Contribution ID: **7** Type: **contributed talk**

Superburst Oscillations

Thursday, 24 May 2018 11:45 (15 minutes)

Accreting neutron stars (NS) can exhibit high frequency modulations in their lightcurves during thermonuclear X-ray bursts, known as burst oscillations. Their frequencies can be offset from the spin frequency of the NS by several Hz (known independently), and can drift by 1-3 Hz. While most burst oscillations have been observed during H/He triggered bursts, there has been one observation of oscillations during a superburst. A plausible explanation for this phenomenon, suggested for H/He triggered bursts, is that a wave exists in the bursting ocean throughout the burst; given the similar physics, one might expect a similar phenomenon during a superburst. The frequency evolution of a buoyant r-mode in a superburst is found to be sensitive to the background parameters, in particular the temperature of the ocean and ignition depth. The rotating frame frequency varies during the burst from 4-14 Hz, and predicts an NS spin frequency 6 Hz higher than the that inferred from an oceanic r-mode model for the H/He triggered burst oscillations. Comparing to the superburst oscillations observed on 4U-1636-536, the calculation also over-predicts the frequency drift during the superburst by 90 %.

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Session Classification: Session M5