Behind the Bubbling: Studying the Variability of Hα Emissions in the Hyades and Praesepe Open Clusters

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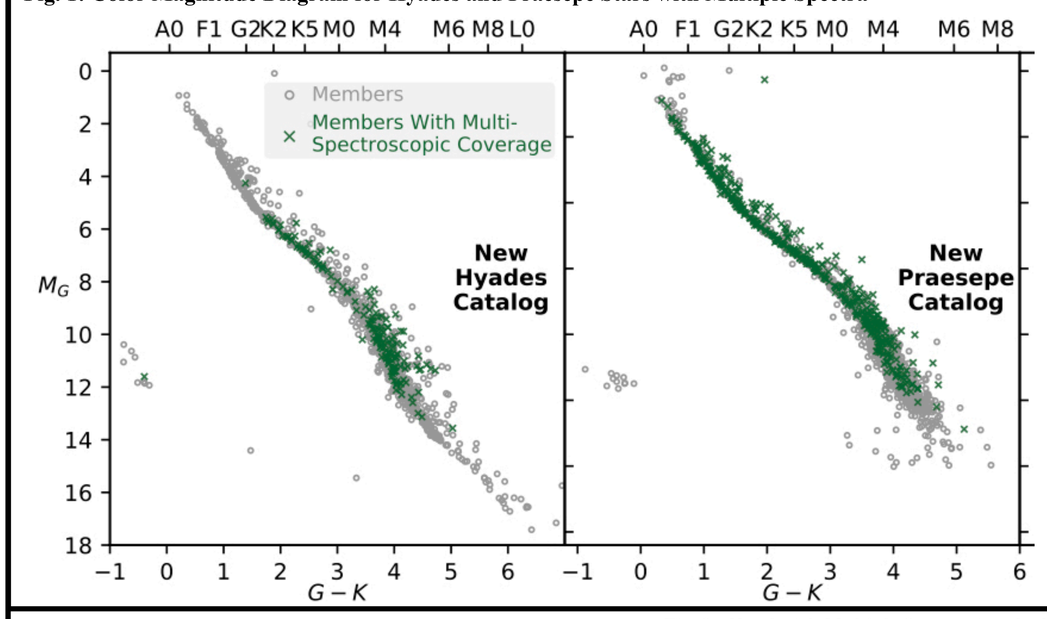
The Multi-Observatory Hα Variability Dataset's Makeup

- Multiple Hα emission measurements in a low mass star can reveal a great deal about the evolution of the star's magnetic activity.
- Using an updated GAIA membership catalog for Hyades and Praesepe we were able to match spectra taken across multiple observatories (LAMOST, SDSS, MDM, etc) and campaigns, resulting in **460** stars having two or more high quality spectra, **340** for Praesepe and **120** for the Hyades.
- These stars have shown to be quite diverse in spectral type, equivalent width (EW) value and time separation.

Fig. 1: Color Magnitude Diagram for Hyades and Praesepe Stars with Multiple Spectra



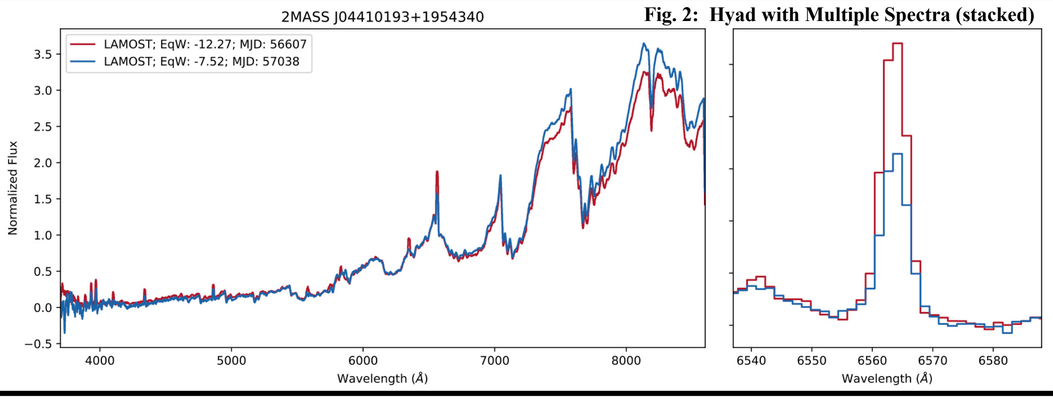
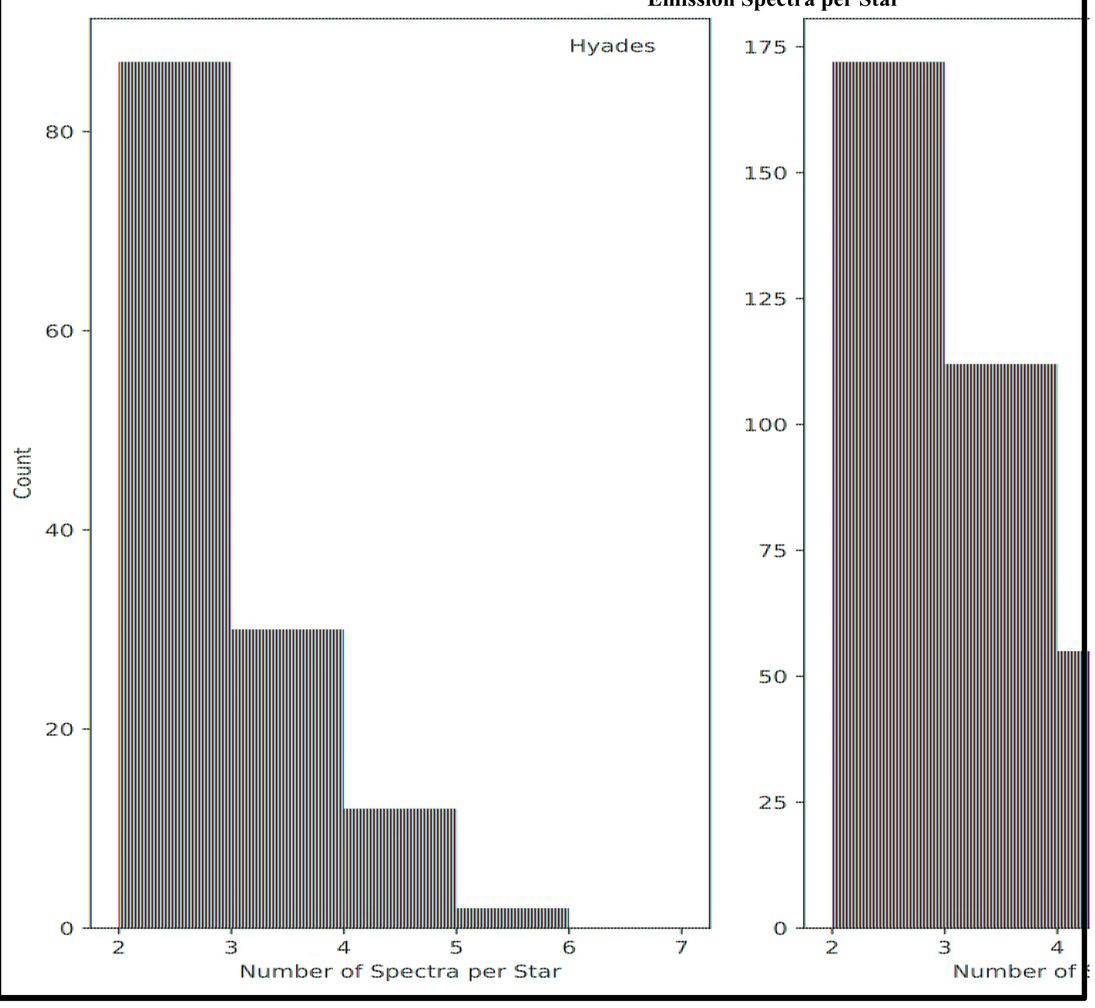


Fig. 2: Hyad with Multiple Spectra (stacked)

Fig. 3: Histogram of Number of Clear Hα Emission Spectra per Star



EW Variability across Stellar Activity, Spectral Type, and Rotation

Fig. 4: Scatter Plot of Mean Equivalent Width [Å] Against Amp(EW) and Std(EW), Medians are Shown with 1σ Error Bars

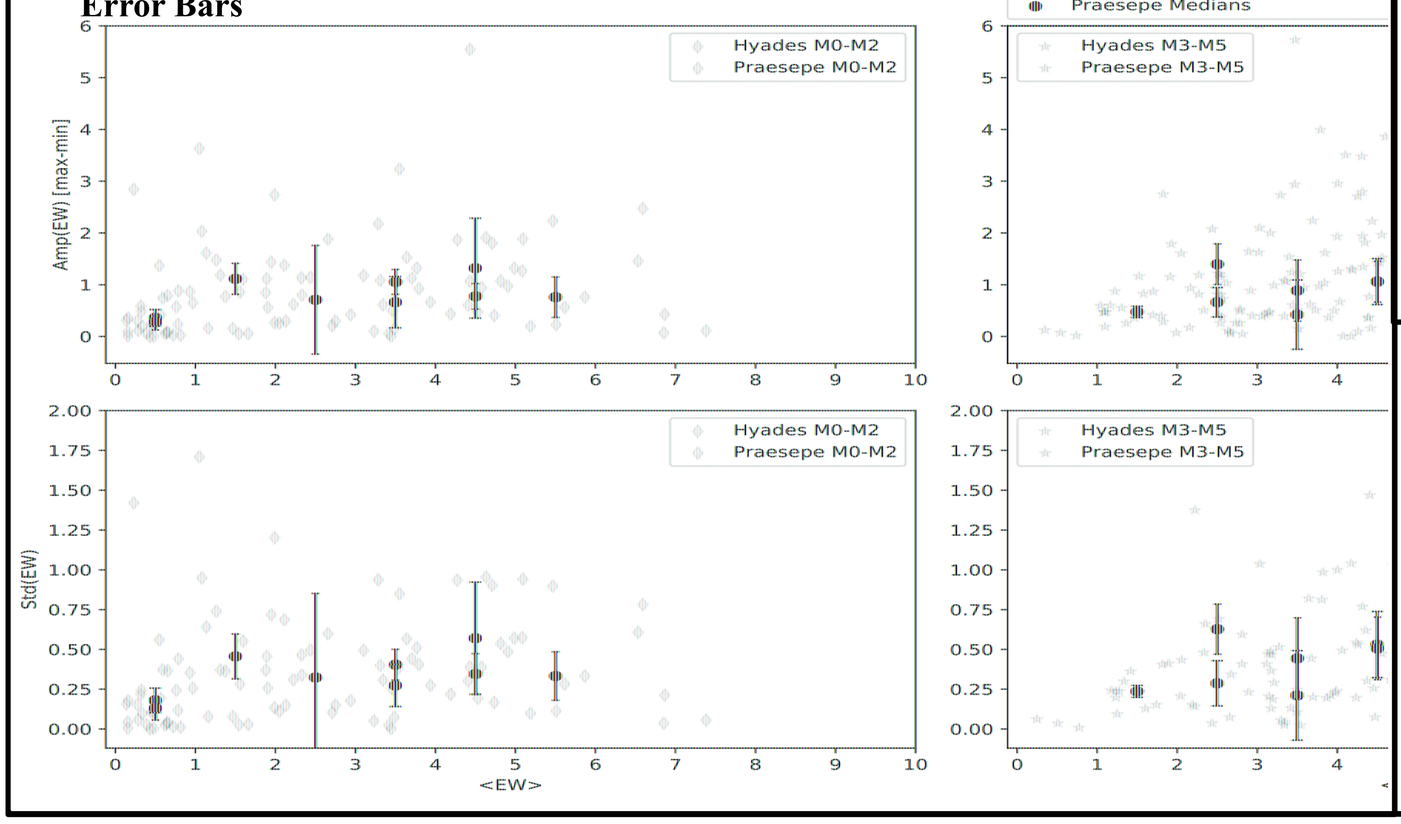


Fig. 5: Box and Whisker Plot of Spectral Type Groups Against Variability Metrics Whiskers=(16,84 pct) Orange Line=Median

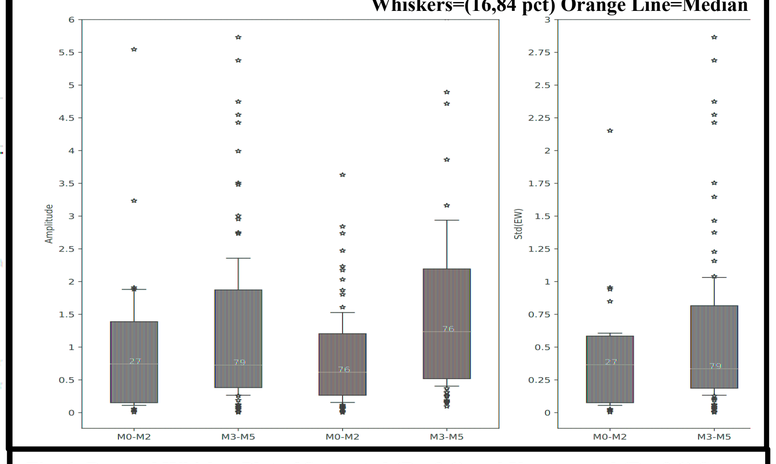
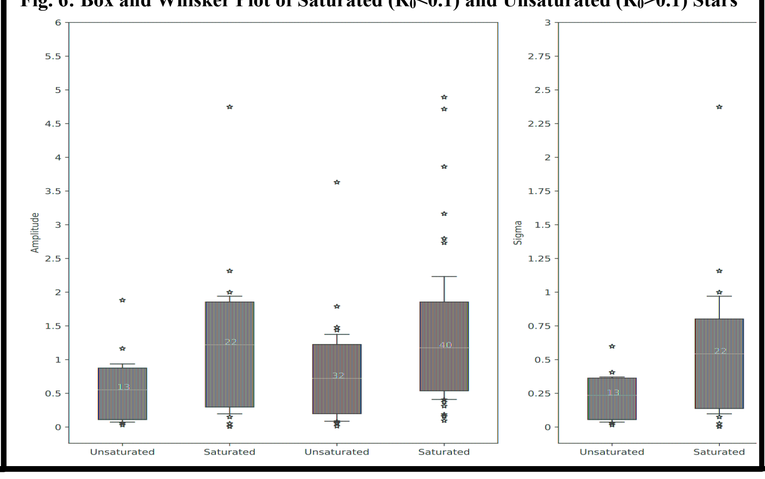


Fig. 6: Box and Whisker Plot of Saturated (R_0<0.1) and Unsaturated (R_0>0.1) Stars



- We categorize how the Hα of a star changes with the variability metrics of Amp(EW) and Std(EW) defined in the literature.
- Star types are defined by activity level (Mean EW and L_HA/L_BOL [not featured]), spectral type, and cluster membership.
- We, shockingly, find that a star's activity has little effect on how variable its Hα EW values are.
- Further, this flat variability is present in both spectral type and cluster groups, with the median values of each group being slightly different.
- Rotation does not seem to strongly affect the variability metrics either.

Searching for Periodicity: EW's Time Dependence

- Studying time allows us to gain insight into the mechanism behind Hα and the chromosphere of low mass stars in general.
- Our dataset's time separation is extensive, ranging from hours to years.
- Different timescales of variability seem to be at play for saturated and unsaturated stars.
- Spikes in ΔEW seem to point to potential periods of 23 and 240 days in the dataset.
- Our later work aims to incorporate more LAMOST spectra and look into further statistical analyses to gain insight into the time-variability mechanism

Fig. 7: Histogram of Praesepe (Red) and Hyades(Blue) Time Separation Between Spectra

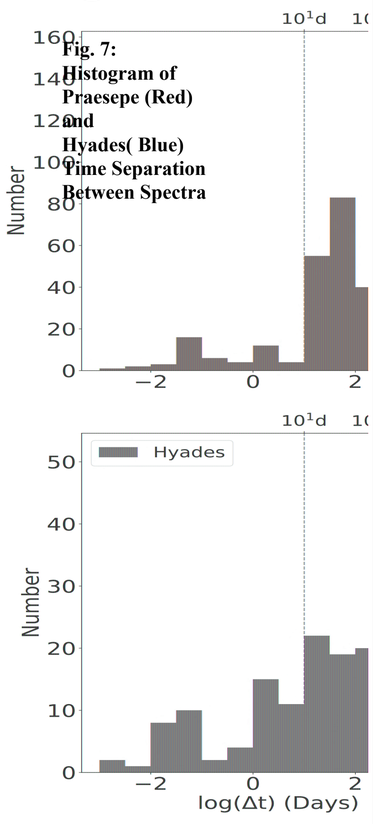
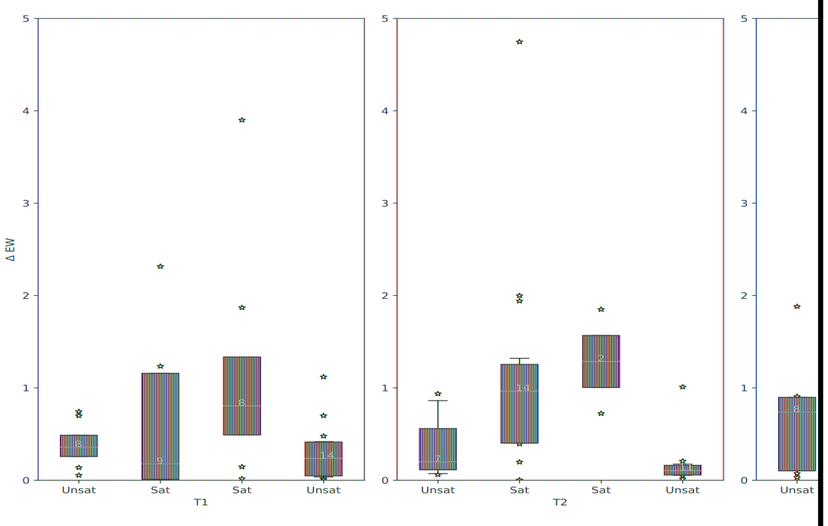


Fig. 8: Box and Whisker Plot highlighting the, potentially, long variability time scale saturated stars are operating on. [T1<100days, 100days<T2<1000days, T3>1000days]



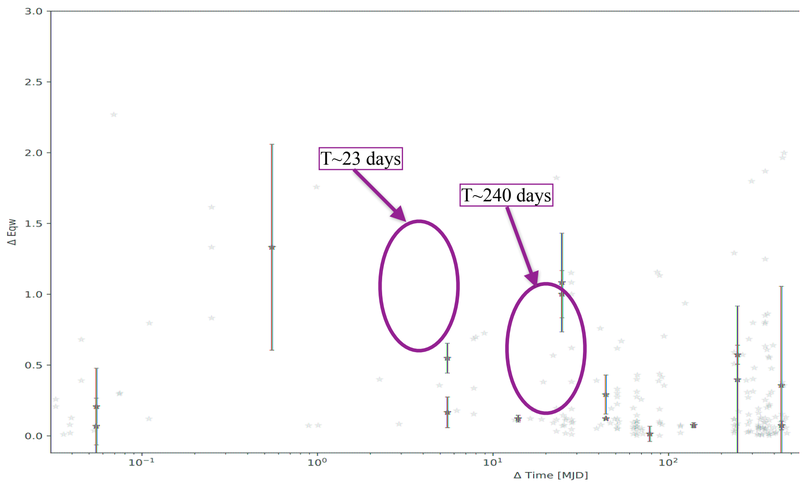


Fig. 9: Scatter Plot of ΔEW Distribution for all Hyades and Praesepe Spectra. Potential Periods for Variability are Highlighted

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