Stellar activity, accretion, and chronometry in the UV

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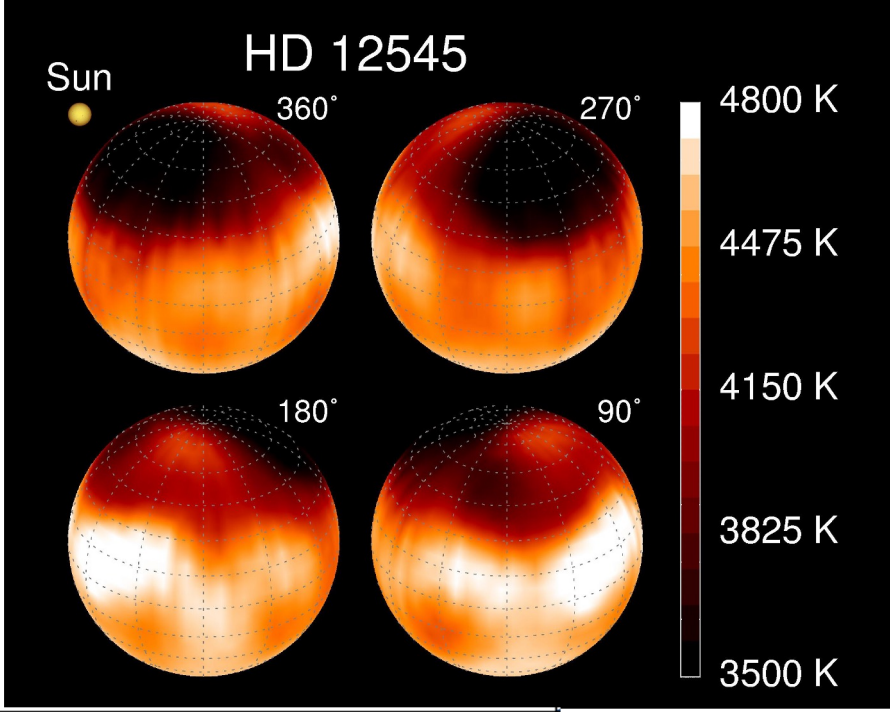
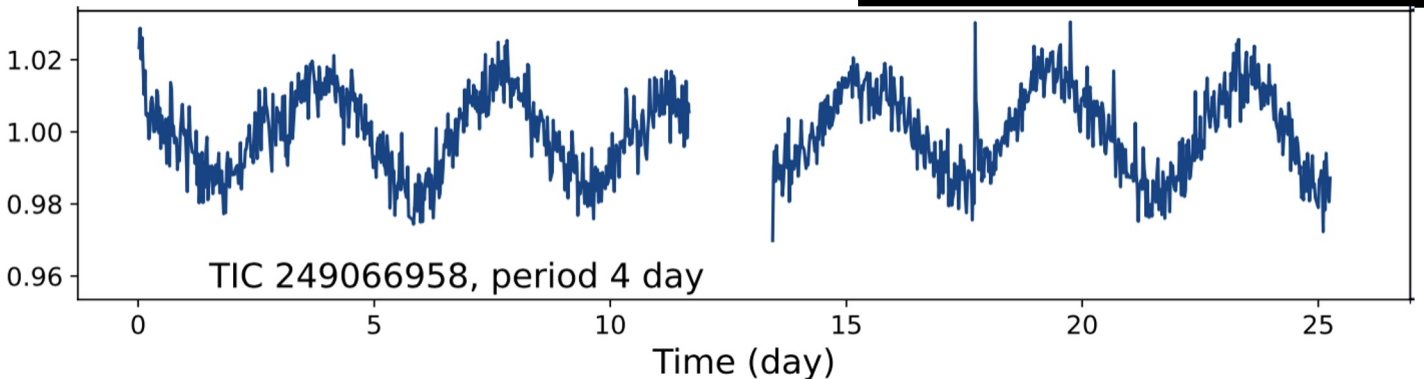
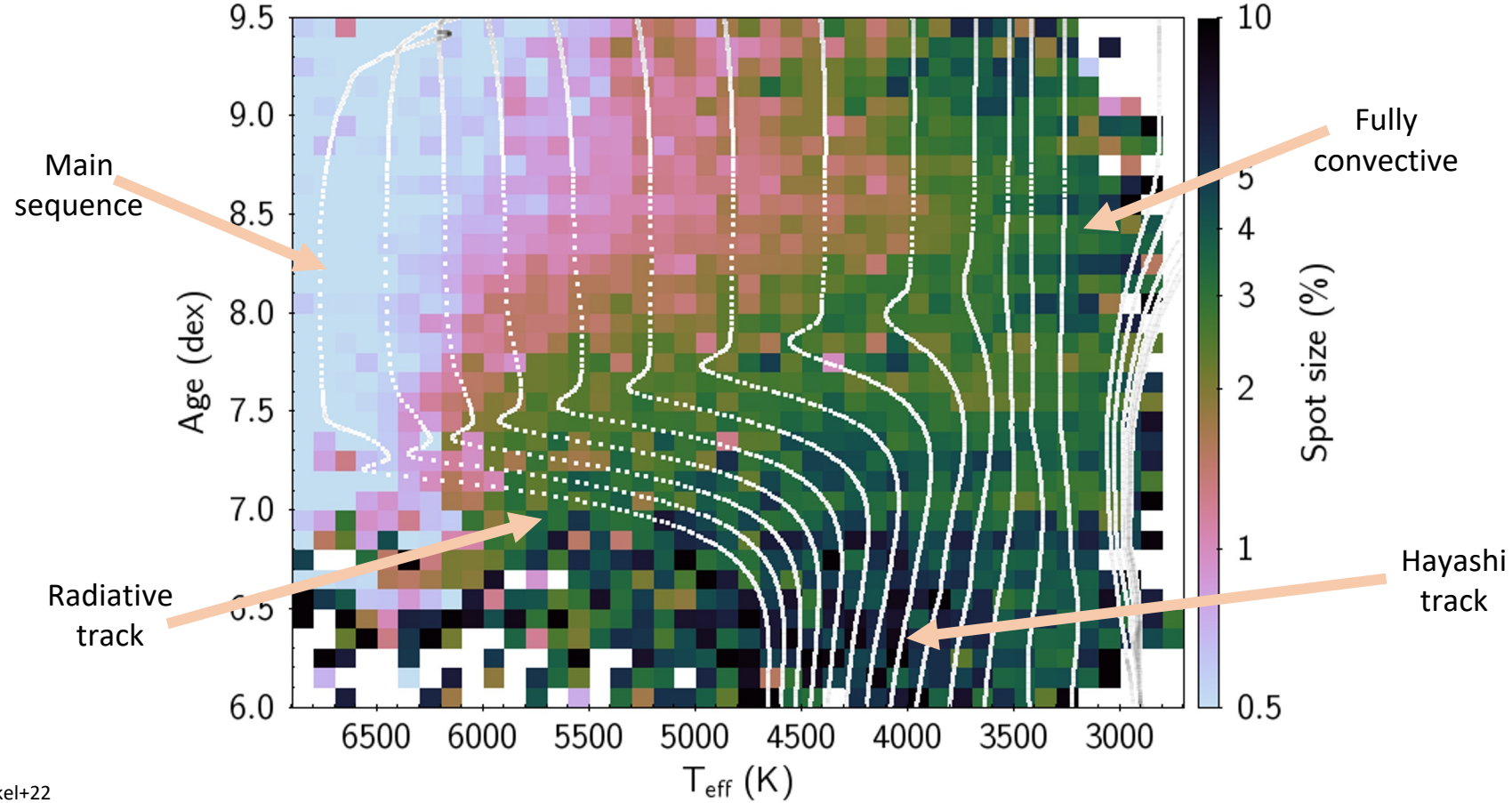
Rotating variables





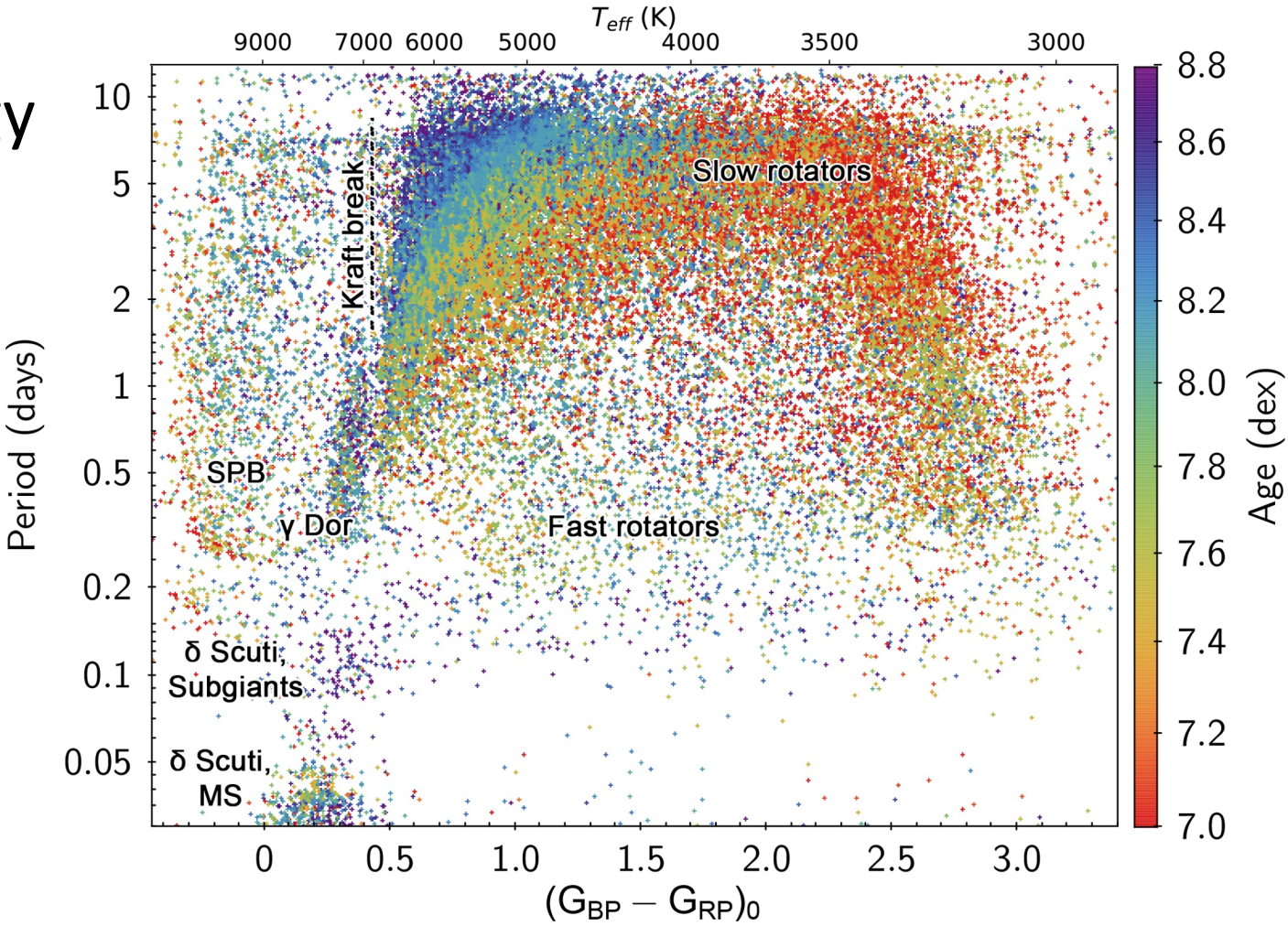
Spot coverage decreases with age



Kounkel+22

Gyrochronology

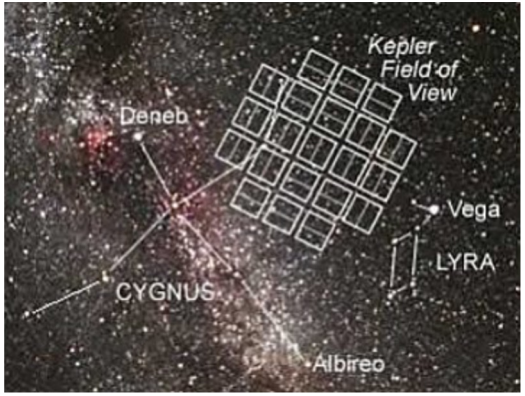
- As stars age, they spin down their rotation from magnetic dragging
- In future, measuring rotational period will allow estimating ages of stars

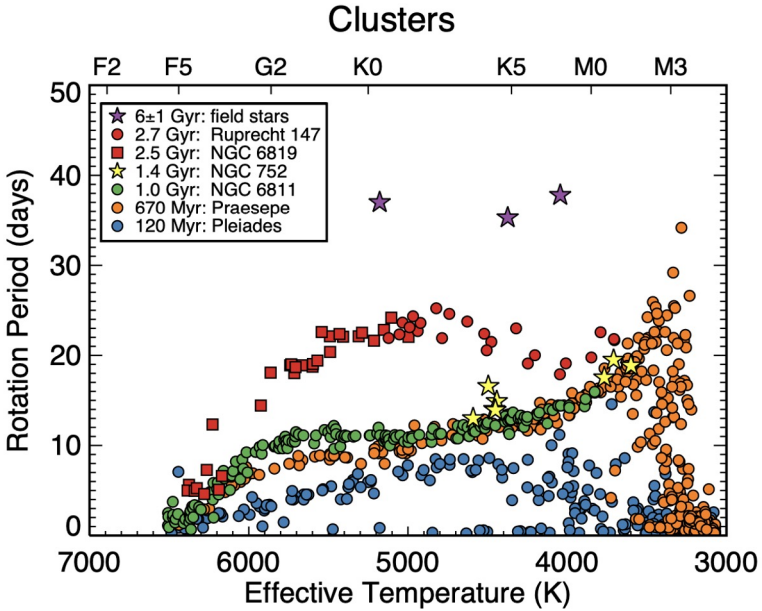


Kounkel+22

Searching for variable stars with Kepler

- Full coverage of the period space
- 34,000 rotating variables
- Only 115 sq. deg field
  - Only sparce calibration data for gyrochronology

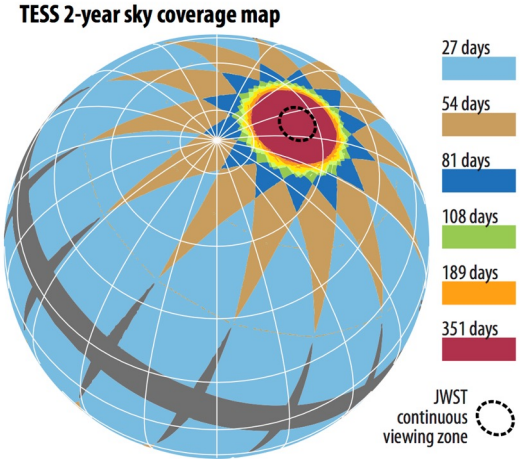


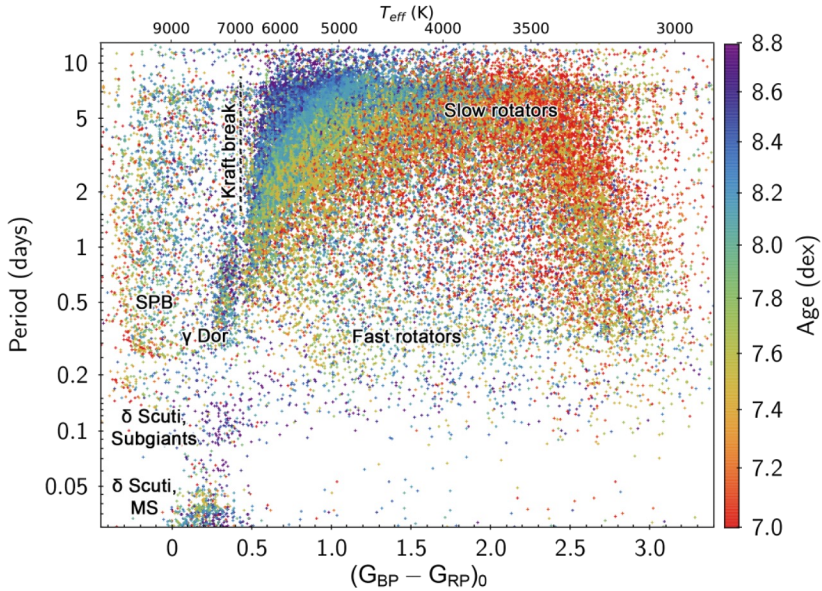


Curtis+20

Searching for variable stars with TESS

- Almost complete sky coverage
- Only 27 day baseline
  - Difficult to measure rotation periods longer than 12 days
  - Missing 92% of variables

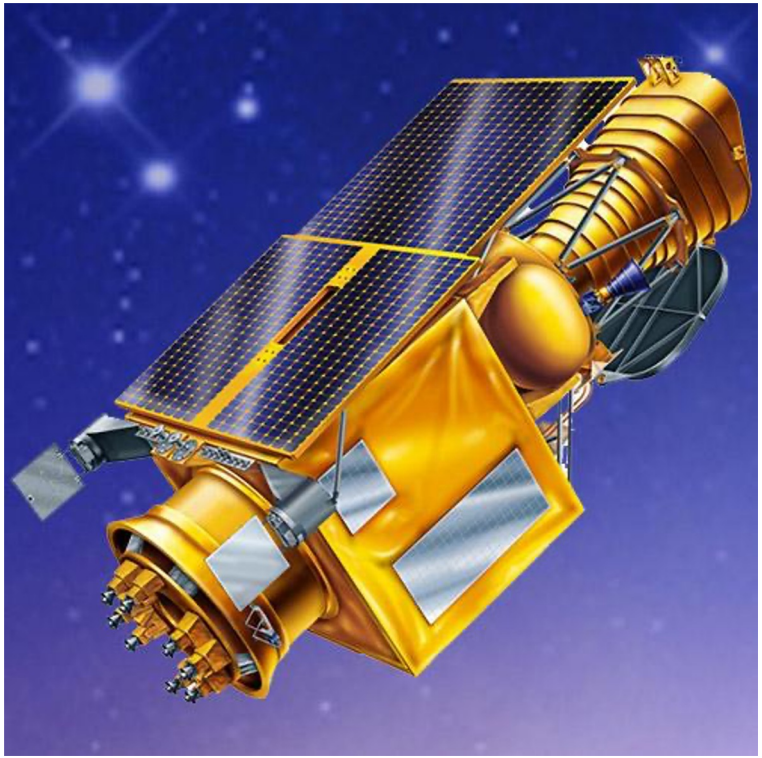




Kounkel+22

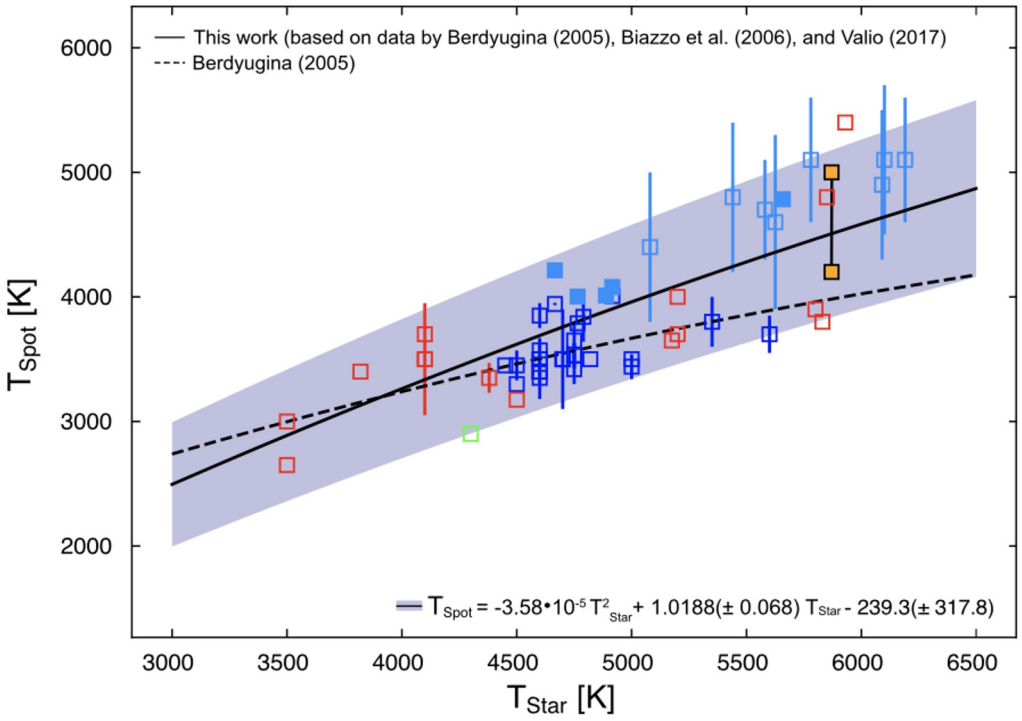
Searching for variable stars with ULTRASAT

- Best of both worlds:
  - 4 day cadence is perfect to measure periods of long period rotators
  - Area of coverage ~20 times of Kepler



Spot properties

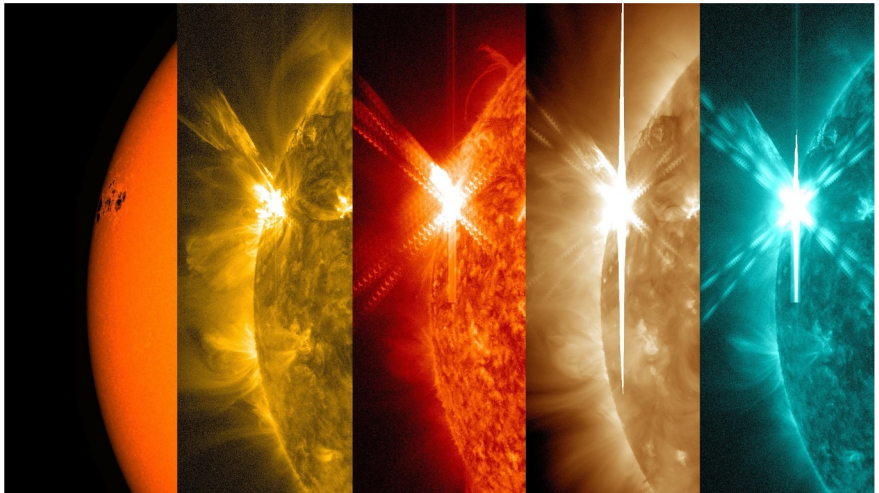
- Only a handful of stars have independently derived spot temperatures
- Difference in color between ULTRASAT and TESS will significantly increase the census

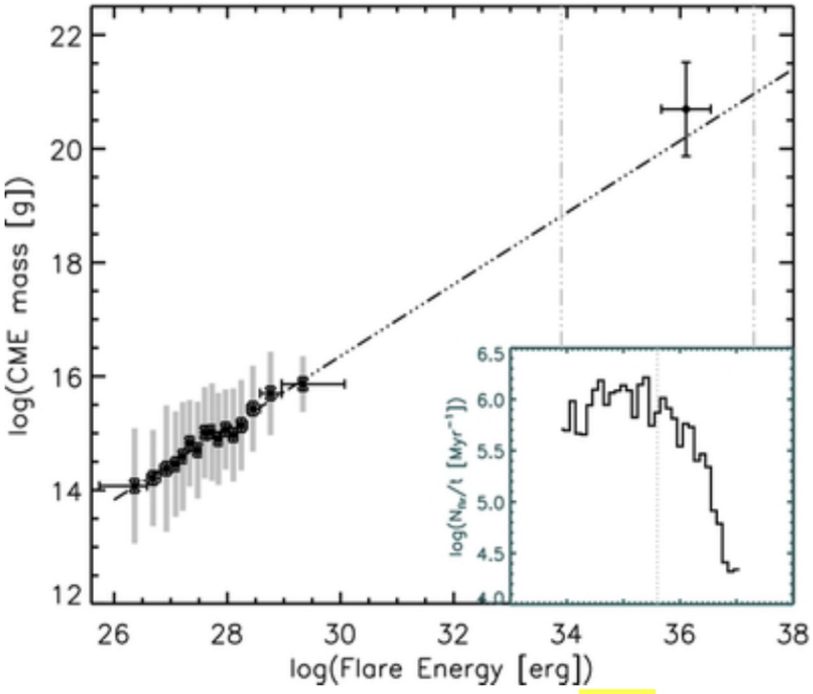


Herbst+21

Flares

- Flares are 15 times brighter in UV than in optical
- Evolution of flare properties as a function of age and mass

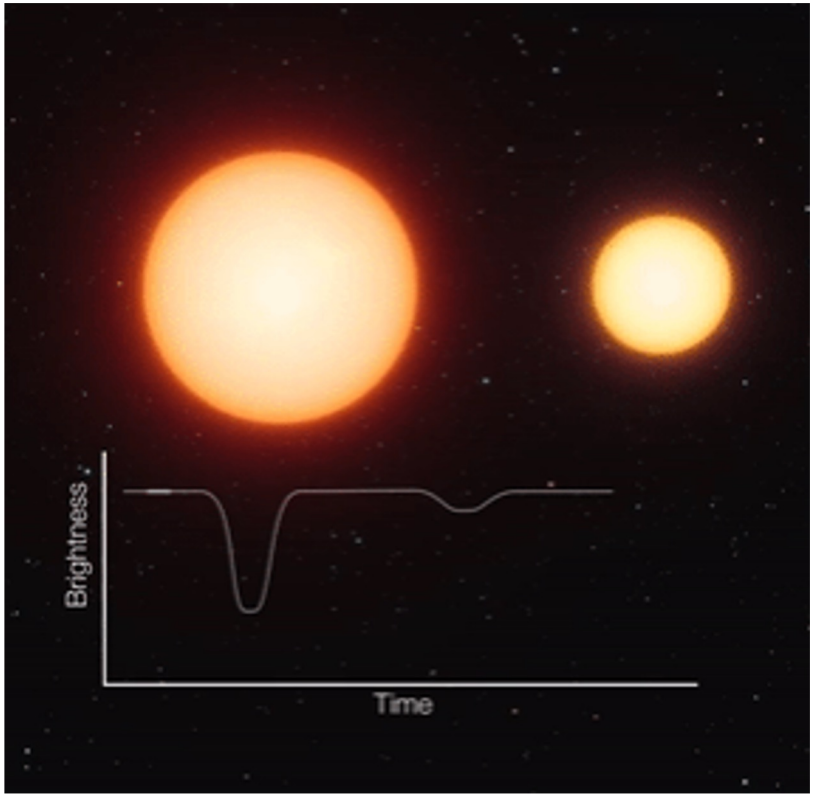




Aarnio+12

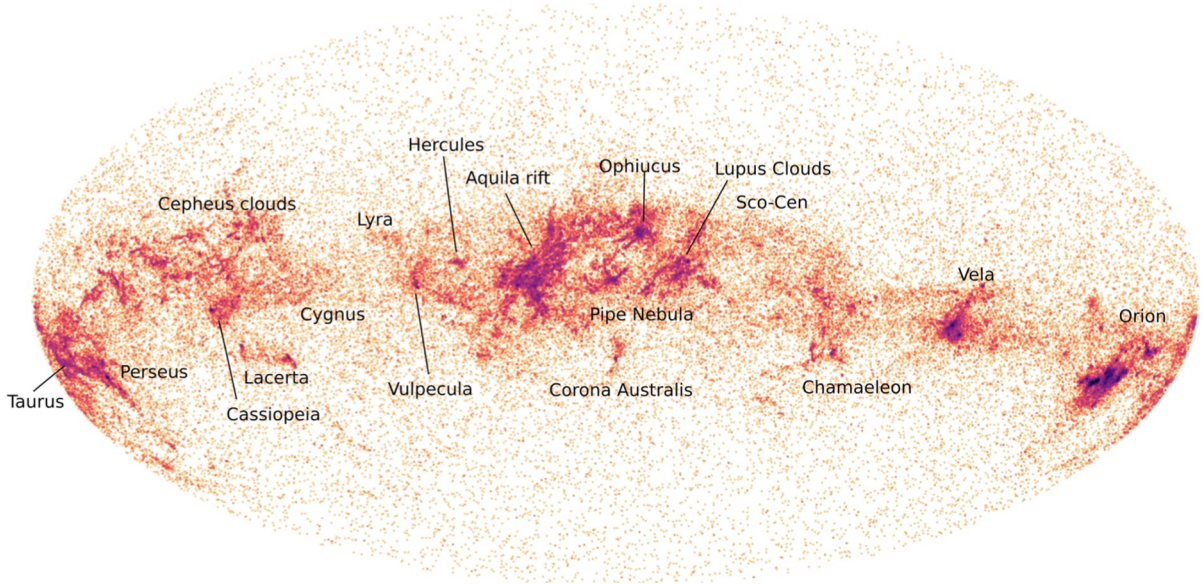
Eclipsing binaries

- Fundamental stellar laboratories
- Enable directly measuring mass, radius, Teff, etc
- Characterization of chromospheric activity in EBs is particularly valuable



Accretion in young stars

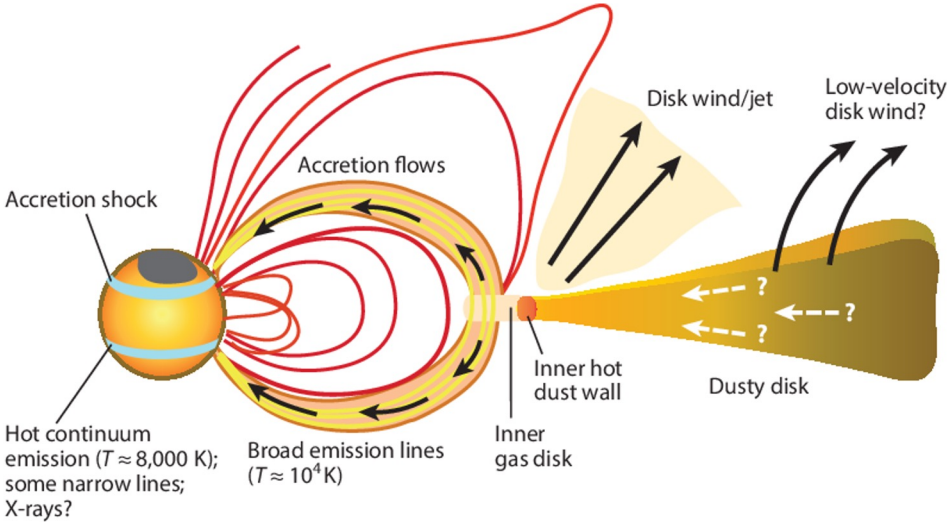
- ULTRASAT will provide all sky UV photometery



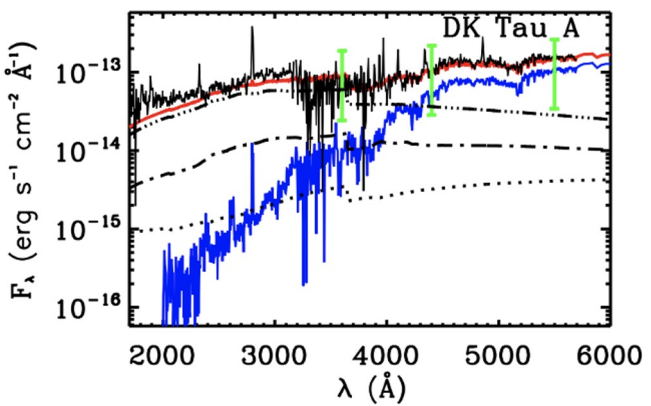
Zari+18

Accretion in young stars

- ULTRASAT will provide all sky UV photometery
- UV excess in young stars from accretion shocks



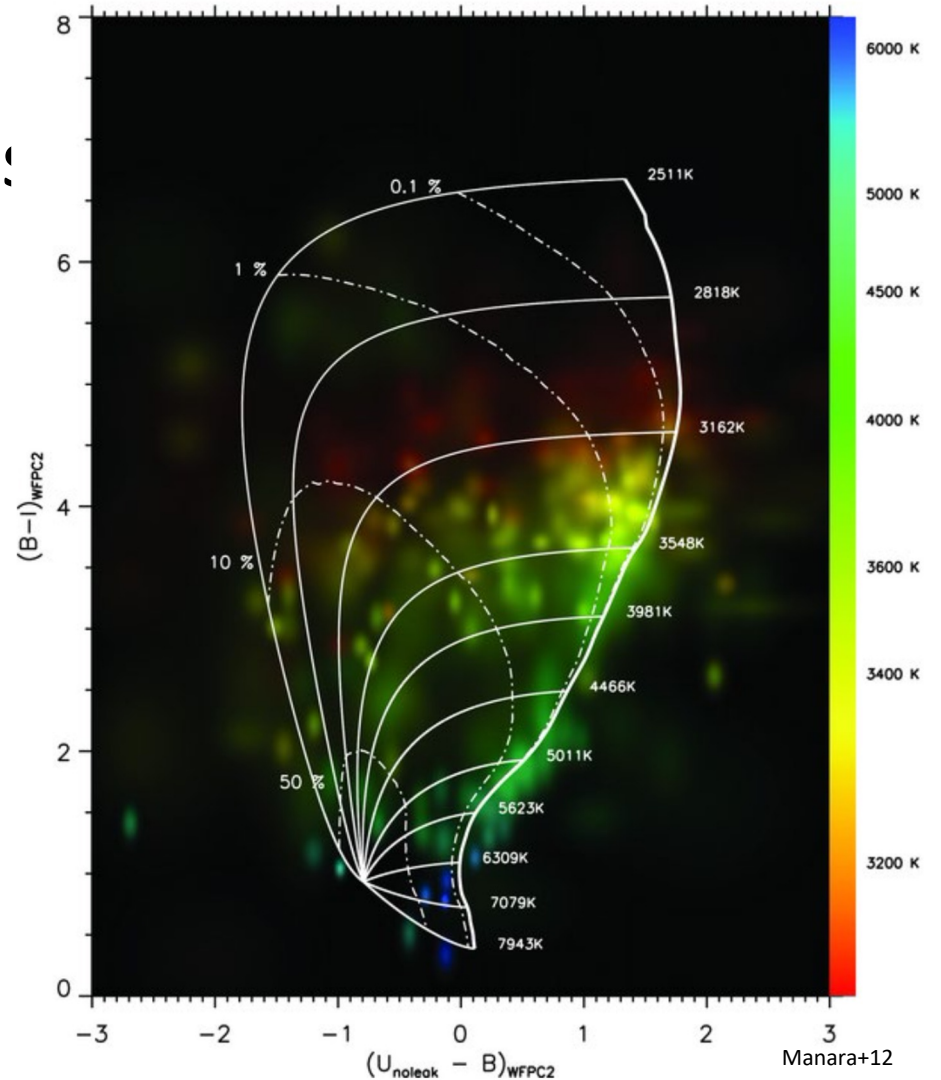
Hartmann+16



Ingleby+13

Accretion in young stars

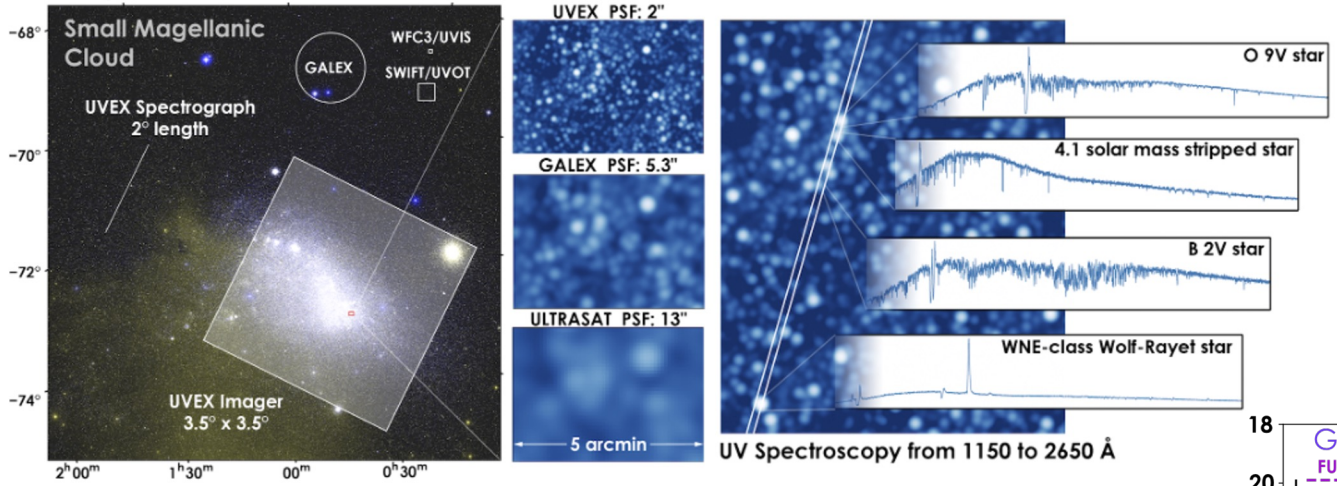
- One of the most direct tracers of the accretion rate
- Require only photometry

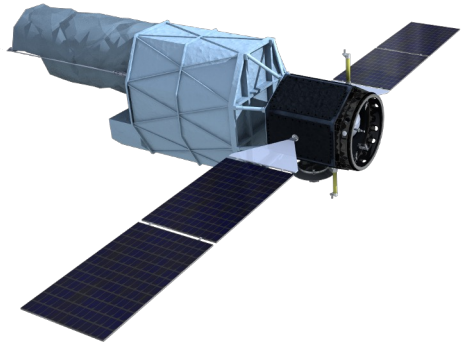


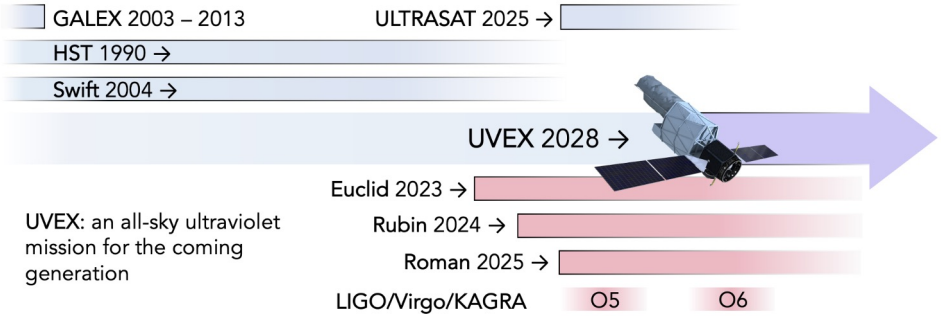
Manara+12

Synergies with NASA UVEX mission

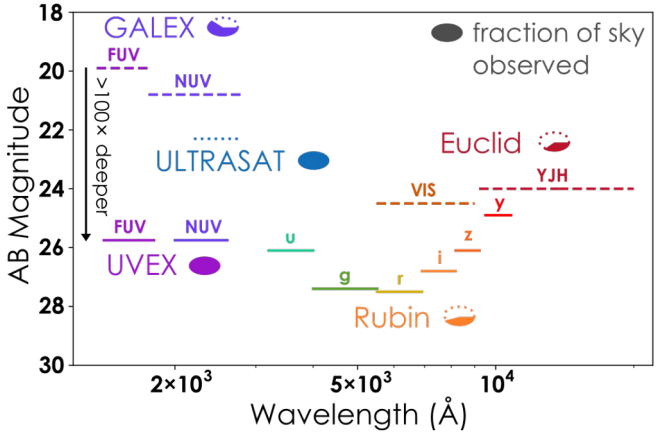
UVEX Capabilities







UVEX: an all-sky ultraviolet mission for the coming generation



Summary

- All modes of operations of ULTRASAT are valuable for understanding of stellar evolution
- Short cadence
  - Flares
- Long cadence
  - Long period rotators
- All-sky imaging
  - Accretion of young stars
- UVEX synergy?