ON THE OUTBURST RECURRENCE TIME FOR THE ACCRETION DISK LIMIT CYCLE MECHANISM IN DWARF NOVAE

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Abstract

Cataclysmic variables are binary star systems consisting of a white dwarf primary and a late-type secondary overflowing its Roche lobe and depositing material into an accretion disk surrounding the primary. Dwarf novae are a class of cataclysmic variables exhibiting outbursts of several magnitudes which last for days to weeks and recur on time-scales of months to years. One theory for these semi-periodic eruptions posits that the material in the accretion disk becomes unstable when a certain "critical mass" is reached. Hence, there should exist two distinct stages in the outburst cycle: first, a quiescent period when matter is being stored up, and then an outburst period as material is accreted onto the white dwarf. The amount of matter stored up in the quiescent stage depends on how big the accretion disk is and hence on the orbital period and component masses. These quantities can be related through considering the conservation of angular momentum and the Roche geometry.

In a naive picture, the time between successive outbursts is just the critical mass divided by the rate at which matter is supplied from the secondary. Several groups have recently worked out scalings for this mass (Meyer and Meyer-Hofmeister 1982; Faulkner et al. 1983; Cannizzo and Wheeler 1984). By combining this with an empirical relationship between the average mass-transfer rate and orbital period (Patterson 1984) we predict a theoretical relation between the burst recurrence time and orbital period. We compare our prediction with recurrence times and orbital periods for thirty dwarf nova systems (Ritter 1984). Although the data are not inconsistent with theory they do contain a large intrinsic scatter. We expect that these preliminary findings will be altered significantly when more sophisticated effects are included in the model.

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