Contribution ID: **47** Type: **Invited Talk**

Recent advances in the modeling and nucleosynthesis of classical novae and X-ray bursts

Monday, 9 September 2024 09:25 (25 minutes)

Classical novae are a class of thermonuclear explosions that involve mass-accreting white dwarfs. The low-mass, main sequence companion (or a red giant, particularly for recurrent novae) overfills its Roche lobe and matter flows through the inner Lagrangian point of the system. While most nova simulations have focused on the early stages of the explosion and ejection, it is clear that a fraction of the ejecta will collide, first with the accreting disk that orbits the white dwarf, and later with the secondary star. As a result, part of the ejecta is expected to mix with the outermost layers of the secondary star. The resulting chemical contamination may have potential implications for the next nova cycle, once mass transfer from the secondary resumes. I will present recent advances on possible mixing mechanisms at the core-envelope interface, and will present new hydrodynamic models of recurrent novae, with emphasis on T CrB, a system that should undergo an explosion likely this year.

Type I X-ray bursts are another class of thermonuclear explosions that involve neutron stars rather than white dwarfs. These events constitute the most frequent type of thermonuclear stellar explosion in our Galaxy (the third, in terms of total energy output after novae and supernovae). To date, most of the efforts undertaken in the modeling of XRBs have relied on non-rotating, 1D hydrodynamic simulations. I will present pioneering XRB models computed with different angular velocities (up to 80% of the critical value) and discuss the differences obtained in the lightcurves and in the associated nucleosynthesis with respect to non-rotating models.

It is worth noting that, while all XRB hydro simulations performed to date report that ejection from a neutron star is unlikely, radiation-driven winds during photospheric radius expansion have been suggested to lead to the ejection of a tiny fraction of the accreted envelope. Here, we will report our results of the coupling of a non-relativistic, radiative wind model with a series of XRB hydrodynamic simulations, quantifying the expected contribution of XRBs to the Galactic abundances.

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Session Classification: Explosive Stellar Objects and Nuclear Physics

Track Classification: Explosive Stellar Objects and Nuclear Physics