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On the Theoretical Orbital Period Distribution of Galactic Novae

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ABSTRACT

Using population synthesis techniques, we analyze the period distribution and properties of galactic novae. Starting with a primordial population of ten million binaries, we determine which systems will ultimately become cataclysmic variables and hence exhibit thermonuclear runaways. The evolution of these particular systems is then followed over the age of the Galaxy. We then compare the observed number of novae within a specific orbital-period range with that predicted by the population synthesis.

Depending on various assumptions, such as the birth rate function and the efficiency of the common envelope phase, we find that the frequency of nova events should be on the order of 50 events per year. This is in agreement with previous theoretical estimates and the observationally inferred rates (once selection effects have been taken into account). Moreover, the observed distribution of novae is in reasonably good agreement with the synthesis results. The drop-off in the number of novae in systems with orbital periods of more than 10 hours is interpreted as being due to mass-transfer instabilities. These instabilities prevent the formation of cataclysmic variables with higher mass donors and consequentially larger orbital periods. We'll also find that although there is approximately an order of magnitude more cataclysmic variables below the 2-3 hour period gap than above it, the number of novae above the gap should be at least a factor of three times more numerous. This result is also consistent with the observations.

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