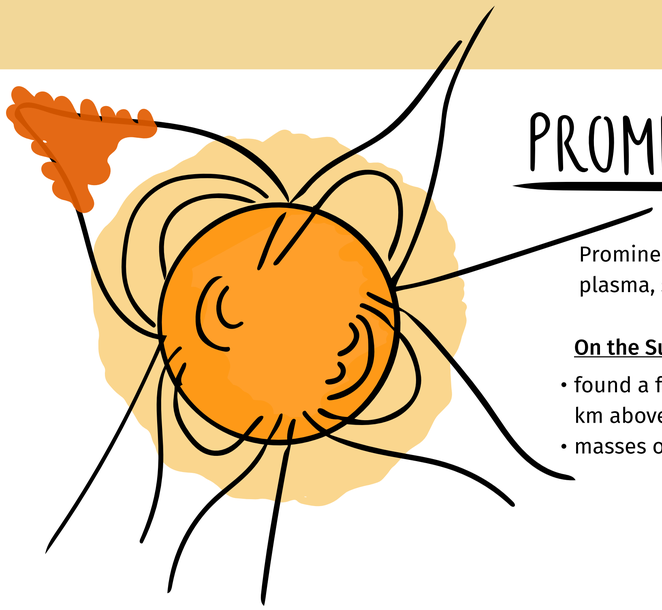
WHICH STARS CAN HOST OBSERVABLE PROMINENCES?

Rose F. P. Waugh and Prof. Moira Jardine, School of Physics, University of St Andrews

rw47@st-andrews.ac.uk, mmj@st-andrews.ac.uk



PROMINENCE?!

Prominences are cool condensations of coronal plasma, supported by the stellar magnetic field.

On the Sun:

- found a few thousand km above surface
- masses of 10^{14} g

On other stars:

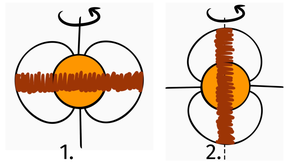
- found a few stellar radii above surface
- masses of 10^{17} g
- co-rotating with the star

MOTIVATION

Understanding these features can:

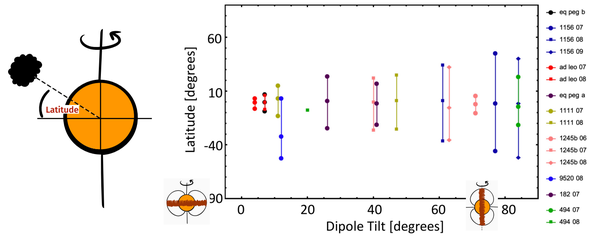
- Tell us about the coronal magnetic field structure,
- they can be used to test extrapolation methods,
- they have a possible link with CMEs,
- ejection could remove considerable mass & angular momentum.

WHERE ARE THE FORMATION SITES?



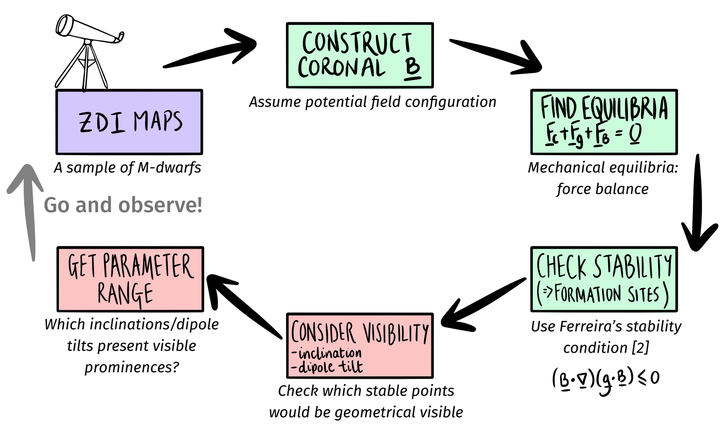
1. Aligned dipole and rotation axes: supports most mass [1] but stable points congregate at equatorial plane. Narrow band of latitudes for prominences

2. Dipole axis perpendicular to rotation axis: closed loops at all latitudes allows for stable points at high latitudes. Large range of latitudes at which prominence material may collect

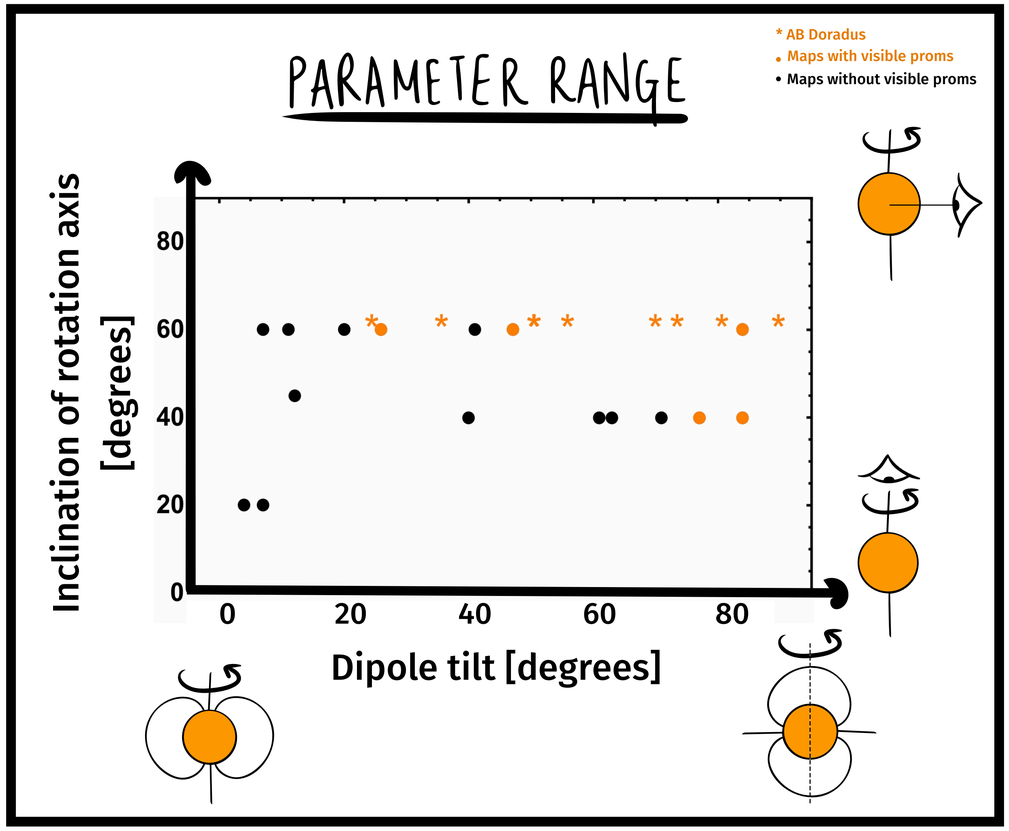


METHOD

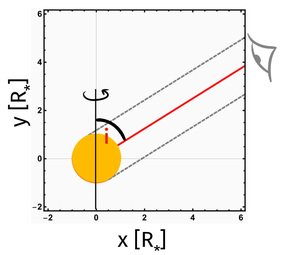
Observations | Theory | Predictions



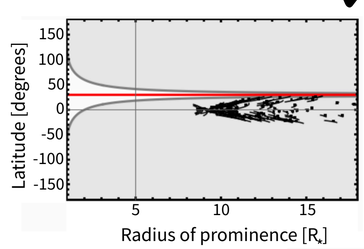
PARAMETER RANGE



WHICH REGIONS OF THE STAR ARE VISIBLE?



- Not all of the star is visible to us from Earth.
- The locations in the stellar atmosphere visible to us are plotted in white. The red line is the optimal viewing angle (90-i)



- Plotting prominence locations on these visibility plots allows us to predict which maps would have held observable prominences.

CONCLUSIONS

- Observed on only a few M-dwarfs but our models suggest they are likely to be common.
- Predict most will be missed by observations, due to their location and the geometry of the system.
- Stars with high inclinations and/or high dipole tilts present better odds for visible prominences.
- AB Dor shows significant variation throughout its cycle for dipole tilt. Could other stars also show such variation? Could this allow for visible prominences at certain points in their cycle?

REFERENCES: [1] Jardine et al. 2019 [2] Ferreira 2000