Flares on Young Stellar Objects in the ρ Oph Star Forming Region

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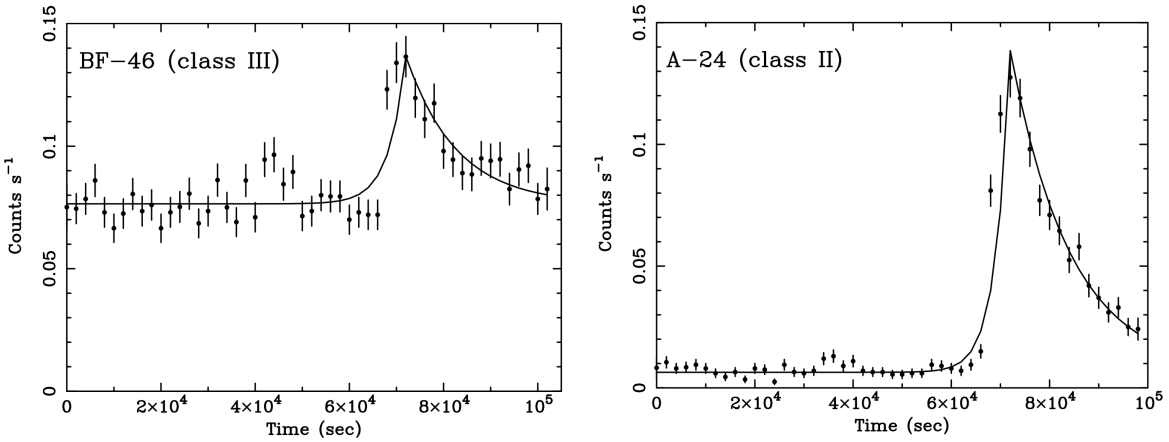
We propose that K2 monitor flares on 13 young stellar objects (YSOs) in the ρ Oph star-forming region. Chandra observed flares lasting hours on these targets. K2 will monitor them 32 times longer than Chandra, collecting hundreds of flares. With K2 data, we will determine flare energy, decay timescale, occurrence rate, and compare to older K and M dwarfs. We will also obtain rotation periods, which are a key input to stellar dynamo models.

Our sample consists of Class II and III YSOs with spectral type K or M, except for one embedded B star. Magnetic reconnection flares from the tenuous coronal plasma suggest loop lengths sufficient to connect the star with a planet-forming disk; the counterpart optical flares constrain the fraction of the stellar surface involved.

The figures below from Imanishi et al. (2003, PASJ, 55, 653) show Chandra flares for our brightest and second faintest targets. The 2000 s time bins are comparable to Kepler long cadence data. These flares would be similar length in the Kepler band pass, which includes impulsive continuum and gradual Balmer lines. Kepler has observed numerous large "super flares" (e.g., Shibayama et al. 2013, ApJS, 209, 5). We request 1 minute data for our brightest Class II source to explore shorter flares.



Imanishi et al. (2003) used two 100 ks Chandra observations to detect 71 X-ray flares from 52 YSOs in the ρ Oph star-forming region. The X-ray flare sources tend to be deeply embedded, leading to very high visual extinction. Only 13 of the 52 YSOs are bright enough to be observed by Kepler. Because our sample consists of stars known to have large X-ray flares, the flare frequency should be high.

We calculated Kepler magnitude (Kp) from Pan-STARRS (PS1) g and r photometry, using a relationship we calibrated using 182,367 KIC stars (CQ=SCP) in the Kepler field. For our targets, EPIC values of Kp extrapolated from J are often too bright because EPIC underestimates visual extinction towards our targets. In the target file, we adopt Kp from PS1 brightened by 2 magnitudes to allow for flare variability.