Asteroseismology provides a **new range** of rotation **periods** and **ages** in which to calibrate **gyrochronology**

EXPANDING THE GYROCHRONOLOGY RELATION WITH ASTEROSEISMIC ROTATION AND AGE

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+ friends

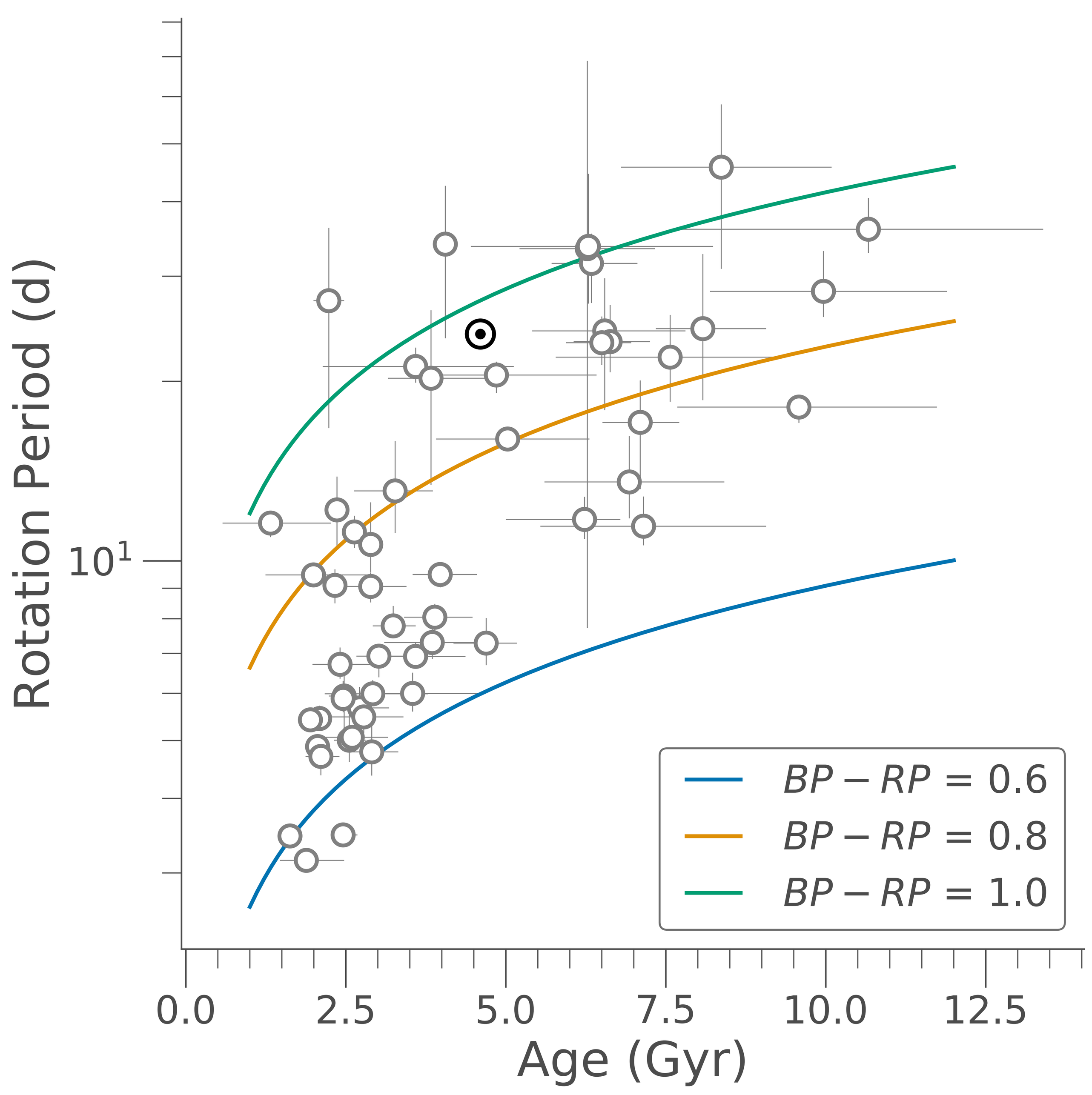
INTRO

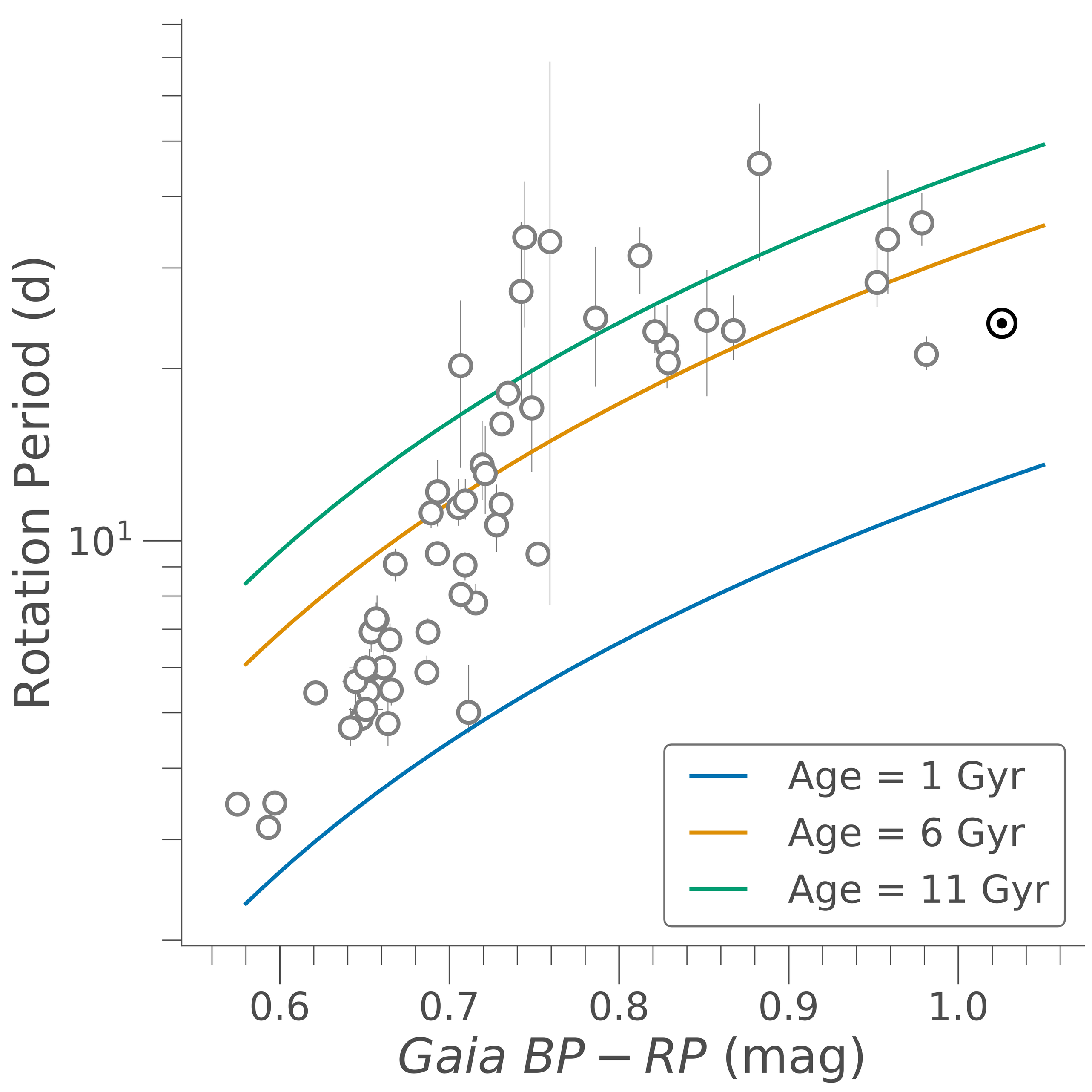
- The **rotation** of stars of a given colour **slows down** as they **age**.
- Calibrating this **'gyrochronology'** relation lets us calculate stellar age.
- van Saders+16 showed that some old stars stop slowing down at a certain point. **Why?**
- Asteroseismic age and rotation periods allows us to **study older stars** in this area of interest.

METHOD

- We use the **LEGACY** and **Kages** samples for their ages and locations of individual frequencies.
- We obtain rotation periods for **55 stars** (so far!) by fitting a holistic model to the l = {0, 1, 2} p-modes, treating the mode frequencies as **latent variables**.
- We fit the classical Barnes+07 gyrochronology relation with ***Gaia BP-RP*** using a **latent variable** model to treat errors in the three observeables.

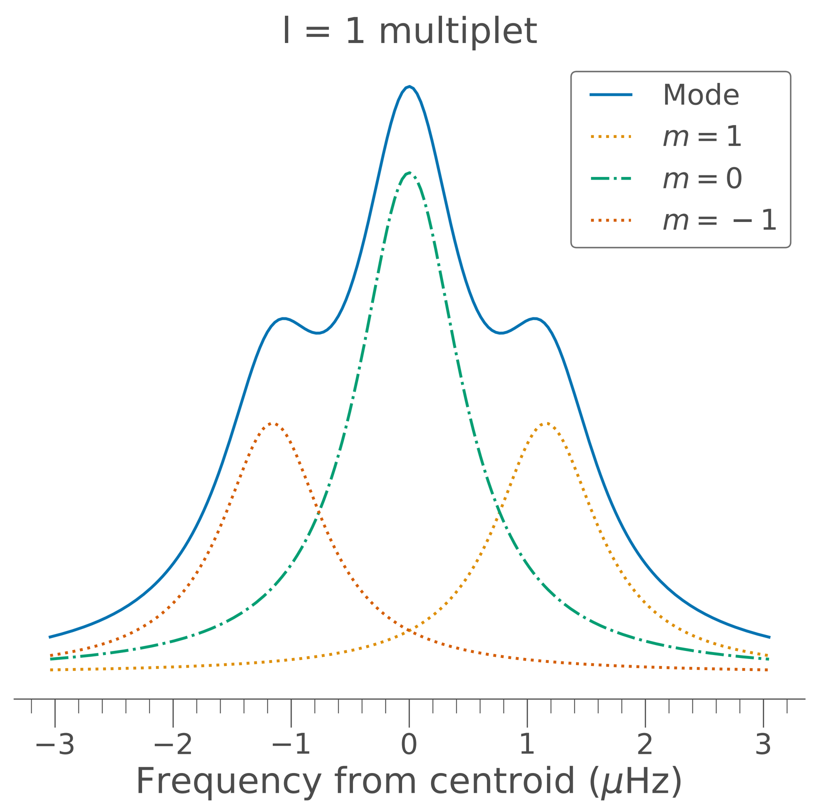
RESULTS SO FAR

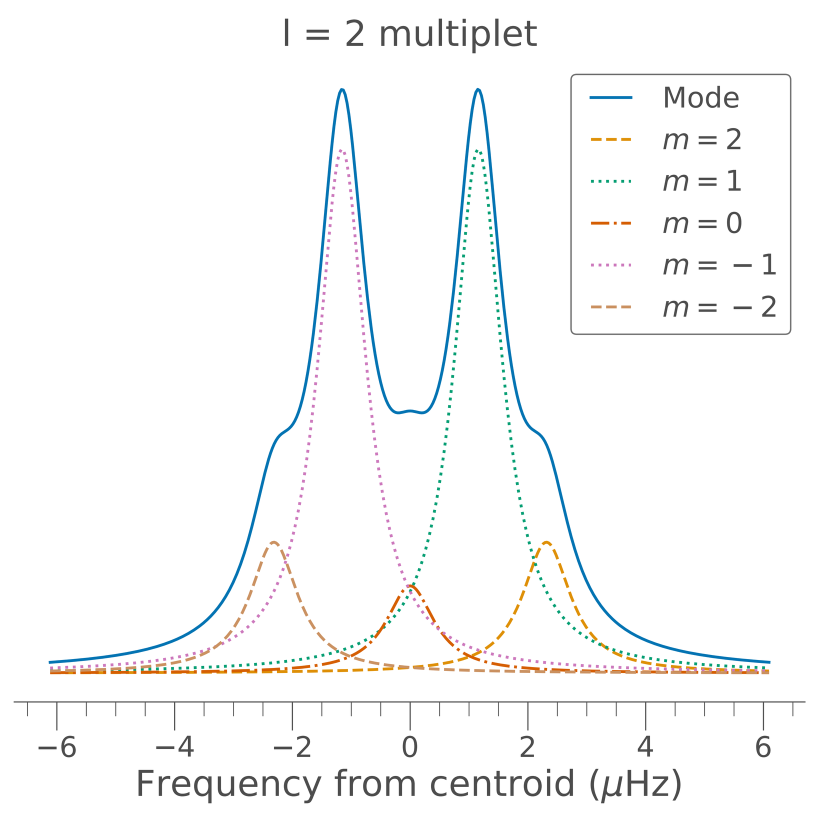




ROTATIONAL SPLITTING

- The rotation and inclination of a star change how modes appear.
- The examples below are for a star with a period of 10 days and an inclination of 45°.





WHATS NEXT?

- **Improving** the fitting process with Gaussian Process priors on **linewidth** and **height.**
- **Fitting** an improved gyrochronology model that treats **mass**, **metallicity**, and the **heteroskedastic** uncertainties.
- **Comparing** our data to evolutionary models and clusters to figure out when (if?) rotation stops slowing.

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Gyrochronology describes how a star's rotation slows down with age as a function of its colour, and can be used to determine ages of stars for which this would otherwise be difficult. However the form of this relation is still unclear, as we are unsure how the slowing of rotation changes for older stars, and lack a full physical understanding of the process. Typically gyrochronology is calibrated through isochrone ages of young clusters and rotation from spot modulation, but these techniques can be less reliable for field stars and stars that are old and less active, limiting our ability to properly calibrate gyrochronology.

Asteroseismology solves these problems by measuring stellar rotation from p-mode frequency splittings and age through comparison to stellar models. In this work, we obtain new periods of rotation for 95 stars in the Kepler LEGACY (Lund et al. 2017; Silva Aguirre et al. 2017) and Kages (Silva Aguirre 2015; Davies et al. 2016) samples, representing some of the highest signal-to-noise main sequence field stars observed by Kepler, and span up to 13 Gyr in age. In this poster, we compare our new rotation periods with established asteroseismic ages and Gaia BP-RP colours to calibrate the gyrochonology relation for field stars, as well as modelling its dependence on mass and metallicity.