THE MINIMUM ORBITAL PERIOD OF HYDROGEN-RICH CATACLYSMIC BINARIES

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This communication summarizes the investigations of the relationship between the minimum binary period and the evolution of very short period hydrogen-rich cataclysmic binaries /CB´s/. In the first work /Paczyński, 1981/ some ideas were developed concerning an influence of gravitational radiation on the evolution of CB´s, and some quantitative predictions were done. In the next paper /Paczyński and Sienkiewicz,1981, hereafter referred to as PS/ more detailed numerical calculations were performed. We considered a widely accepted picture of such binaries. They are believed to have a white dwarf primary component surrounded with an accretion disk. The secondary component, probably the lower main sequence star or degenerate dwarf, overflows its Roche lobe, and matter flows from the inner Lagrangian point towards the disk. In all known cases but one, the binary orbits are circular. No hydrogen-rich CB´s are observed with periods below 80 minutes. Because the nuclear evolution cannot be of any importance for the secondary, we assumed that angular momentum loss due to gravitational radiation is the driving force which causes the mass transfer and a cataclysmic activity. We followed the evolution of such system with a very simple and fast code, and the best input physics actually available /PS, Sienkiewicz, 1981/. We have calculated a large number of evolutionary tracks for many values of a total mass of a binary and the initial mass of the secondary.
Because of a transfer of matter, the mass of the secondary decreases and the orbital period initially decreases and later increases passing through minimum while the secondary proceeds from the lower main sequence stage towards a degenerate condition. It should be pointed out, that during this stage the secondary is out of thermal equilibrium.
A value of the minimum orbital period depends on the total mass of CB, an adopted metal content and physics of opacity sources /Paczyński and Sienkiewicz, 1982/. Assuming moderate opacities and gravitational radiation as the only sink of

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angular momentum, we obtained values of the orbital minimum period reasonably close to the observed 80 minutes cutoff. If the rate of angular momentum loss is increased, than the minimum period increases too /Paczyński and Sienkiewicz,1982/. To determine more precisely a value of the minimum orbital period, it is necessary to know more about the metal abundance in CB´s, as well as about opacity sources in the outer layers of very low luminosity stars.

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