W126a Tidal tearing of highly misaligned circumstellar disks in X-ray/gamma-ray binaries

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About a half of high-mass X-ray binaries host a Be star [an OB star with a viscous *decretion* (slowly outflowing) disk]. These Be/X-ray binaries exhibit two types of X-ray outbursts (Stella et al. 1986), normal X-ray outbursts ($L_{\rm X} \sim 10^{36-37}\,{\rm erg\ s^{-1}}$), which occurs at the interval of the orbital period (10−300 d), and giant X-ray outbursts ($L_{\rm X} > 10^{37}\,{\rm erg\ s^{-1}}$), the interval of which ranges from a few years to more than a few decades. The origin of giant X-ray outbursts is unknown. On the other hand, a half of gamma-ray binaries have a Be star as the optical counterpart. One of these systems [LS I +61 303 ($P_{\rm orb} = 26.5$ d)] shows the *superorbital* (1,667 d) modulation in radio through X-ray bands. No consensus has been obtained for its origin.

In this talk, we report on the cyclic evolution of highly misaligned Be disks in short-period Be/X-ray and gamma-ray binaries, on the basis of 3D hydrodynamic simulations. Each cycle consists of the following stages: 1) As the Be disk grows with time, the initially circular disk becomes eccentric by the Kozai-Lidov mechanism. 2) At some point, the disk is tidally torn off near the base and starts precession. 3) Due to precession, a gap opens between the disk base and mass ejection region, which allows the formation of a new disk in the stellar equatorial plane. 4) The newly formed disk finally replaces the precessing old disk.

We discuss the possibility that this cyclic disk evolution is responsible for both the giant X-ray outbursts of Be/X-ray binaries and the superorbital modulation in the gamma-ray binary LS I +61 303.