Discovery of a New Tidal Disruption Event Candidate from the 2XMM Catalog

Dacheng Lin(dlin@cesr.fr), Eleazar R. Carrasco, Dirk Grupe, Natalie A. Webb, Didier Barret, & Sean A. Farrell
1. Institut de Recherche en Astrophysique et Planétologie, France; 2. Gemini Observatory, Southern Operation Center, Chile; 3. Pennsylvania State University, USA; 4. The University of Sydney, Australia

1. Introduction

Stars approaching supermassive black hole (SMBHs) can be tidally disrupted and subsequently accreted. Such events provide a unique way to find and study dormant SMBHs believed to reside in many galaxies. About a dozen of such event candidates are found, with peak spectra typically soft (~0.04-0.1 keV) and luminosities up to 10^{44} erg/s. We report our discovery of a new candidate, with two ultrasoft X-ray spectra of unprecedented quality near the peak (Lin et al. 2011, ApJ in press, arXiv:1106.0744).

2. A New Candidate: 2XMMi J184725.1-631724

(1) Lying toward the center of a galaxy (z=0.0353, Figure 2), which is inactive: no clear optical emission lines but typical stellar absorption features (Figure 3).

(2) An X-ray transient source. It was detected serendipitously in two XMM-Newton observations (XMM1 and XMM2 in Figure 4), but not in a ROSAT observation in 1992 or a Swift observation in 2011.

(3) Ultrasoft X-ray spectra. Both XMM-Newton spectra can be described by a strong thermal disk plus a weak power law (Figure 5). The disk temperatures (~0.07-0.1 keV) and luminosities are consistent with \( L \propto T^4 \), similar to BH X-ray binaries in the thermal state but for a SMBH of \( \sim 10^6 M_\odot \).

(4) Fast X-ray variability. Both XMM-Newton observations show large variability, with rms values about 21% on timescales of hours (Figure 7). The disk temperature is found to increase with the flux, implying a possible explanation for the fast variability: it is due to the fast variation of the accretion rate caused by shocks during tidal disruption of the star.

3. Conclusion

2XMMi J184725.1-631724 is an ultrasoft X-ray transient, with peak luminosity near 10^{44} erg/s and lying toward the center of an inactive galaxy, thus probably a tidal disruption event. From its two ultrasoft X-ray observations near the peak of unprecedented quality, we gain more insights into such events: (a) Near the flare peak, the disk luminosity appears to follow \( L \propto T^4 \), similar to BH X-ray binaries in the thermal state but for a SMBH; (b) Large variability on timescales of hours are seen, probably due to fast variations in the mass accretion rate caused by shocks during tidal disruption of the star.