Variability in the light curve of tidal disruption events†

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The X-ray light curve of Sw J1644+57 indicates this event would be due to a tidal disruption. The lightcurve shows large amplitude fluctuation. As proposed by Lyubarskii (1997), the aperiodic variability observed in the Galactic X-ray binaries and active galactic nuclei is likely from the fluctuation of the viscous parameter in their disks. We explain the significant fluctuation of the late X-ray lightcurve ($t > 10^6$ seconds) of Sw J1644+57 with this model. We assume the stochastic variations in the viscous parameter featuring as $\alpha(R, t) = \alpha_0 [1 + \beta(R, t)]$, where the time-scale for varying $\beta(R, t)$ is set as ten times of the dynamic time-scale for disk at the radius $R$ (Janiuk & Misra 2012). Based on the simulation results of Lodato et al. (2009), we describe the fallback behavior of the tidal disruption as $\dot{M}_{fb} \propto \left\{ \left[ (t-t_b)/t_{fb} \right]^{\kappa n} + \left[ (t-t_b)/t_{fb} \right]^{5n/3} \right\}^{-1/n}$ for $t > t_b$ and $\dot{M}_{fb} = 0$ for other situations, where $\kappa = 10.0$, $n = 0.5$, $t_{fb} = 10^3 \tau$, and $t_b = 10^2 \tau$ in which $\tau = 2\pi (R_f^5/GM_{BH})^{1/2}$ and $R_f = 5r_g$ is the pericentre distance. Figure 1 compare the power-density spectra (PDS) derived from the observed and our simulated lightcurves. It is found the our simulations are well consistent with the observations.

Keywords. accretion, accretion disks - black hole physics - galaxies: nuclei - X-rays: binaries

References

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