Planets in Binary Systems: A Catalog of Wide, Low-mass Binaries for SIM

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Credit: JPL/Caltech/NASA
Project Goals

1. Construct catalog of wide, low-mass binaries from SDSS
2. Identify optimal binary systems for detection of planets by SIM
3. Examine the feasibility of obtaining orbital parameters of binary systems with SIM
Goal 1: Catalog of wide binaries

SLoWPoKES

Sloan Low-mass Wide Pairs of Kinematically Equivalent Stars

- Catalog of wide, low-mass binaries in the SDSS
- 2000+ common proper motion pairs
- “live” public catalog with photometric & spectroscopic data and system properties
SLoWPoKES characteristics

\[ H_r = r + 5 \log \mu + 5 \]

- white dwarfs
- subdwarfs
- dwarfs
Goal 2: Input Catalog for SIM Planet Search

- SIM broad survey: ~2100 stars with wide range of parameters including binary stars (PI: M. Shao)
- Planets in SLoWPoKES binaries
  - Low-mass: better sensitivity to rocky (and gaseous) planets around M dwarfs
  - Wide: disks survives longer
  - Coeval twins: same mass and age but evolved independently
Optimizing the sample for SIM

Feasibility of planet detection with SIM

1 M_J (1 M⊕) planet around M0 star at 300 pc:
426 mas (1500 µas) for P = 1 year
Integration time: 240 s

Sifting the best binaries for SIM

Radial velocity confirmation

Magnetic activity

Closer companions not seen in SDSS
Goal 3: Stellar Orbits?

- M-L relation will be calibrated using ~100 short-period binaries (PI: T. Henry)
- With μas resolution, SIM could extend this to very wide binaries
- We will conduct simulations to see if this is feasible
  - SIM observes only a tiny portion of the orbit
  - 10" binary at 100 pc ⇒ P ~30,000 yrs, \( v_{\text{orbital}} \sim 2 \text{ mas yr}^{-1} \)
Conclusions

SLoWPoKES, a large catalog of wide, low-mass binaries, has been assembled.

We hope this will be a valuable input catalog for SIM planet and stellar research.

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