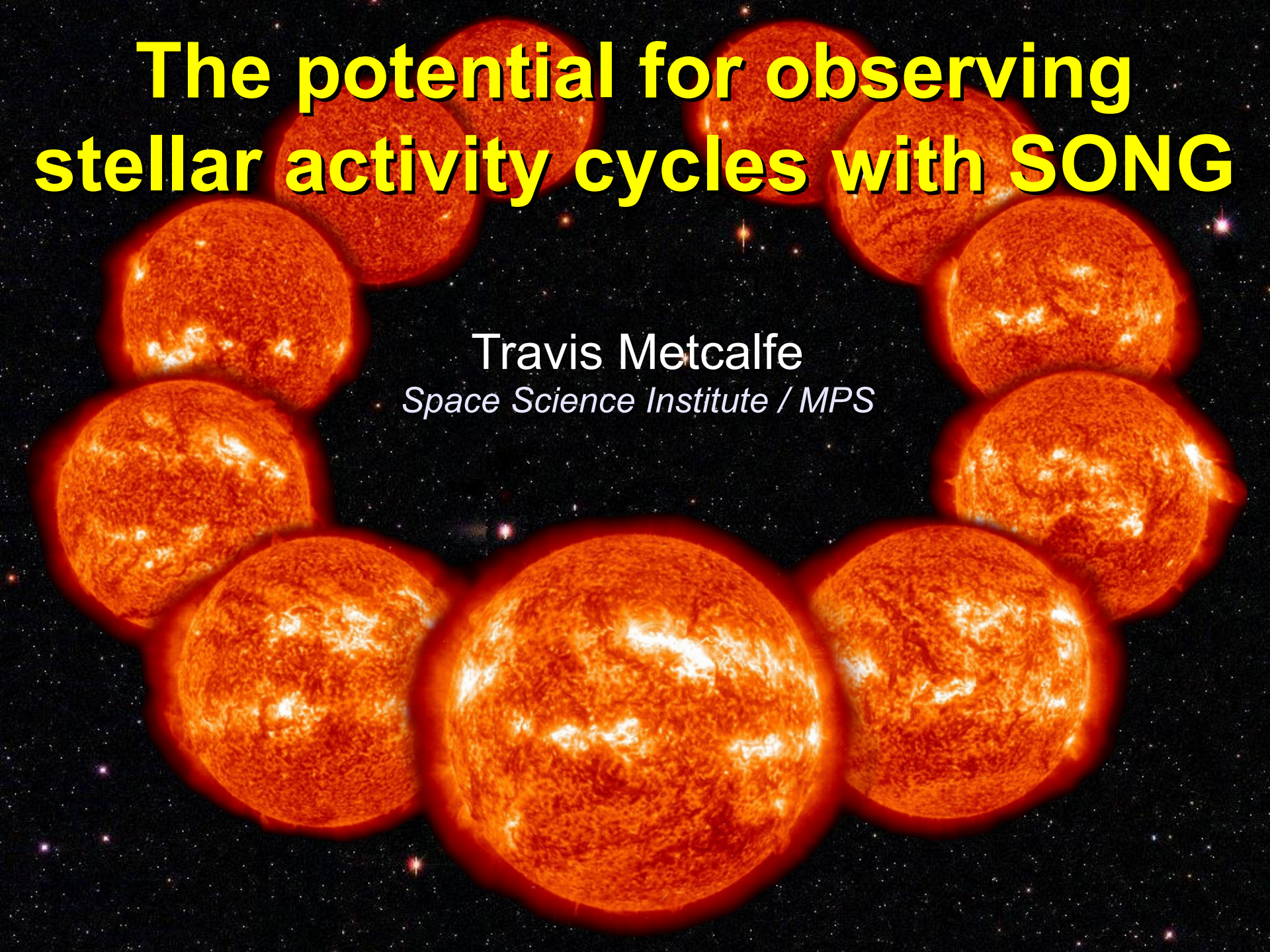


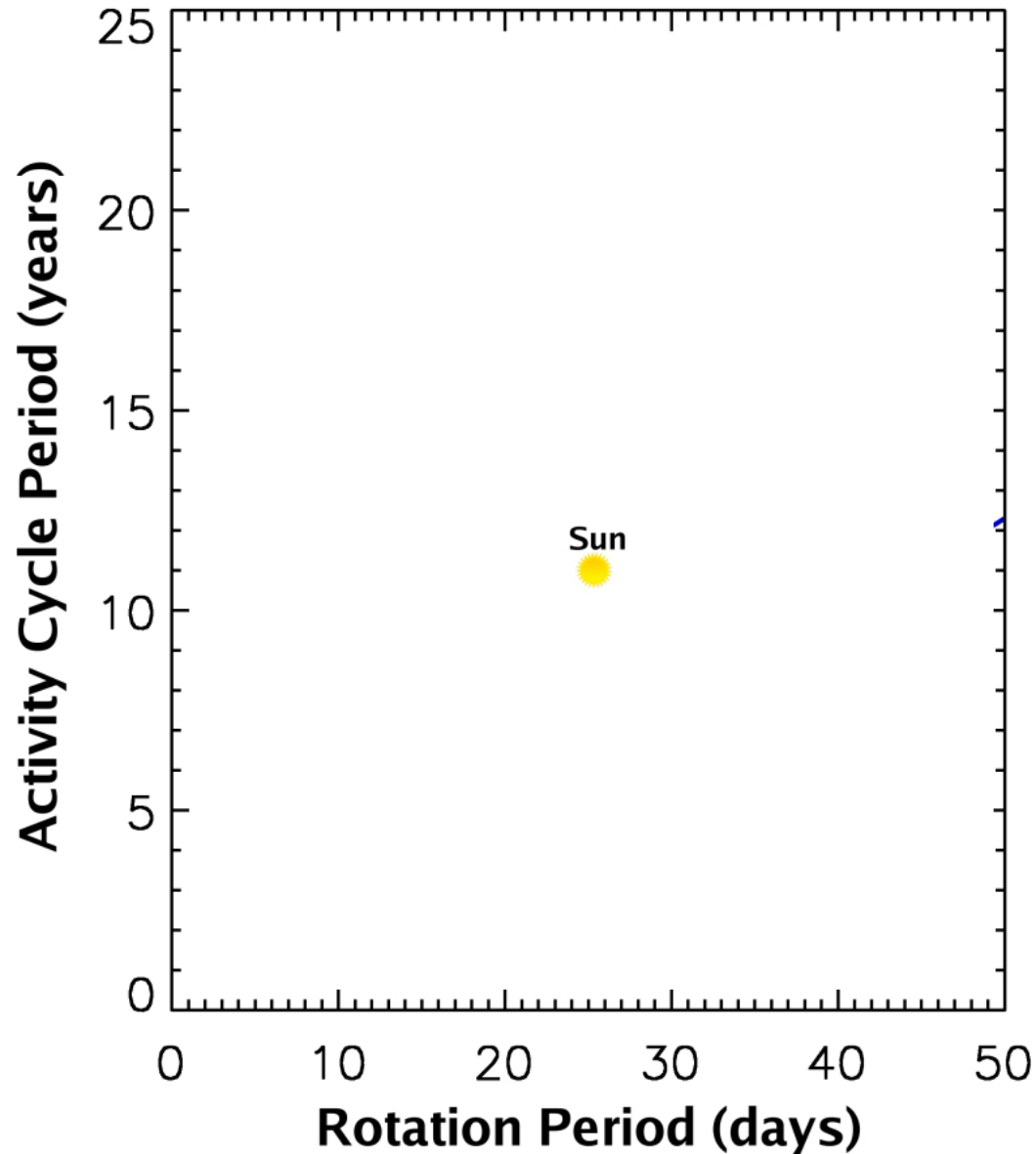
The potential for observing stellar activity cycles with SONG

Travis Metcalfe

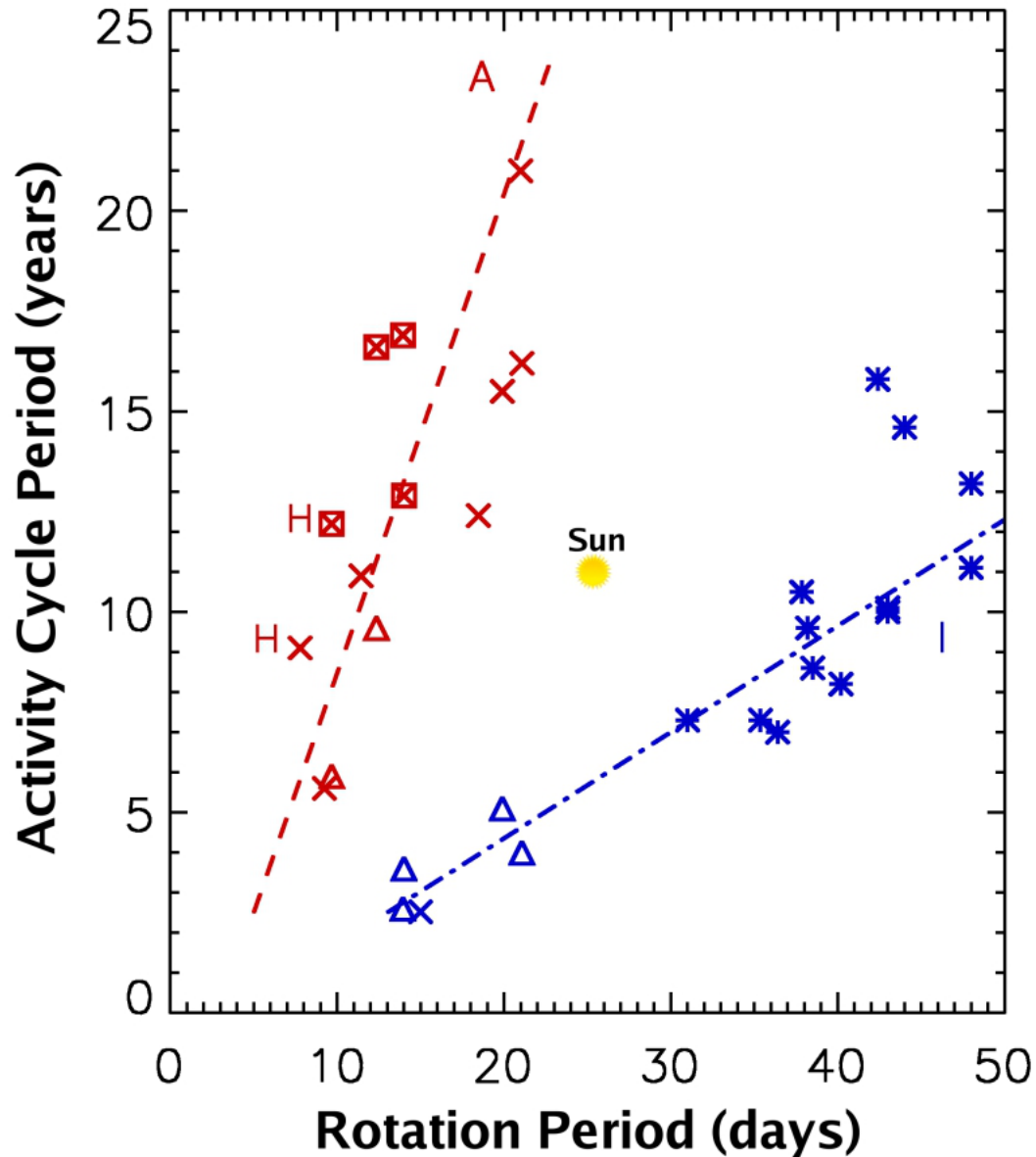
Space Science Institute / MPS

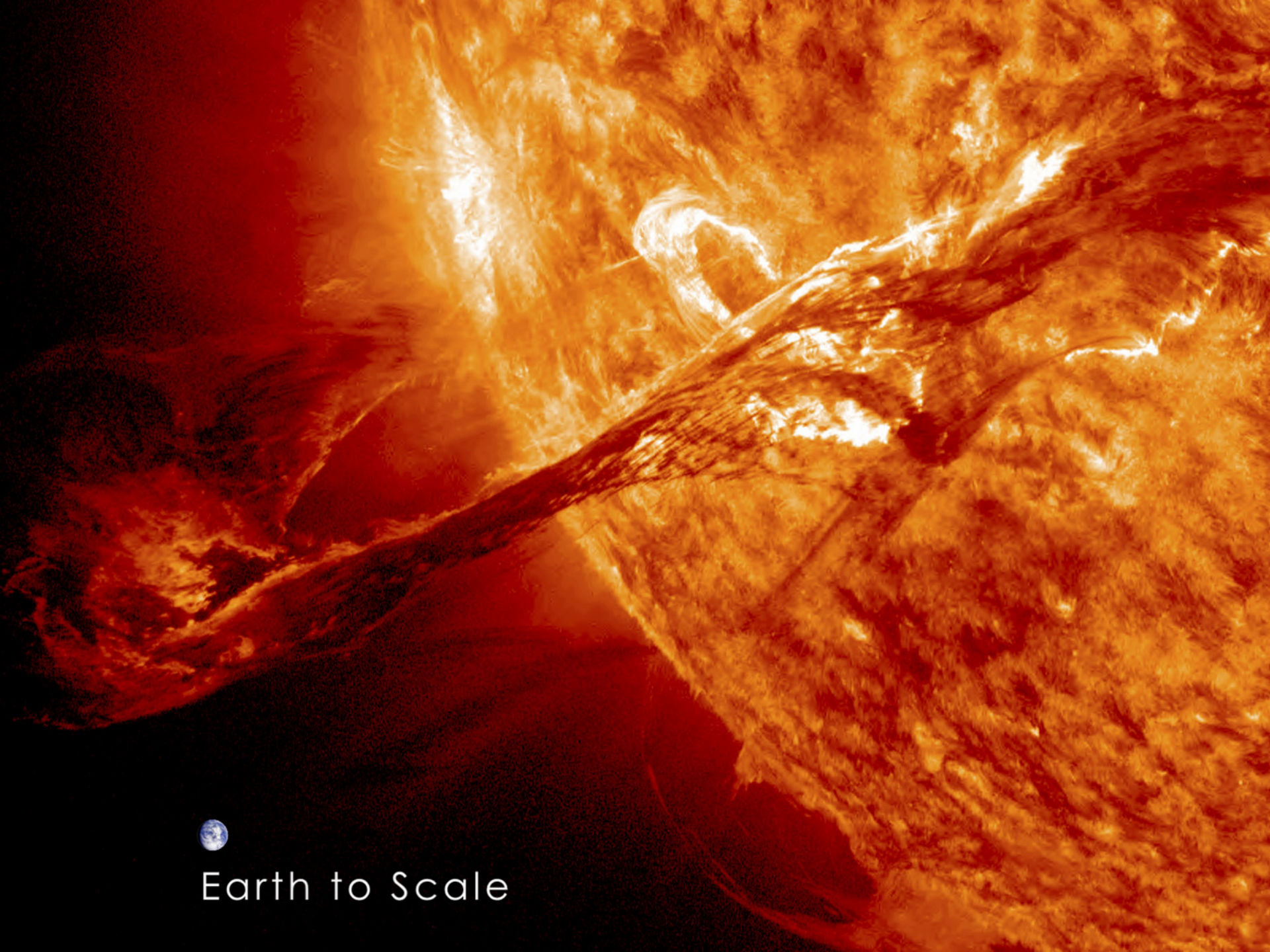


Solar cycle in context



Solar cycle in context





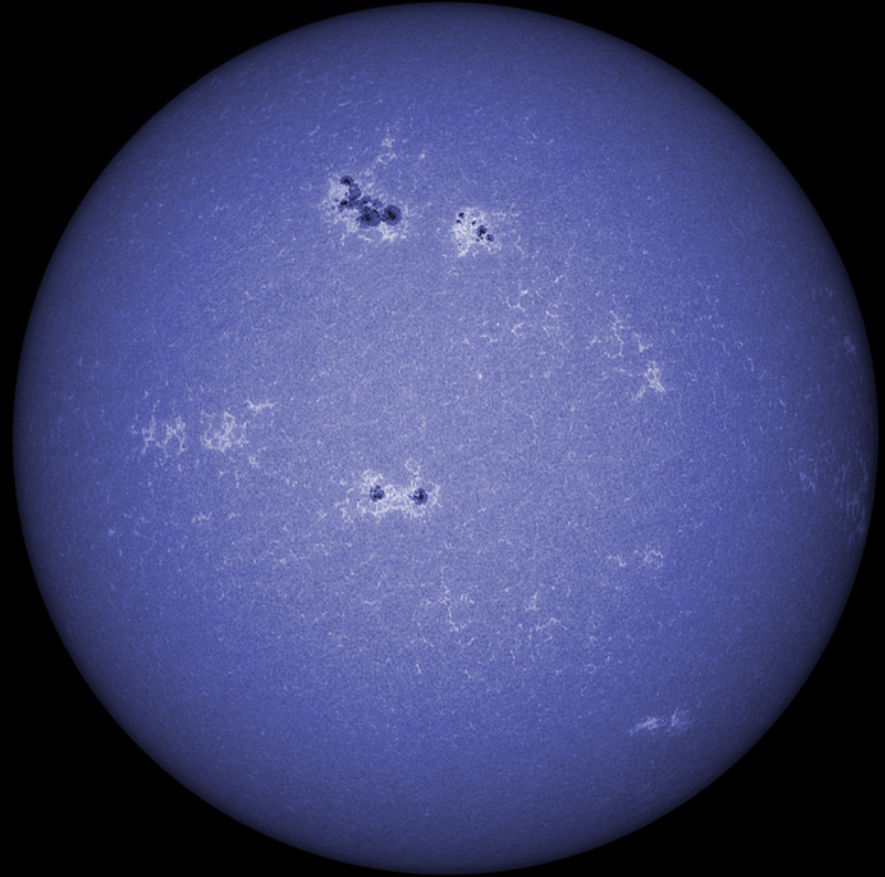
Earth to Scale

Calcium H&K emission

Photosphere

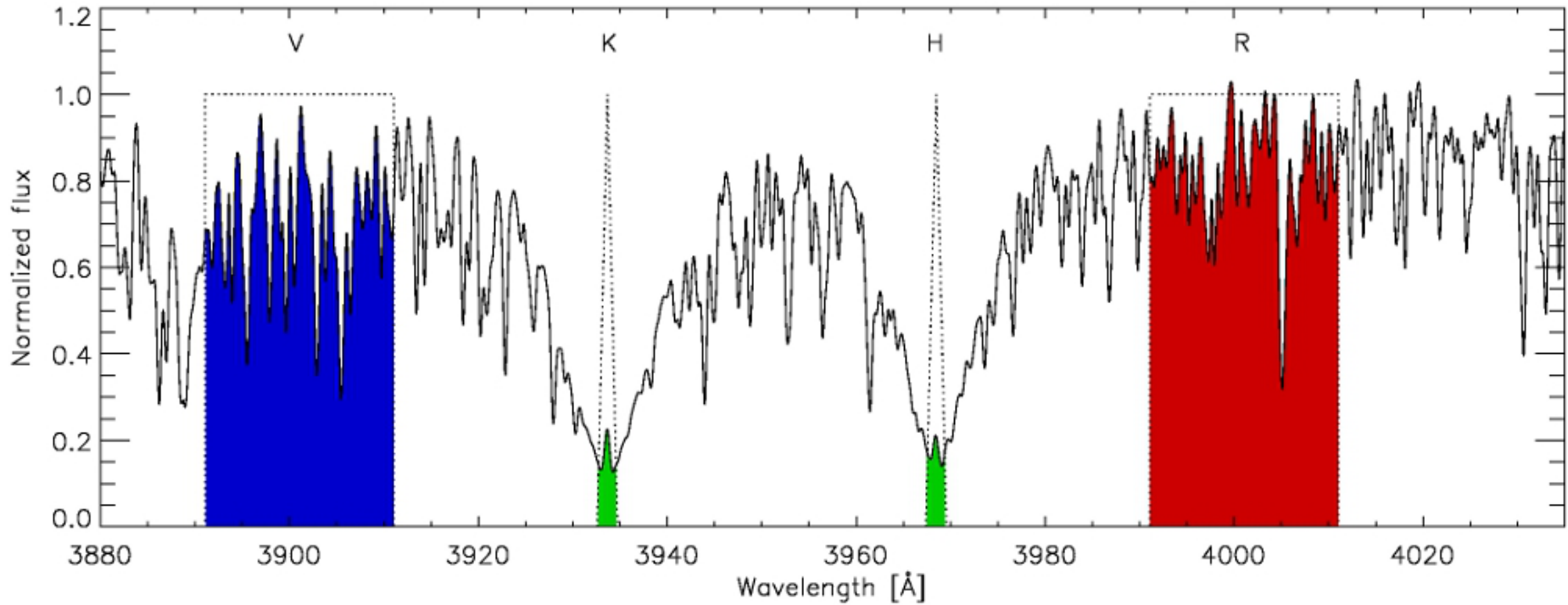


Chromosphere



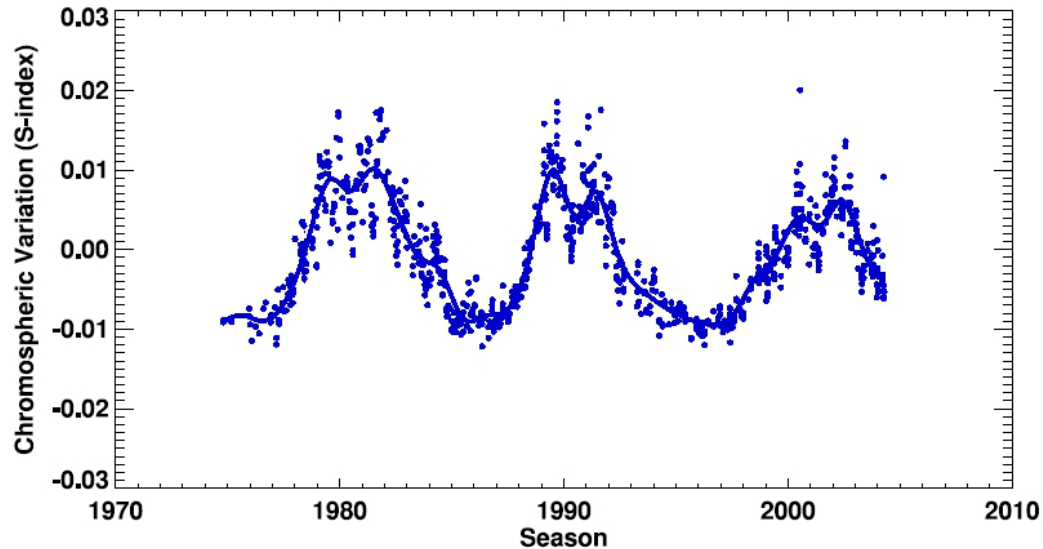
Proxy for the strength and filling-factor of magnetic field

Mount Wilson S-index



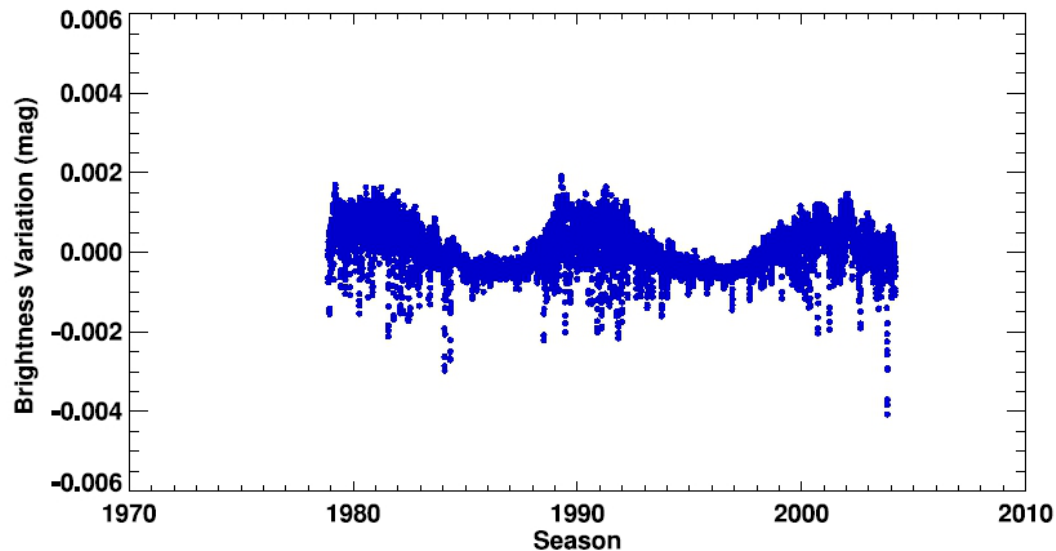
$$S = \alpha \frac{H + K}{R + V}$$

Sun-as-a-star observations



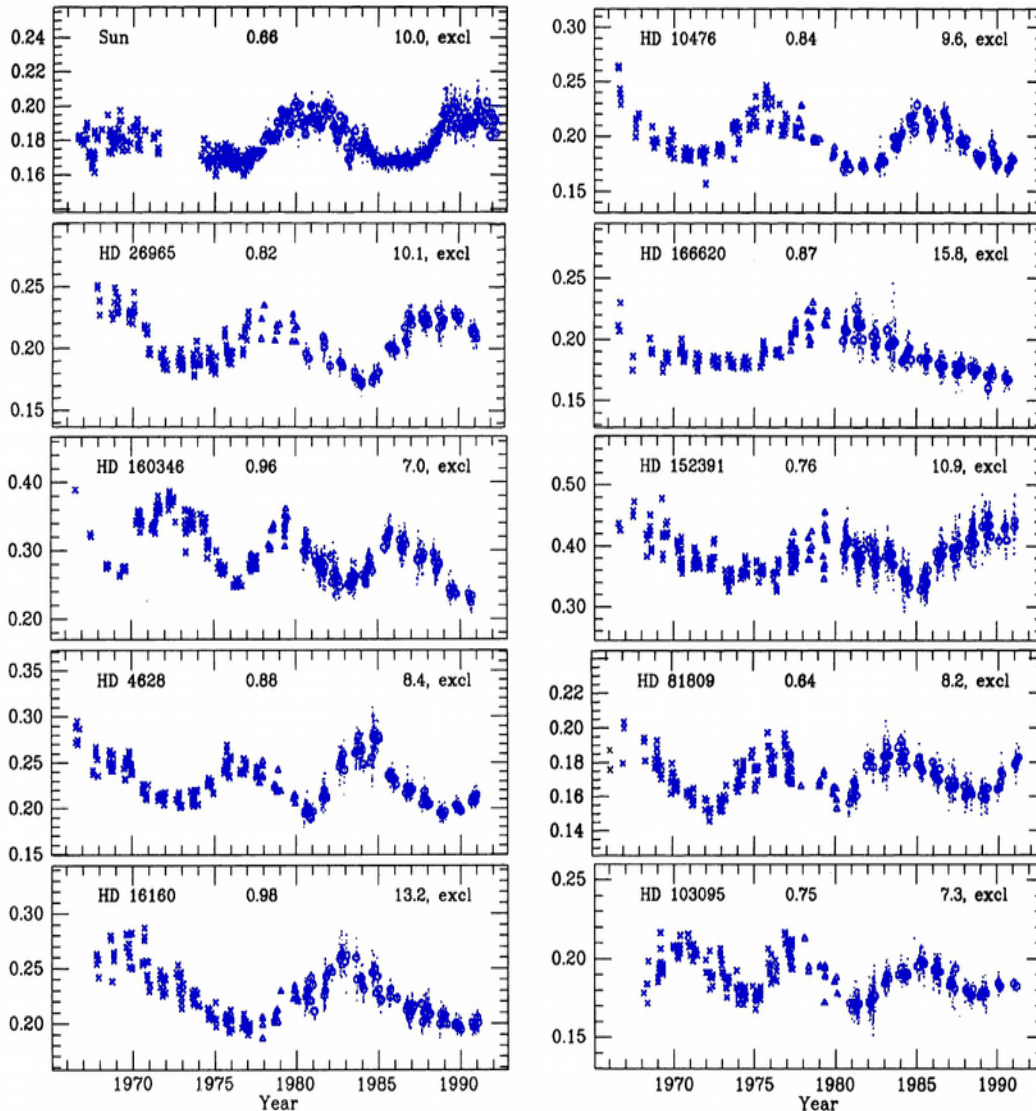
- Use disk-integrated time series measurements to track solar activity cycle

- Photometric variations generally from medium-band Strömgren b and y



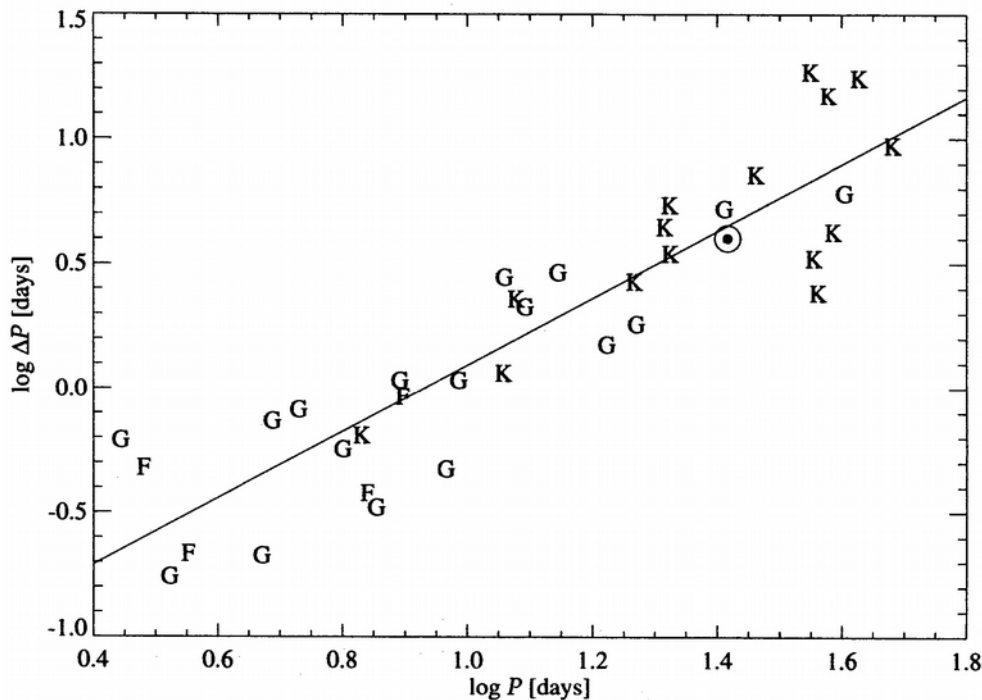
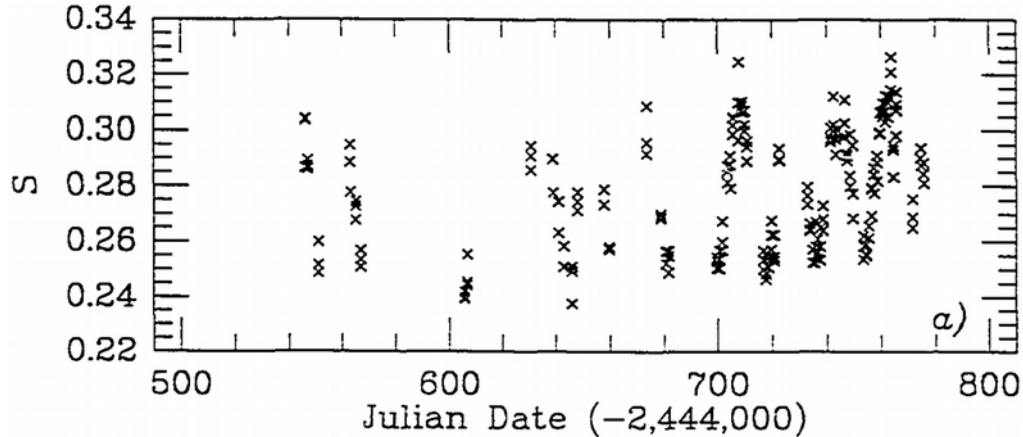
- Amplitude of variations two orders of magnitude smaller in photometry

Mount Wilson survey (1968-2003)



- Started by O. Wilson in 1968 using the 2.5-m for a sample of 91 stars
- Increased cadence in the 1980's using the 1.5-m for hundreds of stars
- The survey stopped in 2003, after nearly 35 years of observations

Rotation and latitudinal shear



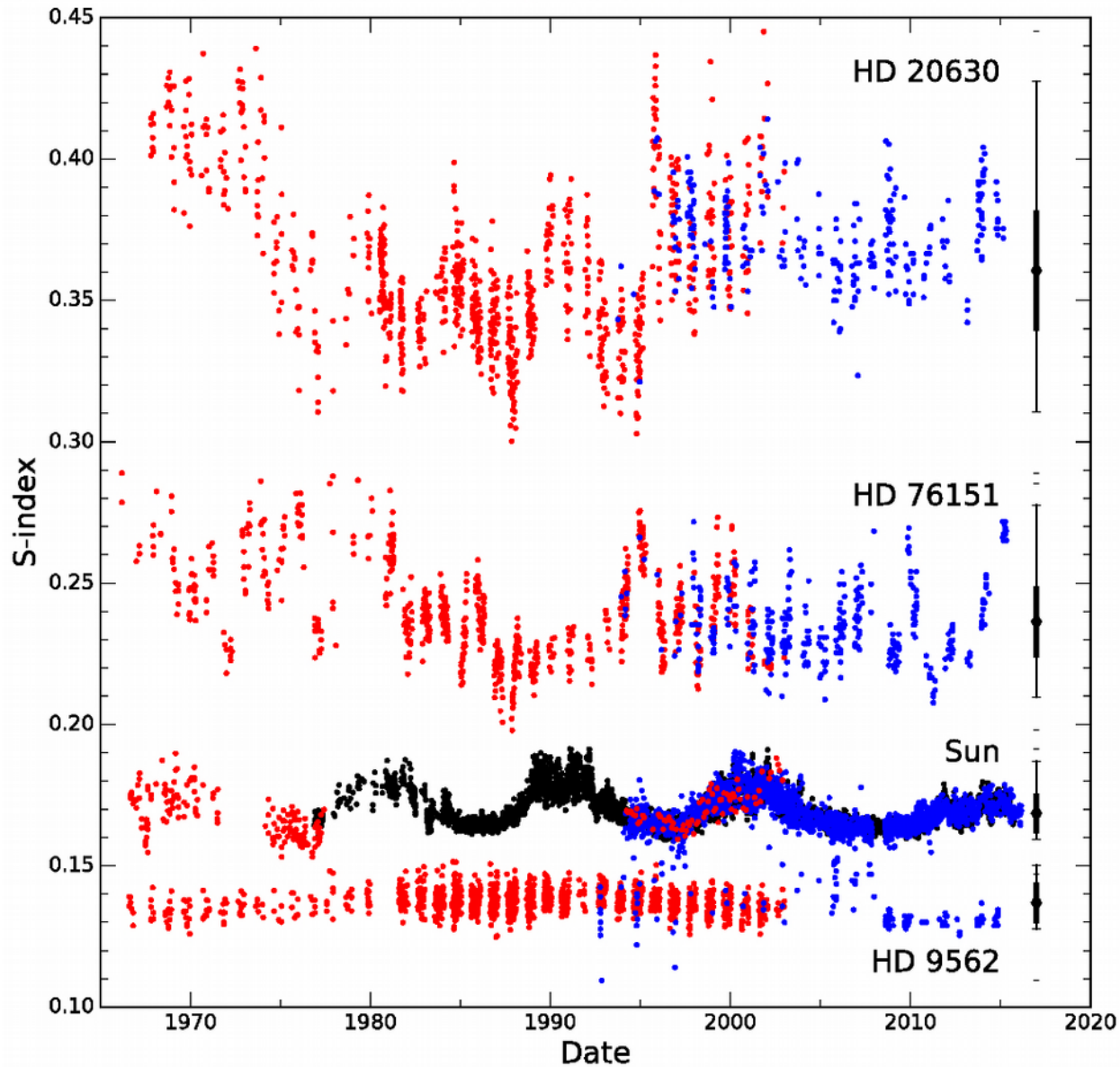
- Observations with daily cadence started in 1980's to measure rotation rates
- Different rotation periods in different seasons as active latitudes migrated
- Larger range of observed periods for cooler stars, traces latitudinal shear

Lowell survey (1992-2018+)



- 1.1-m telescope close to Flagstaff Arizona, allocate 7 nights/month bright time
- Solar observations 3-6x per week, 50 target stars sampled a few nights/mo.
- Solar/stellar/comparison all fed to spectrograph through the same fiber

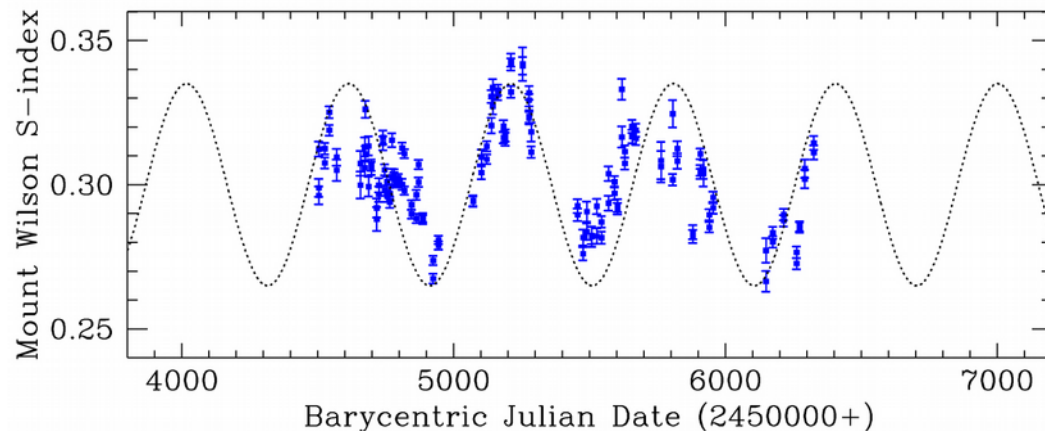
Evolution of activity cycles



SMARTS survey (2007-2013)



- Small telescopes at CTIO now run by a consortium; HAO was a minor partner
- Monitor bright southern asteroseismic targets for stellar activity variations
- Queue-scheduling avoids large seasonal data gaps, reveals shorter cycles

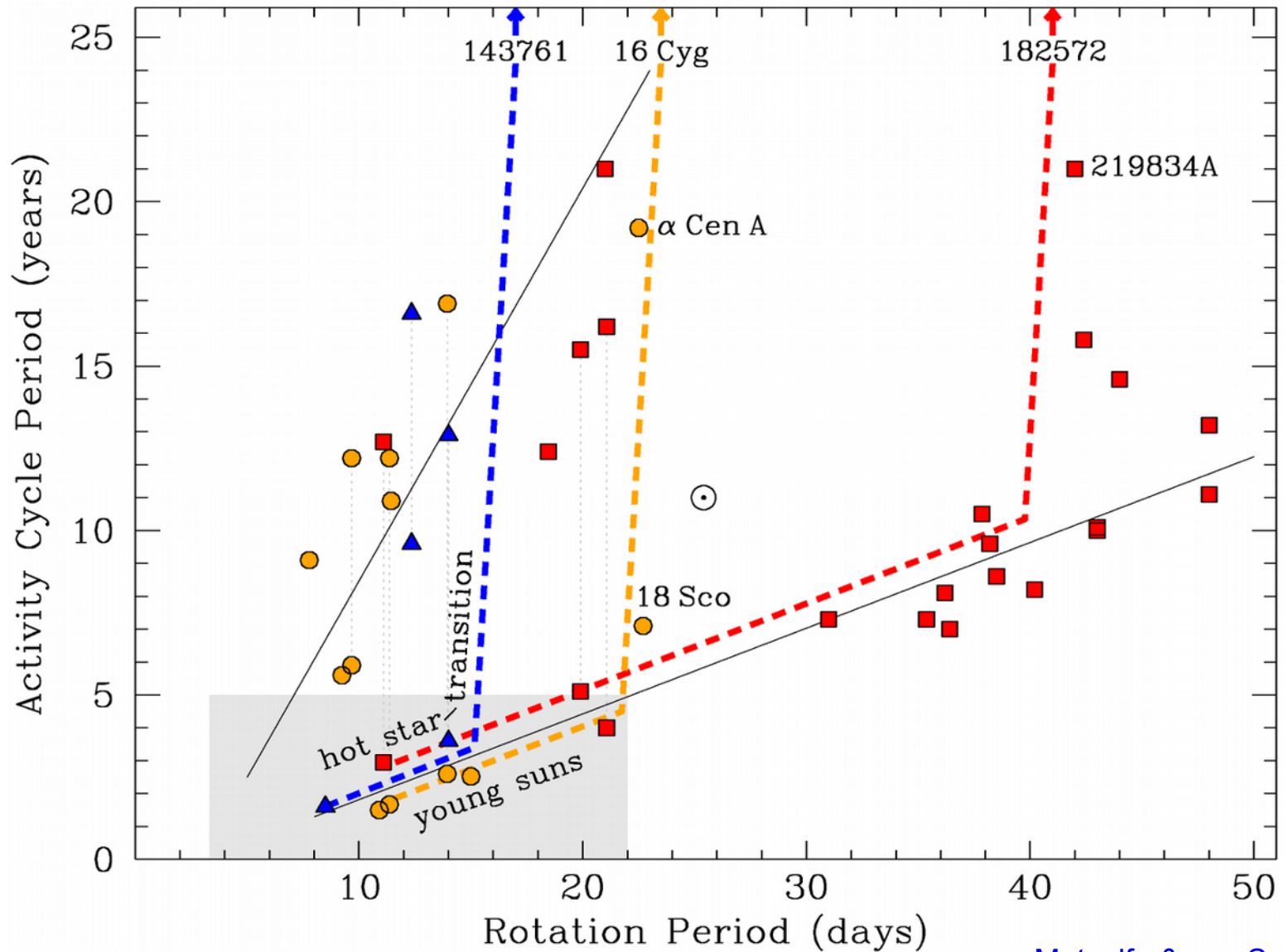


LCOGT survey (2017-2020+)



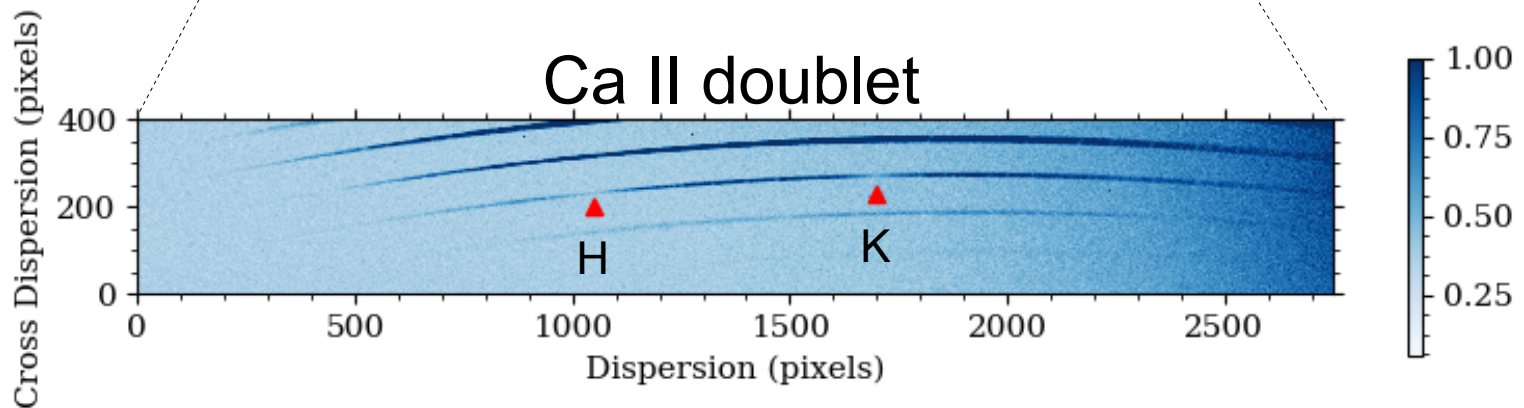
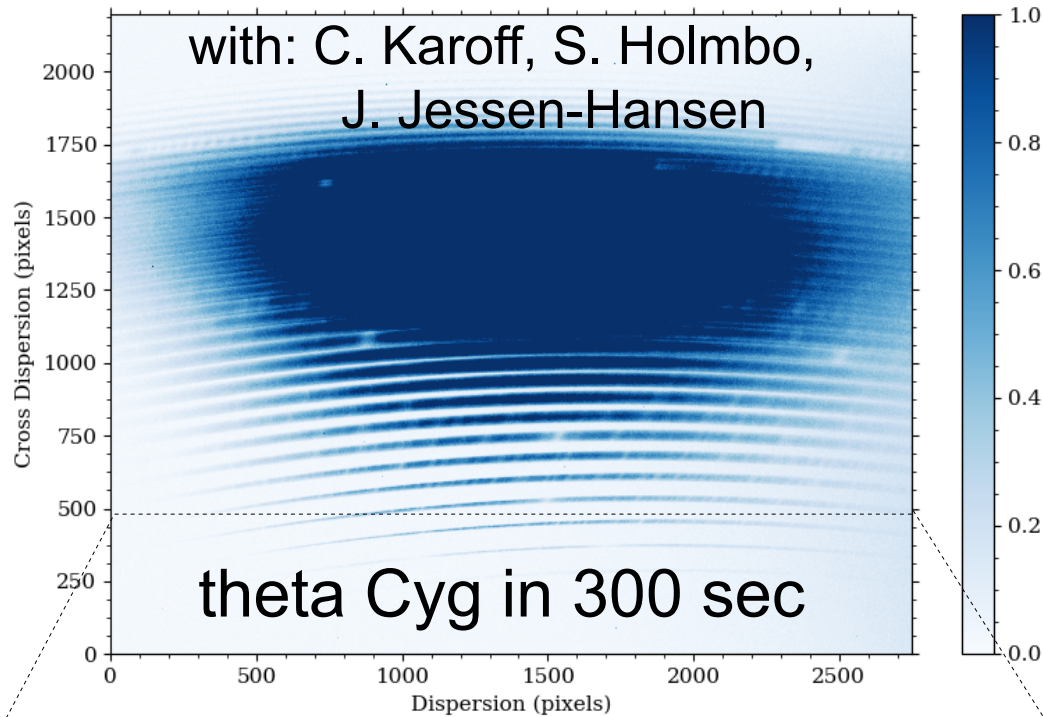
- Network of Robotic Echelle Spectrographs (NRES) on LCOGT
- Asteroseismic targets from Kepler that span a range of activity levels
- Mount Wilson stars with < 22 -day rotation periods should have short cycles

Opportunities for discovery

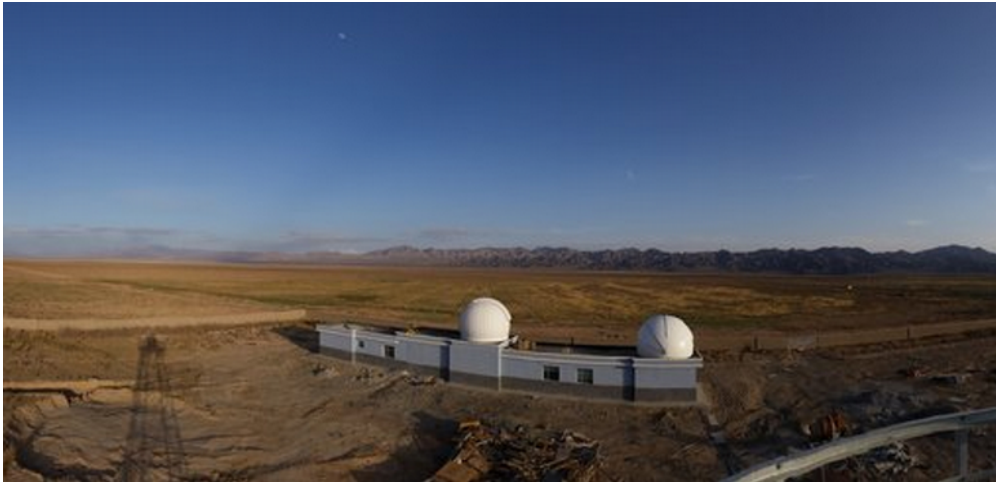


BlueSpec: off-the-shelf spectrograph

Master Student
Nicholas E.
Janssen



SONG survey?



- Commercial fiber-fed spectrograph mounted at the Nasmyth focus
- Daily cadence during asteroseismic runs at beginning/end of night
- Monthly cadence for activity cycles in larger sample of targets