Planets in Wide Binaries from Kepler: Ages, Stability and Evolution of Planetary Systems

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**Goal:** Investigate the age distribution of *Kepler* planet candidates

**Method:** Directly observe planetary age

   Infer ages using observations of the host stars

**With planetary ages, we could …**

- constrain timescales for planet formation and evolution
- compare young vs. old planets
  (are young/old systems more habitable?)
- investigate the longterm stability of attending planetary systems
  (e.g., Kaib et al. 2013)
547 common proper motion binaries

- small angular separation
- common proper motions
- matching distances
- Galactic model

klweisenburger.com/posters/
Rotation periods from Kepler

Calibrate gyro models using 82 pairs

WIDE BINARIES IN THE KEPLER FIELD:
USING ROTATION PERIODS AND COLOR TO CONSTRRAIN
GYROCHRONOLOGY MODELS AND PLANETARY OCCURRENCE RATES

STELLAR AGES

MEASURE ROTATION PERIODS AND B-V COLORS FROM KEPLER PHOTOMETRY...

...TO CONSTRRAIN CURRENT MODELS OF STELLAR ANGULAR MOMENTUM EVOLUTION

OLDER ~2 GYR
YOUNGER ~600 MYR

PLANET CANDIDATES

42 KEPLER OBJECTS OF INTEREST IN 31 SYSTEMS

REFERENCES
BARNES 2007, 449, 457,
BATALHA, ET AL., 2000, APJ, 718, L429,
DAMBIS, ET AL., 2000, AJ, 119, 2566,
ZACHARIAS, ET AL., 2001, M5, 44.

THANKS
JANE VANDERPLAS FOR THE CODE
RANDELL MONROE FOR THE FONT

TOP: KEPLER LIGHT CURVES
RIGHT: A SMALL SAMPLE OF PRELIMINARY ROTATION PERIOD MEASUREMENTS WITH TRIAL ISOCHRONES FROM BARNES (2007) OVERPLOTTED

FLUX
TIME
FLUX
TIME

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BARNES 2001, 440, 167,
BATALHA, ET AL. 2006, A719, 1109,
DIAZ, ET AL. 2000, A1, 119, 2644,
ZACHARIAS, ET AL. 2015, 55, 44.

THANKS
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AND XKCD.
15 of 416 stars with ages host 1+ planet candidates
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expect ~4%
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How does the age distribution of planet-hosting binaries compare to that of their field counterparts?
Age (Gyr)