A22a Interaction between the Decretion Disk and the Neutron Star in Be/X-Ray Binaries

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We numerically study the evolution of a viscous decretion disk around a Be star in Be/X-ray binaries, using a three-dimensional, Smoothed Particle Hydrodynamics code. For simplicity, the disk is assumed to be isothermal and Shakura-Sunyaev's viscosity prescription is adopted. In such a disk, angular momentum is added to the disk by the viscous torque, whereas it is removed from the disk by the tidal/resonant torque exerted by the neutron star companion, which becomes non-zero only at radii where the ratio between the angular frequency of disk rotation and the angular frequency of the mean binary motion is a rational number. As a result, the disk material decretes outward owing to the transfer of angular momentum by viscosity until the tidal/resonant torque becomes larger than the viscous torque at a resonant radius. Outside this radius, the disk density rapidly decreases. In systems with low eccentricity, the disk is truncated at the 3:1 resonance radius, for which the disk truncation is so efficient that the neutron star cannot accrete enough gas at periastron to show periodic X-ray outbursts. On the other hand, in systems with high orbital eccentricity, the disk truncation occurs at a much higher resonance radius, for which the disk truncation cannot be efficient, allowing the neutron star to capture much more gas at periastron than in systems with low to moderate eccentricity. Such systems are likely to display regular periodic X-ray outbursts. Owing to the interaction with the neutron star with an eccentric orbit, the eccentric mode is excited in the Be-star disk. While the growth rate of the eccentric mode, which is much higher than that in the circular-binary case, depends on the eccentricity of the orbit, the saturated mode strength seems insensitive to the orbital eccentricity.