Seismology of accreting white dwarfs

Praphull Kumar and Dean Townsley

The University of Alabama, Tuscaloosa, Alabama, USA

Accreting white dwarfs in Cataclysmic variables (CVs) show short-period (tens of minutes) brightness variations that are consistent with non-radial oscillations similar to those observed in isolated white dwarfs (WDs), known as ZZ Ceti type stars. GW Librae, a dwarf nova, was the first CV in which non-radial oscillations were observed and continues to be the best studied accreting WD displaying these pulsations. These oscillations are thought to be gravity modes (g-modes) based on their periods and similarity to g-modes in isolated WDs. Unlike is observed for isolated WDs, accreting WDs are rotating rapidly, with spin periods comparable to or shorter than typical low-order oscillation frequencies. The relationship between the interior temperature and surface temperature is also different from that in isolated WDs due to the accretion. The surface temperature of an accreting WD is observed to vary significantly on a months to year timescale between dwarf novae accretion events, providing an interesting opportunity to study how this temperature change effects g-mode behavior. In this talk, I will show results from adiabatic seismological calculations for accreting WDs, focusing on low-order ($\ell = 1$) modes including how they vary in response to temperature changes in the subsurface layers due to a dwarf nova accretion event. These calculations include rotation non-perturbatively, as required by the high spin rate. I will discuss the thermal history of these accreting WDs, and compare the seismological properties with and without rotation. Comparison of g-mode frequencies to observed objects may allow inference of features of the internal structure of the WDs such as masses, surface abundance, accretion history, and more. The variation of mode frequencies during cooling after outburst provides a novel method of identifying modes.