W27a Short Timescales of Normal X-ray Outbursts in Be/X-ray Binaries Investigated Through Hydrodynamical Simulations

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Be/X-ray binaries are a class of X-ray transients consisting of a Be star, characterized by a circumstellar disk, and a neutron star. Typically quiescent in X-rays, these systems occasionally exhibit outbursts caused by the neutron star accreting material from the Be star's disk. Based on the peak X-ray luminosity ($L_{\rm X}$), these outbursts are categorized as normal (Type I) outbursts ($L_{\rm X} \leq 10^{37}\,{\rm erg\,s^{-1}}$), lasting a small fraction of the orbital period, or giant (Type II) outbursts ($L_{\rm X} > 10^{37}\,{\rm erg\,s^{-1}}$), which typically persist for several tens of days, sometimes exceeding one orbital period (e.g., Reig 2011).

The short duration of normal outbursts presents a challenge, as it is much shorter than the viscous timescale of a standard accretion disk. Okazaki, Hayasaki & Moritani (2013) proposed that these events may involve Radiatively Inefficient Accretion Flows (RIAFs). However, the possibility of standard accretion flows cannot yet be excluded. This study explores an alternative explanation that the rapid dispersal of the accretion flow by the Be star's wind accounts for the short outburst timescales. Through hydrodynamical simulations, we examine the interaction between the stellar wind and accretion flow in Be/X-ray binaries, offering new insights into this phenomenon.