burst lasting 10–100s with a recurrence time of hours to days. Almost all observed thermonuclear X-ray bursts are thought to be triggered by the thermally unstable triple-alpha process, as most observed bursters are sufficiently hot that hydrogen burning is via the beta-limited, thermally stable hot CNO cycle. Recently, two faint bursts were detected from SAX J1808.4-3658 that were plausibly triggered by thermally unstable CNO burning. If confirmed, this would be the first observation of unstable H burning on an accreting neutron star. Using MESA, a stellar evolution code, we explore the unstable ignition of H on a slowly accreting, cool neutron star over a range of metallicities ($0.01 < Z < 0.30$). Analogous to unstable H ignition in classical novae, we find that the CNO abundance at the base of the accreted layer must be enhanced in order to launch convection and produce a sharp rise and an observable burst. Following this initial burst, our models settle into a long phase of thermally stable, hot CNO burning that produces an extended tail. This tail is also seen in the observed bursts. The tail energetics and duration depend on the CNO abundance in the accreted matter, and thus open a new probe into mixing in the neutron star envelope.

Author: CASTEN, Sierra (Michigan State University)

Co-authors: Dr GUICHANDUT, Simon (McGill University); Dr CUMMING, Andrew (McGill University); Dr BROWN, Edward (Michigan State University)

Presenter: CASTEN, Sierra (Michigan State University)

Session Classification: Stellar Evolution III –Novae and XRBs