

A TESS Monitoring Survey of Young Intermediate-Mass Stars

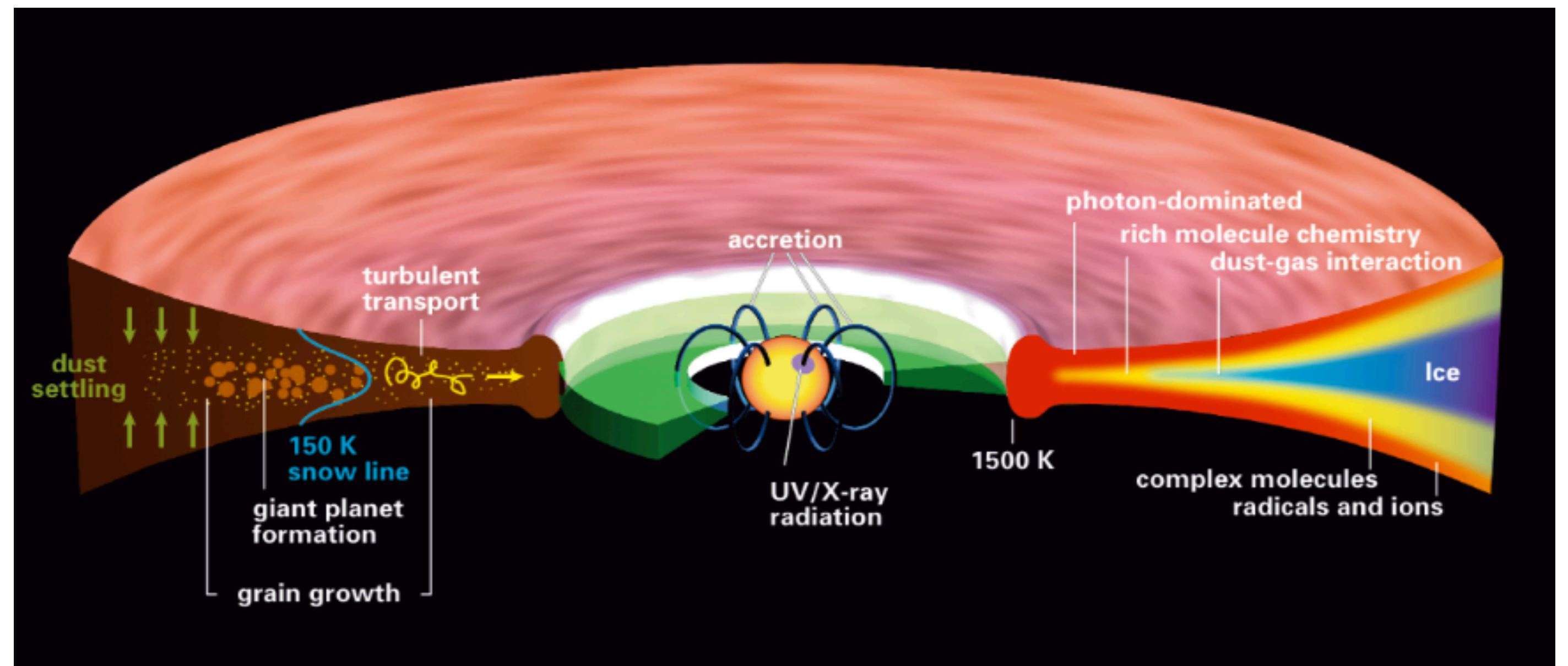
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Summary: One of the many types of targets observed by TESS are young stars in clusters and associations. With the mission's focus on relatively bright sources, observations of the more massive Herbig Ae/Be stars (HAeBes) are leading to a unique set of high-precision light curves. Hundreds of HAeBes appear in TESS's fields of view during its first two years of observation. We are undertaking a comprehensive photometric monitoring survey of these objects and their diskless cousins. The goals of our survey include a study of variability patterns and relationship to circumstellar material among HAeBes, a search for transiting planets and eclipsing binaries, as well as an assessment of the presence of starspots.

TESS Targets:

Herbig Ae/Be (HAeBe) emission line stars are young accreting sources with masses at or above $\sim 1.5 M_{\odot}$. They are typically located in obscured regions, surrounded by nebulosity. These objects have infrared excesses indicative of a disk, as shown at right. We have mined the literature for known HAeBes; our current preliminary sample of 65 is derived from Thé et al. (1994) with additional targets from Hernández et al. (2005). We capitalize on their brightness ($V \sim 8-15$), which is optimal for TESS observations. HAeBe stars have been observed at 30-minute cadence thus far in sectors 5—7 and 10 – 12.

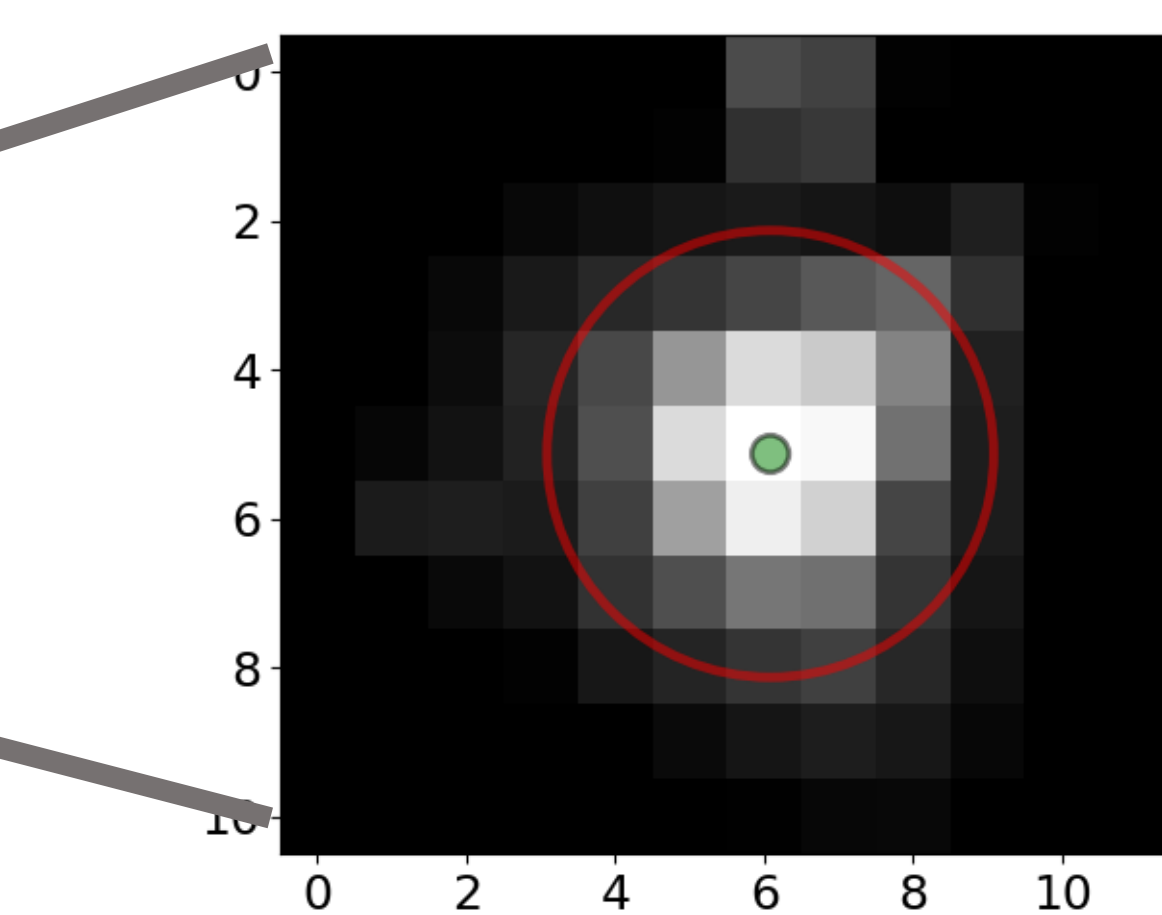


Schematic of a young star with disk. (Henning & Semenov 2013)
Higher mass stars may have fundamentally different accretion and inner disk geometry as compared to those that are solar mass and below.

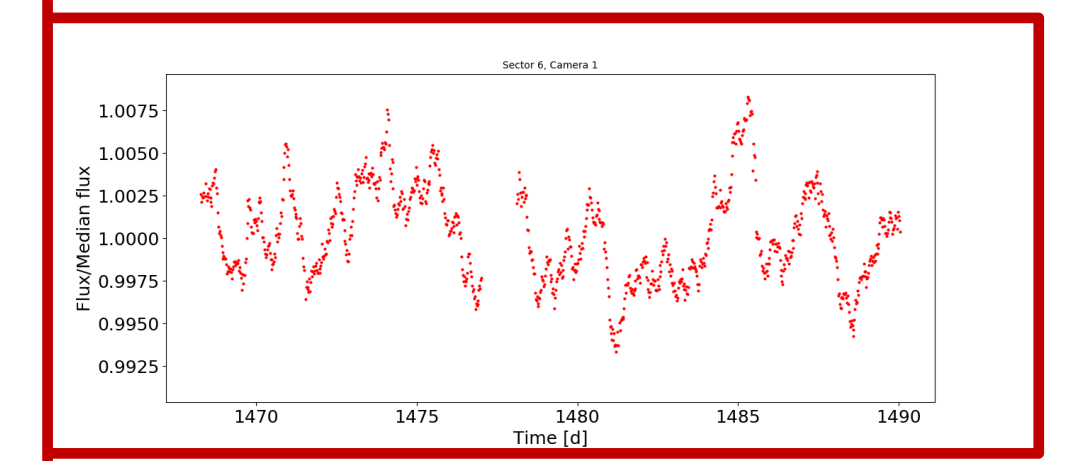
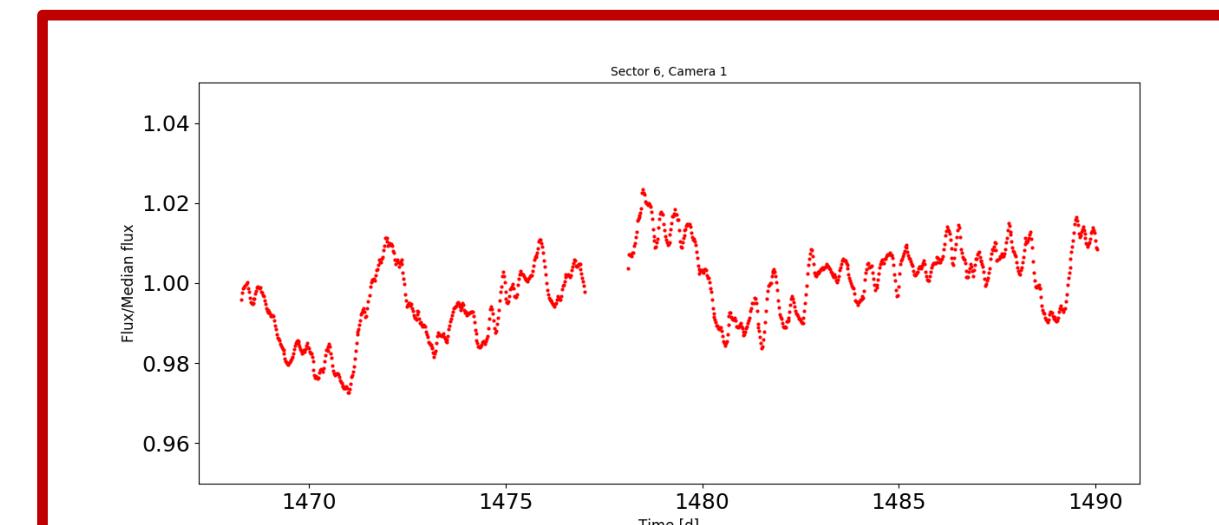
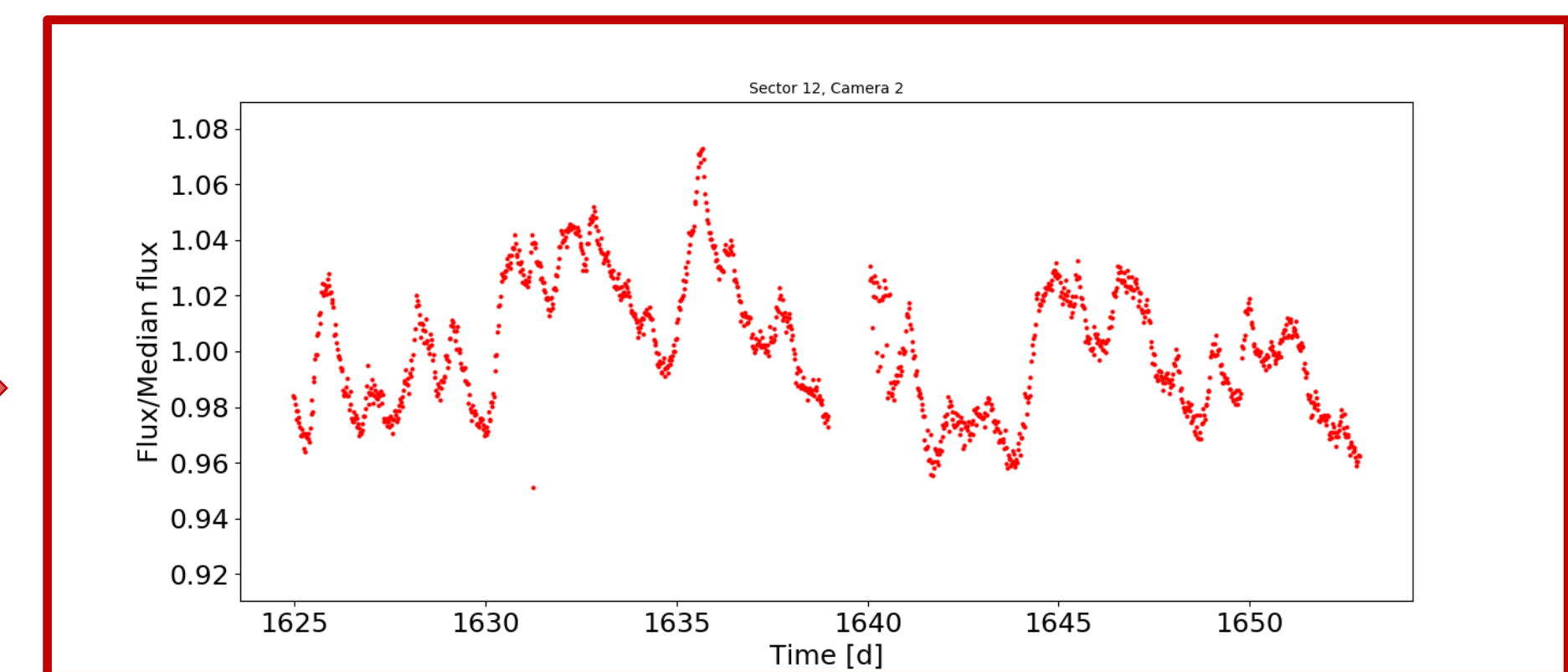


A typical Herbig star: surrounded by nebulosity and low-mass stars, but bright enough to dominate the photometry.

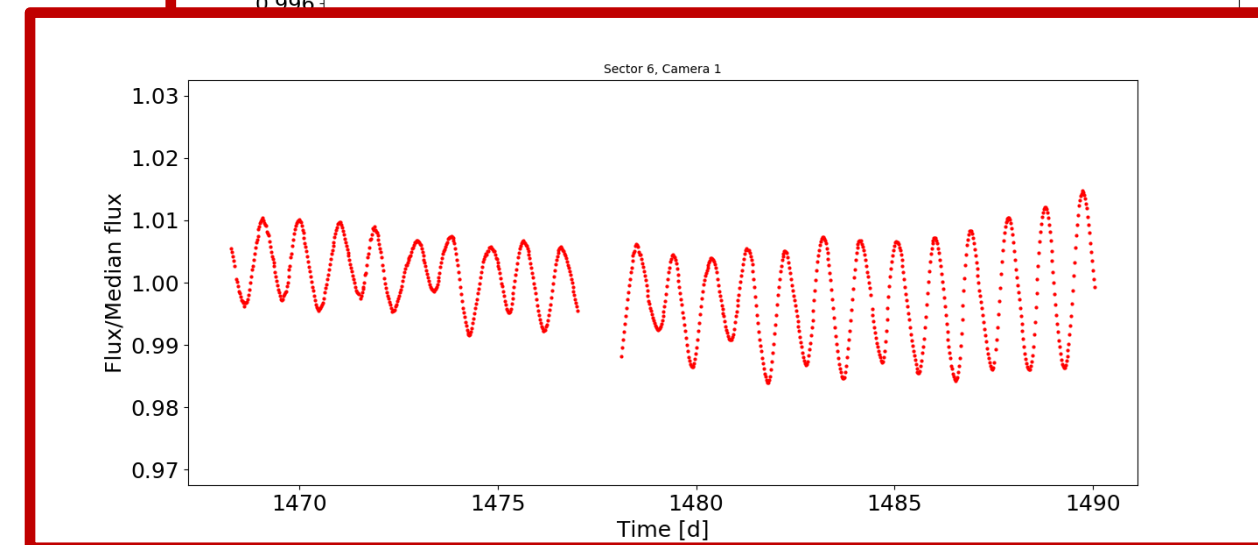
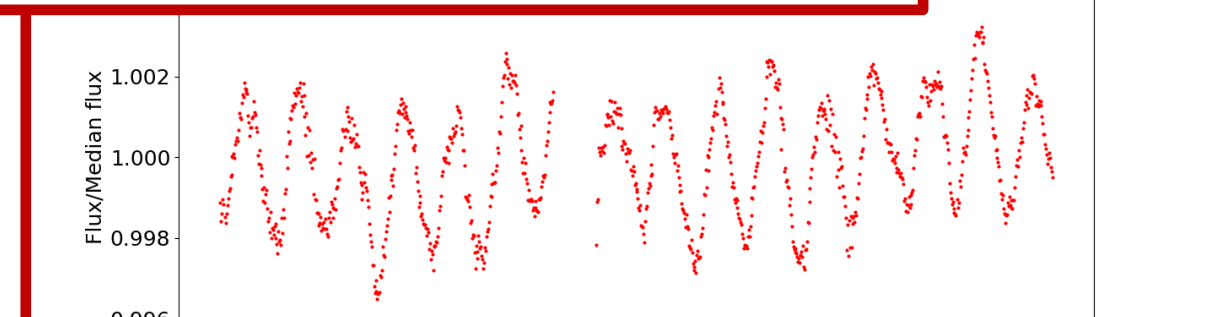
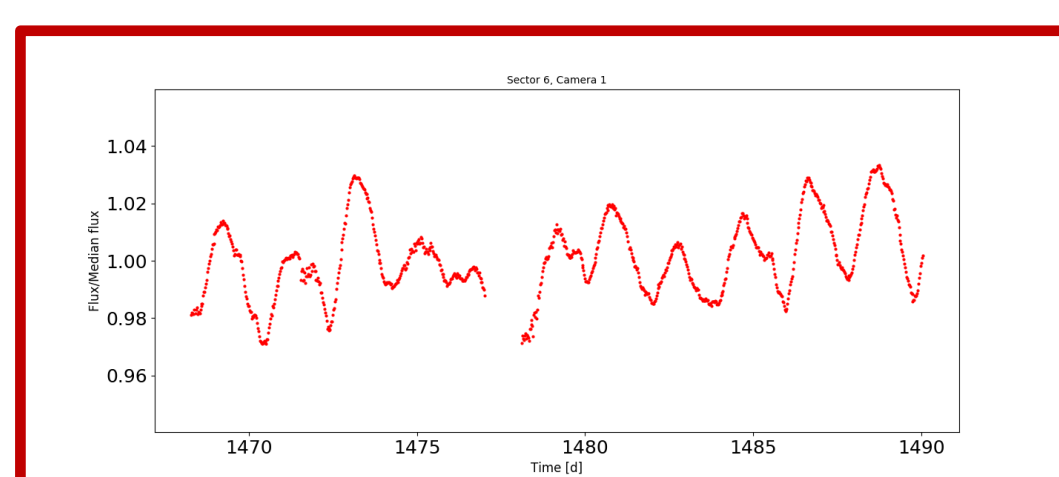
From Image to Light Curve



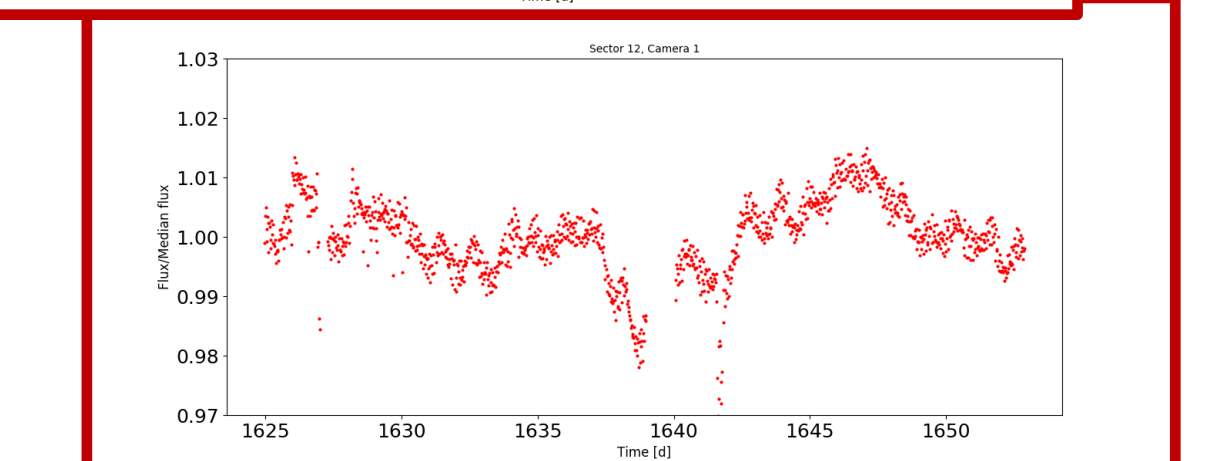
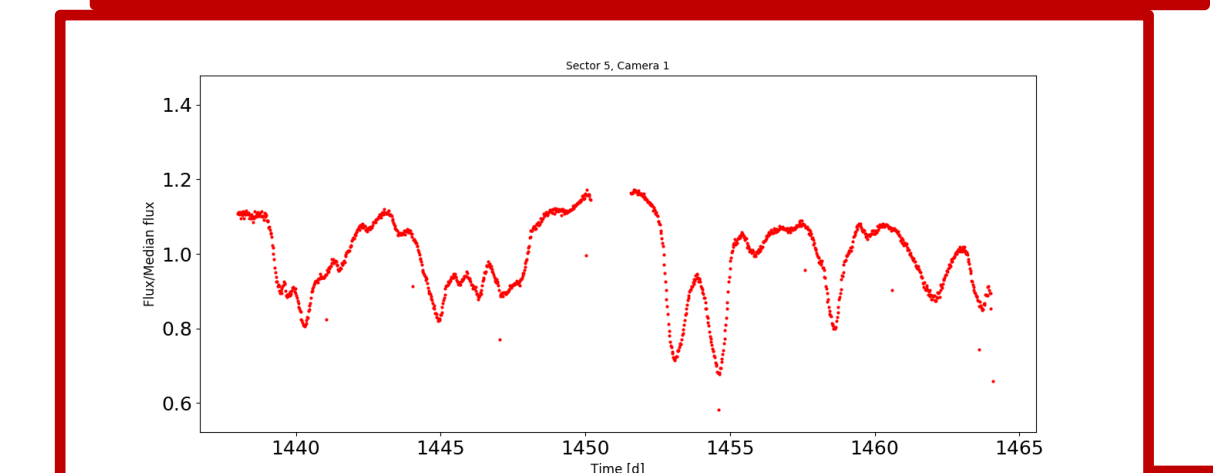
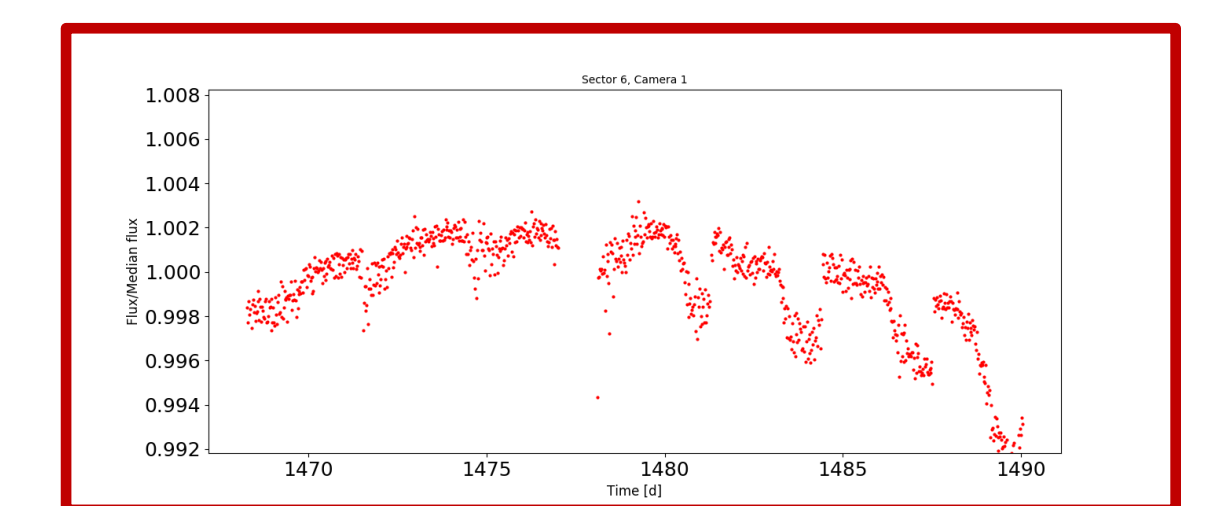
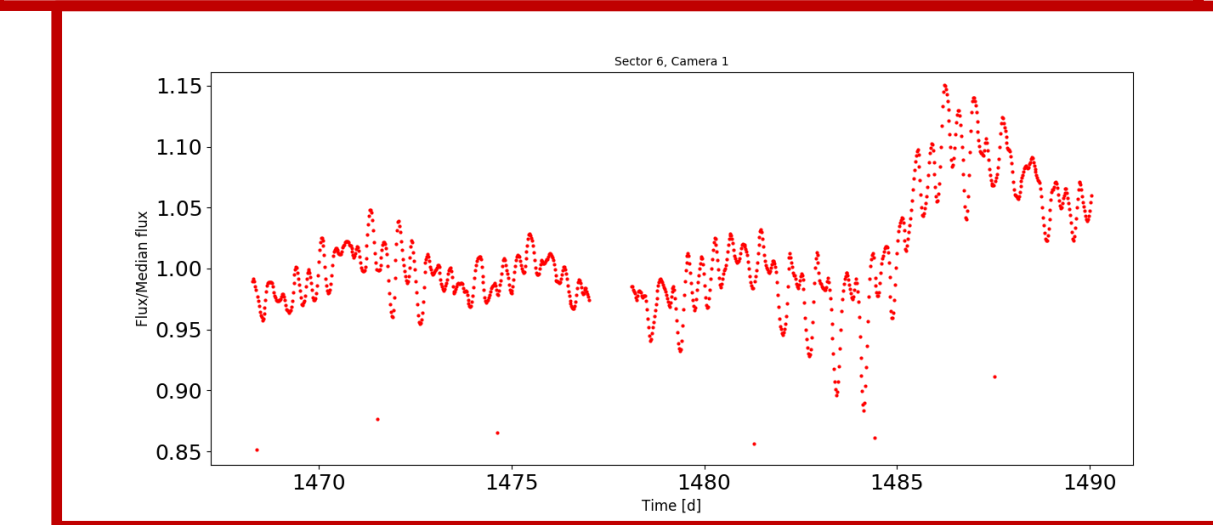
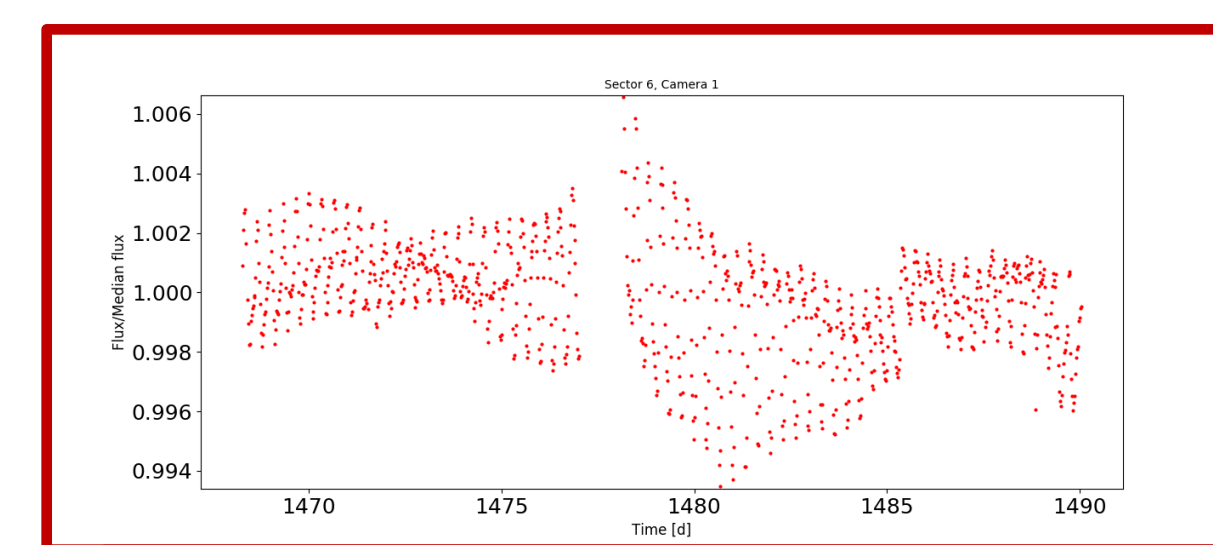
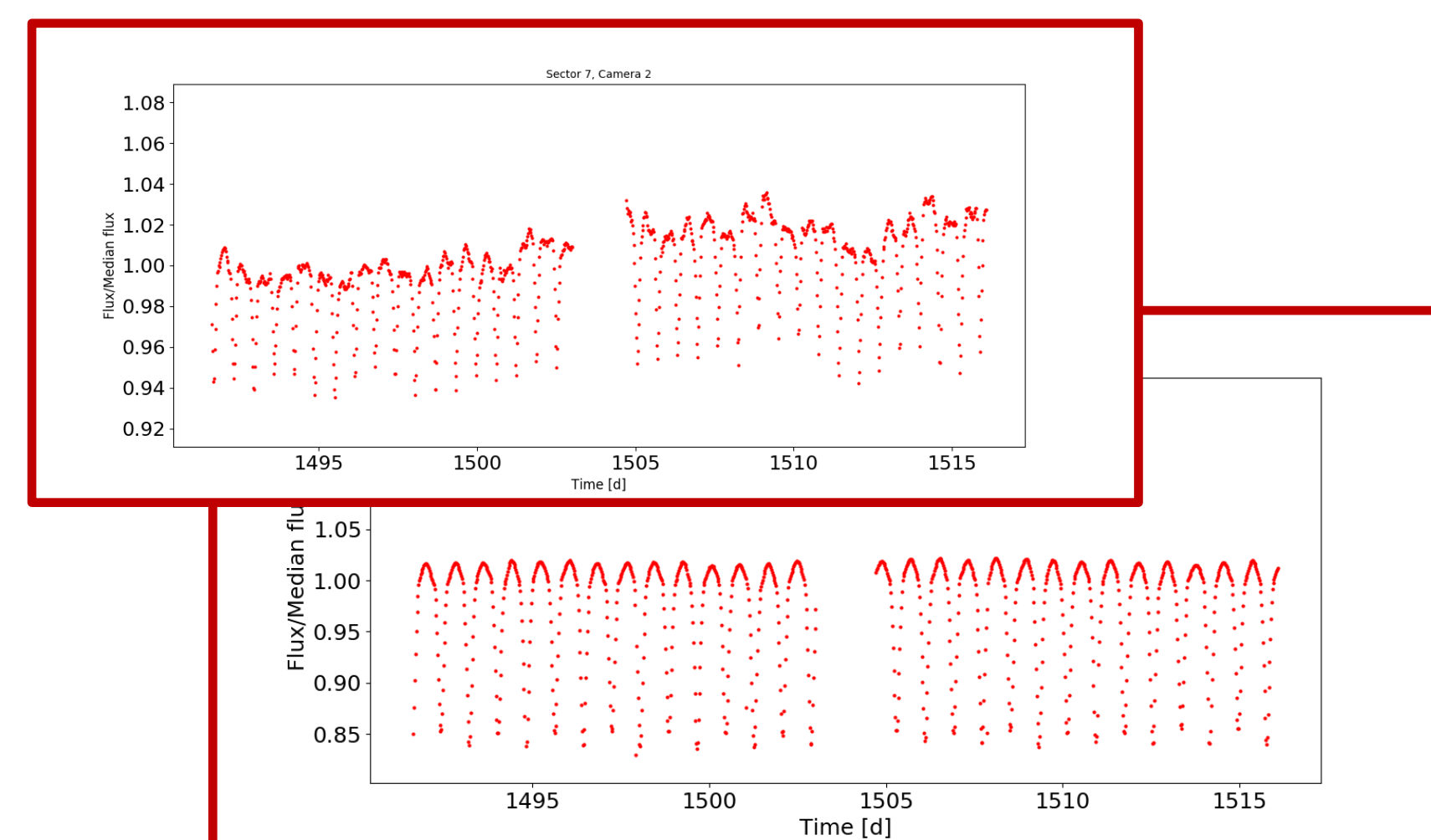
- Create custom target pixel files using the *astrocut* Python code
- Place a circular aperture on the star's position as given by the WCS.
- Sum the flux in 1-4 pixel apertures



▪ Stochastic accretion



We find...



▪ Starspot modulation

▪ Eclipsing binaries

▪ Pulsation?

▪ Obscuration?

Comparison with Low-mass Stars Monitored with other Space Telescopes

Herbig Ae/Be stars have inner disk edges at larger distance from the stellar surface; accretion geometry may also differ from that of lower mass stars. We believe that these differences are being borne out in the lack of short-timescale “dipper” stars in this sample, and the dominance of stochastic behavior that is likely tied to accretion.

Future Plans:

- Add in the northern hemisphere sample of HAeBes
- Conduct simultaneous multiband and spectropolarimetric monitoring
- Identify diskless intermediate mass stars for rotation studies and eclipse/transit searches