DEFINING CHARACTERISTICS OF FAST NOVAE

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Scrutiny of the light curves of the common novae yields important clues concerning both the nature of the nova outburst and the characteristics of the underlying white dwarfs. Ultraviolet and infrared observations have served to make available essentially complete bolometric light curves for several recent novae. These data confirm our earlier prediction that, following maximum, both fast and slow novae experience an epoch (of varying duration) of substantially hydrostatic evolution defined by thermonuclear burning of the residual hydrogen fuel at constant bolometric luminosity. Theoretical studies reveal that the luminosity during this phase of a nova's evolution is well represented by the Paczynski core mass-luminosity relation for such shell burning configurations involving degenerate stellar cores. This luminosity represents, as well, an increasingly significant fraction of the Eddington luminosity with increasing white dwarf mass.

The distinguishing early spikes in the visual light curves of fast novae are found to be superimposed upon this plateau luminosity and may typically imply photon luminosities well in excess of Eddington. This behavior has been found to be associated with the energy release resulting from positron decays of unstable CNO isotopes occurring in the outer regions of the envelope (where thermonuclear burning contributions to energy generation are negligible) and is thus sensitive to the concentration of CNO nuclei.

That low effective temperatures characterize this luminosity peak testifies to the fact that significant mass outflow has occurred, insuring that a substantial mass exists at large radius. The implied "mass loss luminosity" through the rise to peak light may indeed exceed the photon luminosity, placing even more stringent demands on energy generation.

Numerical hydrodynamic models indicate that CNO concentrations well in excess of solar are demanded to reproduce these defining features of fast nova light curves.

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