N20b Two Scenarios for Type I X-Ray Outbursts in Be/X-Ray Binaries

岡崎敦男（北海学園大工）、I. Negueruela (SAX SDC)

Be/X-ray binaries form a major subgroup of high mass X-ray binaries. These are systems consisting of a Be star earlier than B2 and a compact star, presumably a neutron star. The orbit is wide ($P_{\rm orb}$ = several tens of days − several hundred days) and eccentric ($e > 0.3$). Be/X-ray binaries exhibit three types of X-ray activity which suggest a complicated interaction between the Be-star envelope and the neutron star: (1) persistent low-luminosity X-ray emission ($L_X \lesssim 10^{34}\,{\rm erg\,s^{-1}}$), (2) periodical (Type I) X-ray outbursts, coinciding with periastron passage ($L_X \approx 10^{36-37}\,{\rm erg\,s^{-1}}$), and (3) giant (Type II) X-ray outbursts ($L_X \gtrsim 10^{37}\,{\rm erg\,s^{-1}}$), which show no orbital modulation (Stella et al. 1986; see also Negueruela et al. 1998).

In this paper, we study the resonant interaction of a neutron star with a Be disk for seven Be/X-ray binaries for which the orbital parameters are known, assuming that the Be disk is formed by viscous decretion. Comparing the viscous and resonant torques exerted on the disk gas, we find that the Be disk is truncated at a radius which depends on the orbital parameters and viscosity.

Based on this result, we propose the following scenarios for Type I X-ray outbursts in Be/X-ray binaries: In systems with wide orbits like A 0535+26, GROJ 1008−57, and 2S 1845−024, the outer radius of the resonatly-truncated Be disk can expand significantly during the neutron star orbits far from periastron. Such systems will exhibit regular, periodic Type I outbursts around periastron. On the other hand, for systems with close orbits like 4U 0115+63, V 0332+53, and 2S 1417−619, we expect no Type I outbursts as long as the disk is axisymmetric. Be disks, however, often suffer global $m = 1$ perturbations and become elongated. If the $m = 1$ perturbation makes the disk elongated toward periastron by chance, the Roche lobe overflow can occur around periastron passage. Such systems will, then, show transient and/or irregular Type I outbursts.