Contribution ID: **10** Type: **Talk**

Do Accreting Neutron Stars All Have Identical Crusts?

Wednesday, 30 August 2023 12:30 (30 minutes)

Accretion onto a neutron star induces nuclear reactions which heat the crust. By fitting crust models to the observed thermal evolution of the neutron star after accretion halts and the neutron star enters quiescence, we obtain constraints on the composition and heating of the neutron star crust, notably the crust impurity concentration and the amount of heat deposited per accreted nucleon. Heat deposition in the shallowest layers of the crust is required to fit the early-time cooling as well as to explain the observed recurrence time of superbursts, but the physical mechanism that causes this heating is unknown. It is also unknown whether this shallow heating is constant among different accretion outbursts and different neutron stars and whether different neutron stars have the same crust composition.

We model the thermal evolution of seven neutron stars in which crustal cooling has been observed using the crust cooling code dStar. We estimate the model parameters by performing Markov Chain Monte Carlo fits to the observational data. To test whether model parameters are constant across different outbursts and neutron stars, we perform our analysis first for each neutron star independently, then perform joint fits in which the heat deposition or crust impurity are shared among all neutron stars. We find that models in which the shallow heating is shared across neutron stars fit the data significantly more poorly than those in which it is not shared. This suggests that the shallow heating is indeed different for different neutron stars.

Primary author: GRACE, Justin (Michigan State University)

Co-author: BROWN, Ed (Michigan State University)

Presenter: GRACE, Justin (Michigan State University)

Session Classification: Accreting Neutron Stars