STELLAR VARIABILITY IN ISOLATION:

TWO CASE STUDIES OF TIME-RESOLVED STELLAR SIGNALS WITH EPRV INSTRUMENTS

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Motivation

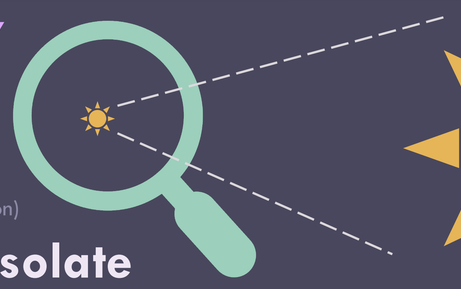
Intrinsic stellar variability is the next fundamental limit for detecting and characterizing Earth-mass planets with RVs

Leading mitigation techniques disagree on underlying stellar signals and vary from star to star (Zhao et al. 2022)

We need a better understanding of source-dependent performance for these techniques

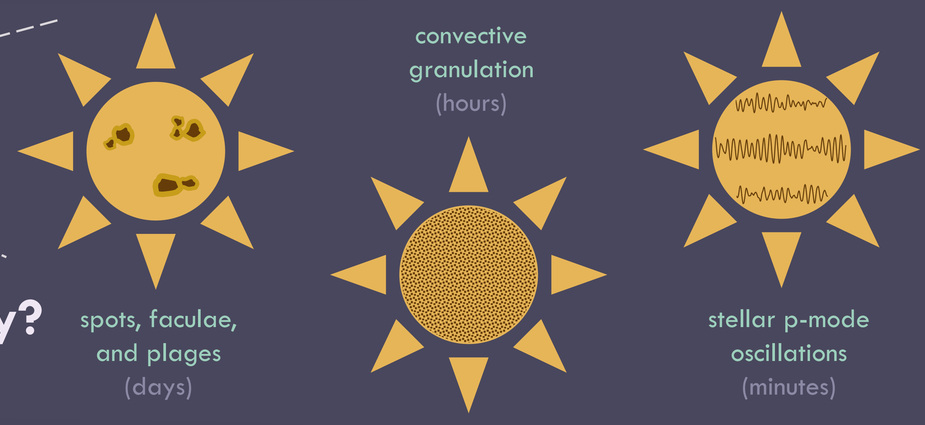
An Opportunity

New EPRV instruments offer unique probes of stellar variability signals
(e.g., stability, resolution, precision)

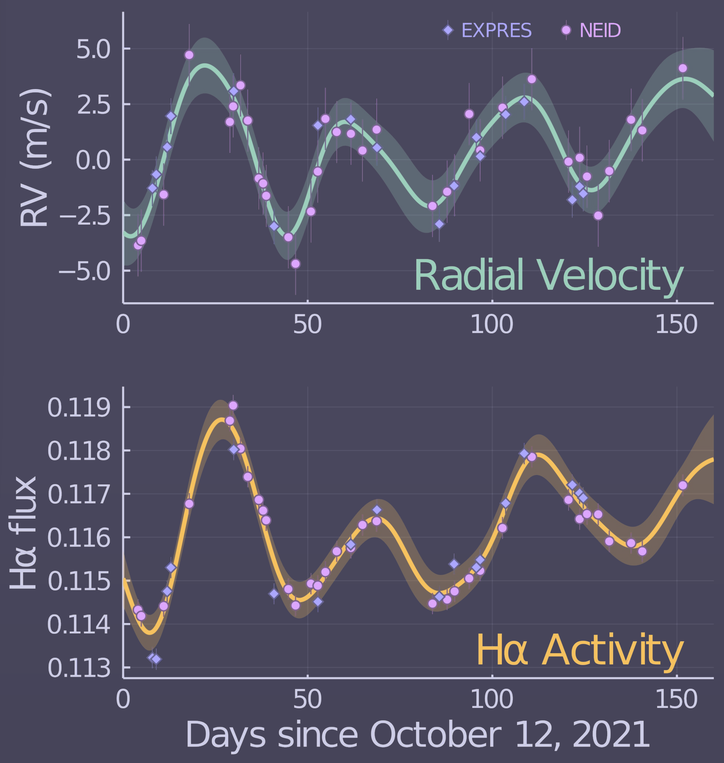


How can we isolate individual sources of variability?

Sample the relevant timescales!

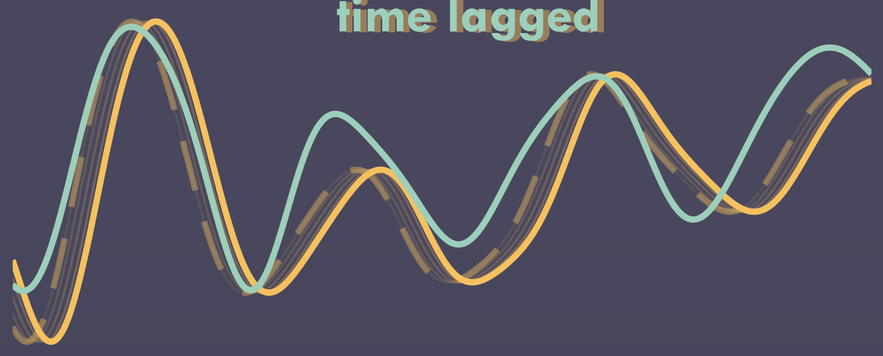


Case Study 1: Rotationally Modulated Activity in K-dwarf HD 26965 with NEID & EXPRES



High-cadence observations with NEID & EXPRES over several rotation cycles (left) reveal highly correlated RVs & activity

RVs & Hα activity are slightly **time lagged**



A time lag of 4–5 days between activity & RVs is roughly 1/8th of the 40-day rotation period, consistent with a 45° phase offset for photometric and convective effects of a spot (Aigrain et al. 2012, Boisse et al. 2012)

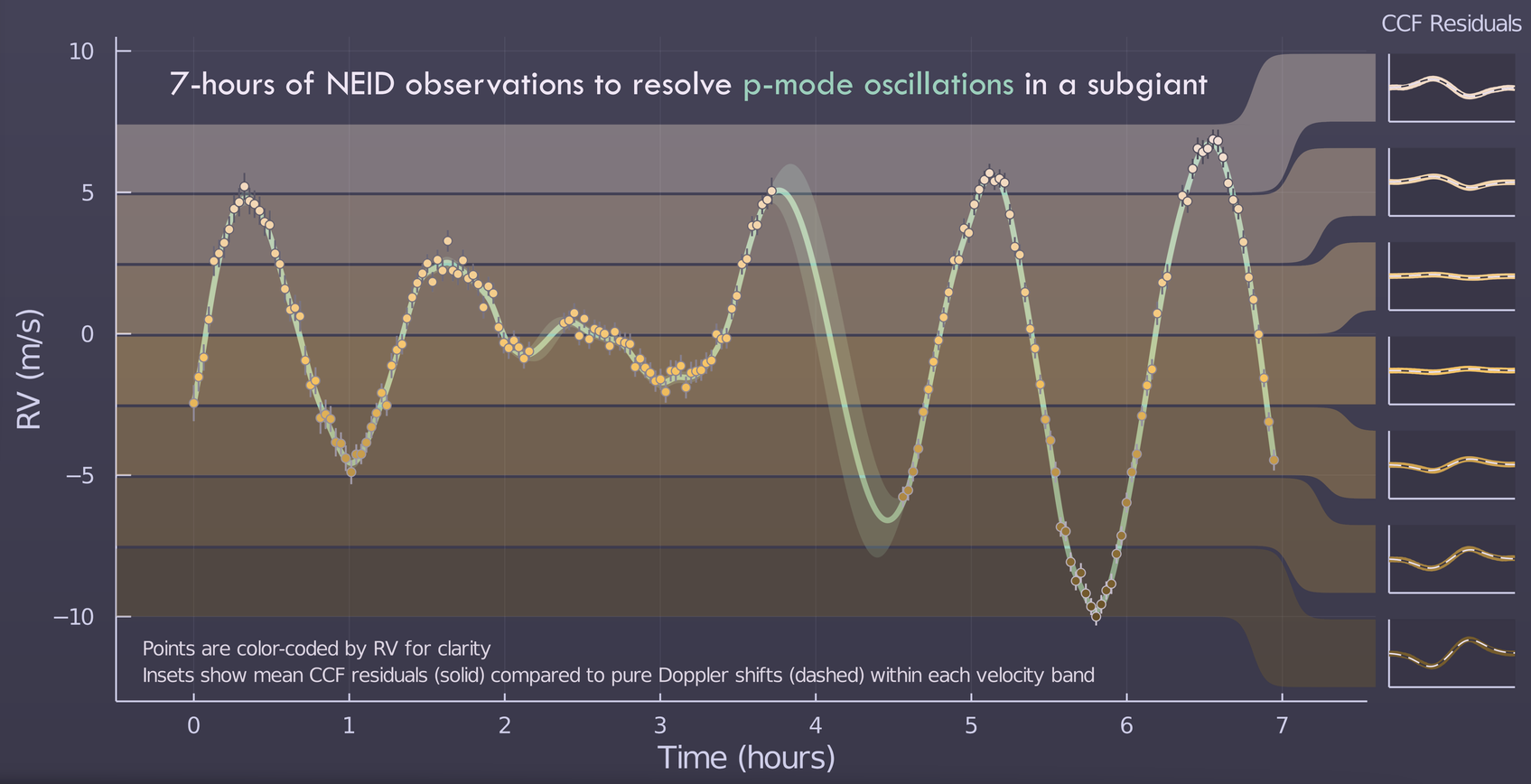
However, EXPRES observations over 3 seasons suggest that the time lag can vary over time (Zhao et al., in prep)

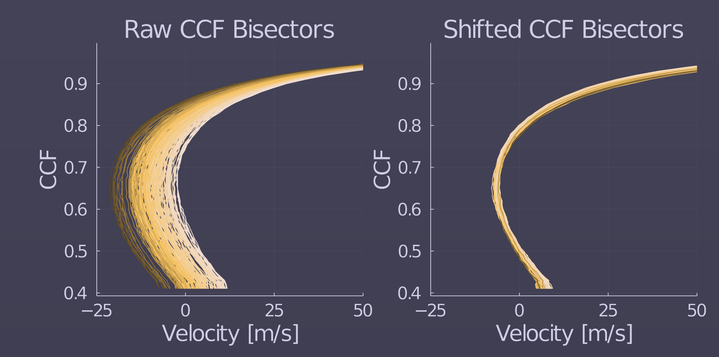
Decomposition of the RVs into a sum of convective and photometric components along with line-by-line analysis reveals distinct line populations that trace each component!

Check out Jared Siegel's talk for more details!

HD 26965 will continue to be a high-impact touchstone target for studying rotationally modulated activity signals

Case Study 2: Time-resolved P-mode Oscillations in Subgiant HD 142091 with NEID





Stable line bisectors indicates no *asymmetric* distortions.

CCF profile deformations due to stellar oscillations are therefore primarily pure Doppler shifts

Key Takeaways

We can improve stellar variability diagnostics through isolated time series and new EPRV probes

Time-lagged activity in HD 26965 identifies distinct photometric and convective components

Resolved oscillations on a subgiant show that CCF deformations are shift-driven

Let's Connect!

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