Explosive transients from stellar collisions

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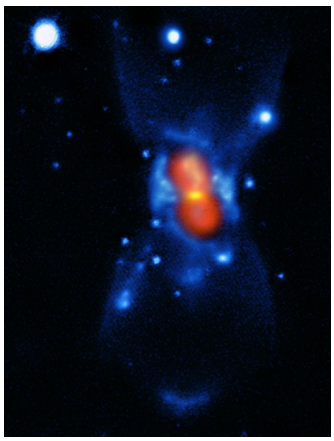
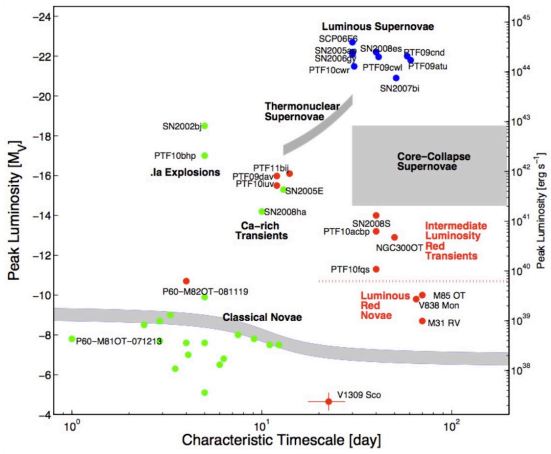
Detection of transient phenomena related to stellar collisions is likely to increase dramatically in this new era of time-domain astronomy. Recent theoretical investigations have highlighted important questions about the effects of different numerical approaches on the outcomes of stellar collisions, e.g. the amount of mixing, the temperature of the shock, the energy released and the amount of nuclear burning.

In this project white dwarf-main sequence (WD-MS) collisions will be investigated to study the collision energetics and the fate of the MS companion - whether it is fully disrupted or not, and if mass is ejected, how much, if any, of it remains bound, for different stellar masses and collision velocities. In addition, we will also compare the results of different numerical approaches (e.g., AMR and SPH). The work will have implications for explosive transients; the hydro-code simulations combined with post-processing radiative transfer tools will be used to make synthetic observables that can be used to identify these collisions in transient survey programs.

For this project students must be comfortable with unix/linux commands and programming (python and/or C/Fortran). Previous experience with computational hydrodynamics and/or radiative transfer will also be very useful. Please email for further details and to make arrangements to discuss the project.





Left: Merger remnant CK Vul with ALMA [T. Kaminski.] Middle: The phase space of observed cosmic explosions [Kasliwal 2011]. Right: HST observation of V838 Mon (remnant of a stellar merger).