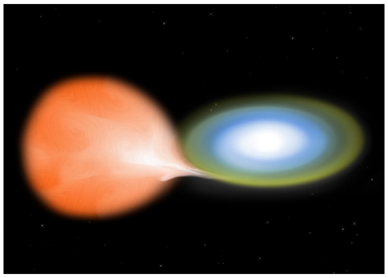
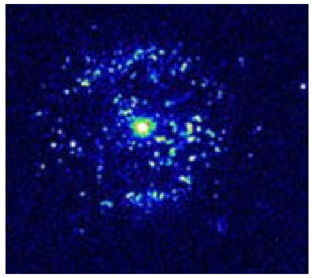
Angular Momentum Loss in Explosive Stellar Binaries

JINA



Cataclysmic Variable[1]



Nova T Pyx[2]

The evolution of compact stellar binaries is driven by the loss of angular momentum from their orbit. The orbit contracts and leads to the transfer of mass which can result in explosive outbursts such as classical novae, x-ray bursts and supernovae. Such objects are relatively rare, compared to stars, and therefore are often quite distant and difficult to study when not in a bright outbursting state. An exception to this is mass-transferring binaries containing a white dwarf star (WD). These binaries are relatively common and can be observed in a fairly detailed manner with modern instruments.

The light emitted from the surface of the WD is released internally by the compression of material due to the addition of mass as well as hydrogen fusion at a very low level. These deep layers have long thermal times and thus respond slowly to the sporadic changes in surface accretion which help make these variables easy to find in the sky. Measurements of the light emitted when the mass transfer is quiescent can thus provide clues about the mass transfer rate averaged over hundreds of thousands of years or more.

By slowly piecing together information about the creation and evolution of these binaries, insights are gained which have important ramifications for the outbursts which they display, and more generally about angular momentum loss in all types of stellar systems. This type of information for binaries is essential for broader interpretation of their outburst properties in terms of nucleosynthetic contributions, observability and frequency, and cosmological inferences from observations of their outbursts.

Townsley, D. M. & Gänsicke, B.T. "Cataclysmic Variable Primary Effective Temperatures: Constraints on Binary Angular Momentum Loss," 2008 ApJ, submitted

Image credit: [1]NASA/CXC/M.Weiss, [2]HST.

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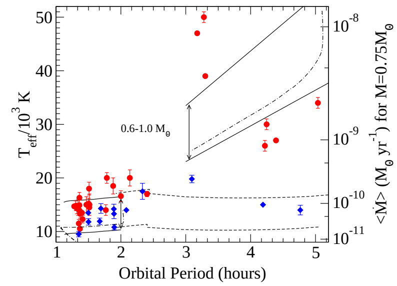
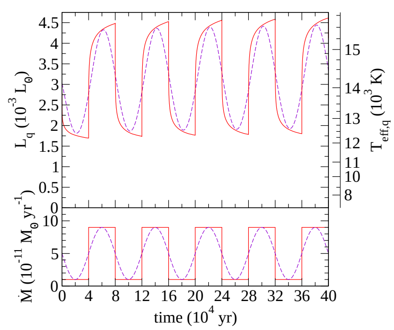
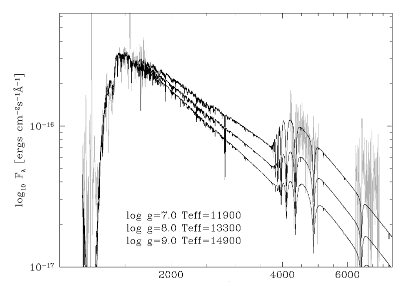


Surface effective temperatures for strongly magnetic binaries (blue) and non-magnetic binaries (red) show a contrast due to different mass transfer rates.



Numerical simulation of response of surface temperature to long-term variations in mass transfer rate.



Optical and UV spectrum of HV Virginis and several candidate model spectra. The deep, broad, absorption which dominates the left quarter of the spectrum is the Lyman α Hydrogen line. From Howell et al. 2002, ApJ, 574, 950.

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