THE SPACE PHYSICS OF STAR-PLANET INTERACTIONS

SHINE SESSION #11
MOTIVATION

• Kepler has discovered hundreds of exoplanets around GKM stars.

• The emphasis on habitable planets means that there is a need for knowledge regarding how stellar winds and magnetic fields might affect such planets located, and the resulting planetary response and feedbacks.

• Making progress, while interdisciplinary, is essentially a space physics problem, and meshes well with goals of SHINE.
QUESTIONS DISCUSSED

• Is stellar activity associated with larger and/or more frequent active region and starspot emergence, and (if so) how does this affect the astrospheric current sheet and the open/closed field distribution?

• What is the relationship between stellar activity and the magnetic/kinetic energy density in the stellar wind? How does this relationship scale for highly active stars?

• What would increased flux emergence (beyond solar norms) mean for large-flare, CME and SEP production?

• What observables might we look for to address these questions?
There was discussion about the nature of stellar magnetic activity, which could refer to:

- photospheric magnetism (incl. starspots)
- flares
- eruptions (incl. stellar CMEs)
- winds

Can we use relationships between each of these on Sun and scale to analogous relationships on other stars?
EMBEDDED PLANETS

- What space physics environment are planets embedded in?
  - Wind + transients
  - Inside/outside Alfvén radius?
  - Photon environment (esp. EUV and X rays)
- Effects likely to also depend on orientation of planetary magnetic axis wrt stellar ecliptic plane
- Asterospheric magnetic fields also modulate cosmic rays
EVOLUTIONARY HISTORY

- Stars and planets interact over their respective lifetimes, so different behaviors possible at different points in their lifetimes
FUTURE PROSPECTS

• There is likely a space-weather-defined habitability zone that may or may not overlap with “traditional” habitability zone (defined by existence of water)

• Opportunities exist for SHINE-related science to inform study of star-planet interactions

• Such cross-disciplinary investigations can also help with SHINE science