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”12321” Models of Classical Nova Explosions

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Classical novae are thermonuclear explosions that take place in the envelopes of accreting white dwarfs in stellar binary systems. The material piles up under degenerate conditions, driving a thermonuclear runaway. The energy released by the suite of nuclear processes operating at the envelope heats the material up to peak temperatures of (100 - 400) MK. During these events, about 10-3 - 10-7 solar masses, enriched in CNO and, sometimes, other intermediate-mass elements (e.g., Ne, Na, Mg, Al) are ejected into the interstellar medium.
In this talk, we present new multidimensional simulations of mixing at the core-envelope interface during classical novae, for different masses and chemical compositions of the underlying white dwarf. Accretion of solar composition material onto CO and ONe white dwarfs was initially computed with the 1D hydrodynamic code SHIVA. When the temperature at the core-envelope interface reached 100 MK, the structure was mapped onto a 3D cartesian grid that was subsequently followed with the multidimensional code FLASH (”1 to 3” or “123” models). In this multidimensional framework, Kelvin-Helmholtz instabilities can naturally lead to self-enrichment of the accreted envelope with material from the underlying white dwarf at levels that agree with observations.The final fate of the runaway was followed with SHIVA, remapping the 3D structure onto a 1D grid (”3 to 1” or “321” models), which allows the investigation of the dynamic stages of the explosion.
New nucleosynthesis results, with particular emphasis on the production of 7Li, recently reported from observations of novae, will also be presented.

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