

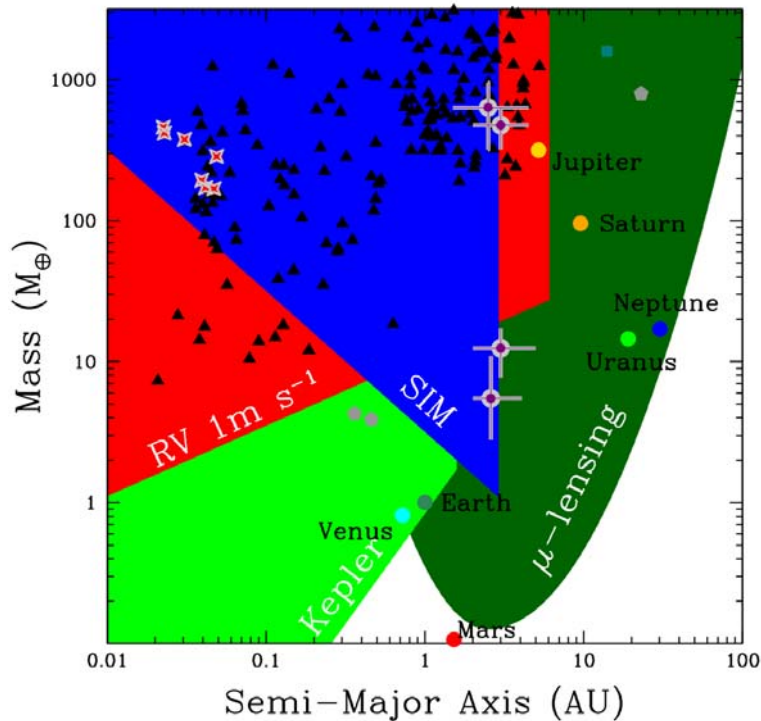
Report from Breakout Group on Exoplanet Searches

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Mark Trueblood, Alan Uomoto

Science Drivers

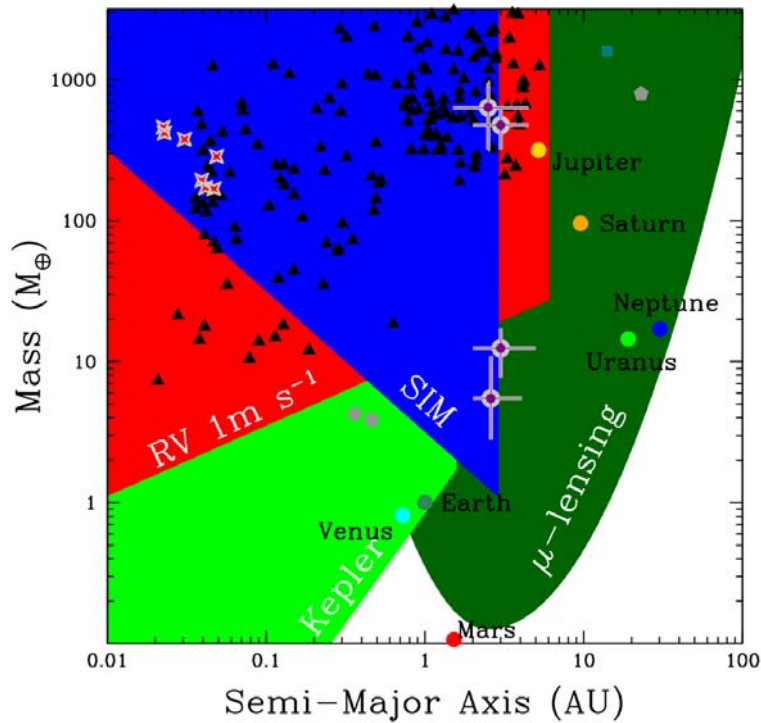
- Census of Exoplanets
- Habitable Planets
- Planet Characterization
- Direct Detection

Detecting Planets (Ground, O/IR)



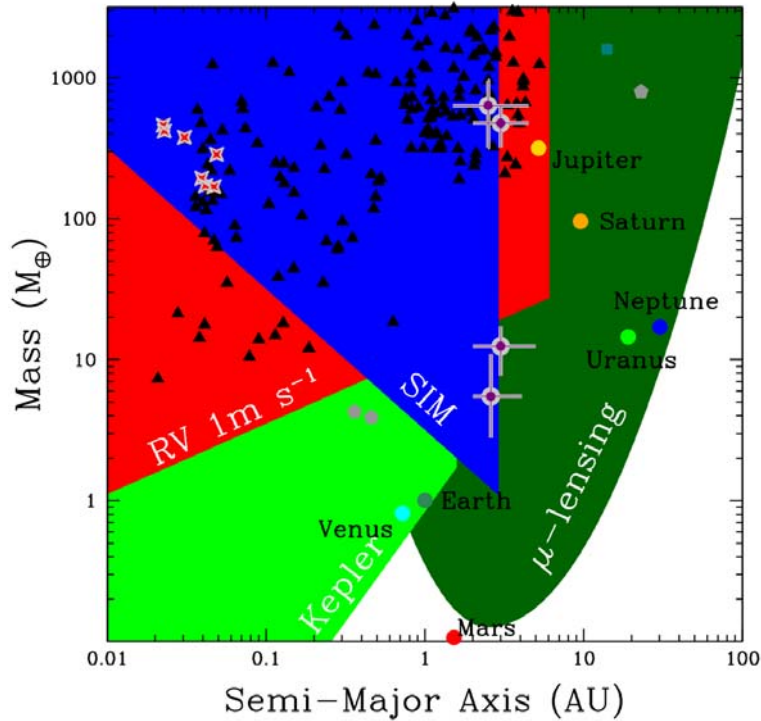
- Methods
 - Transits (Timing)
 - **Microensing**
 - **RV**
 - Astrometry
 - Direct Detection

Census: More of the Same



- Increase sample of planets
- 10 m/s on fainter stars
- Multiplexed RV

Census: Terrestrial and Below



Direct

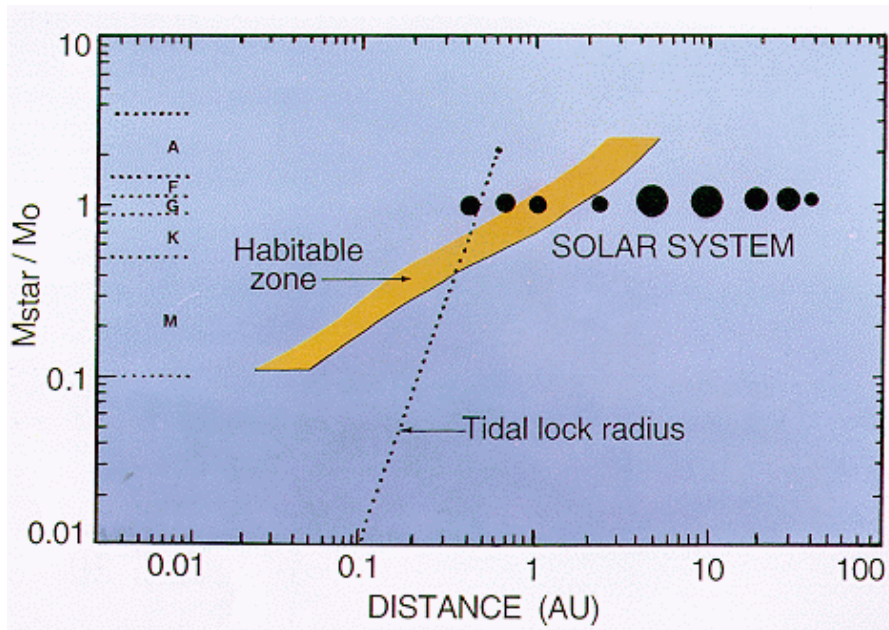
Transits

Microlensing

RV

$$K \approx 10 \text{ cm s}^{-1} \left(\frac{M_p \sin i}{M_{\odot}} \right) \left(\frac{M_*}{M_{\odot}} \right)^{-1/2} \left(\frac{a}{\text{AU}} \right)^{-1/2}$$

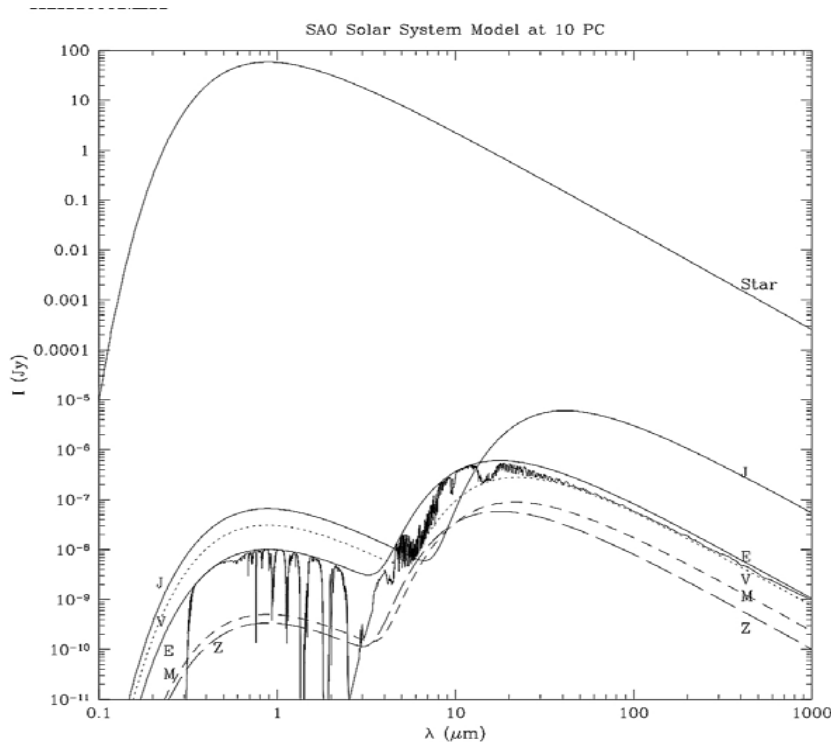
Habitable Planets



$$K \propto M_*^{-3/2}$$

- A stars -- SIM
- G stars -- Kepler
- Late G/K -- Optical PRV
- Late K/M -- NIR PRV

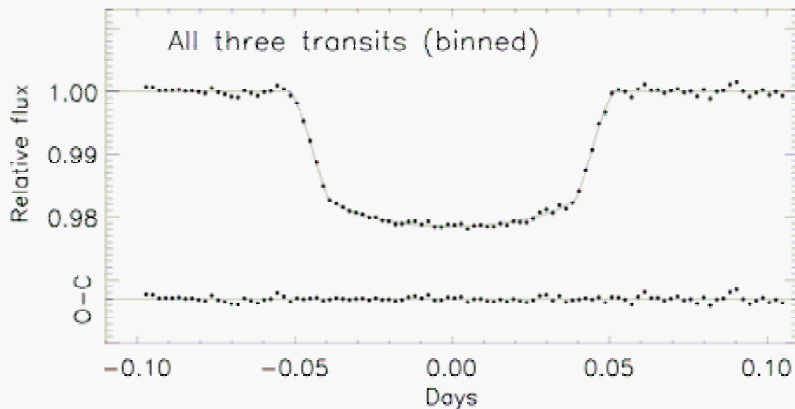
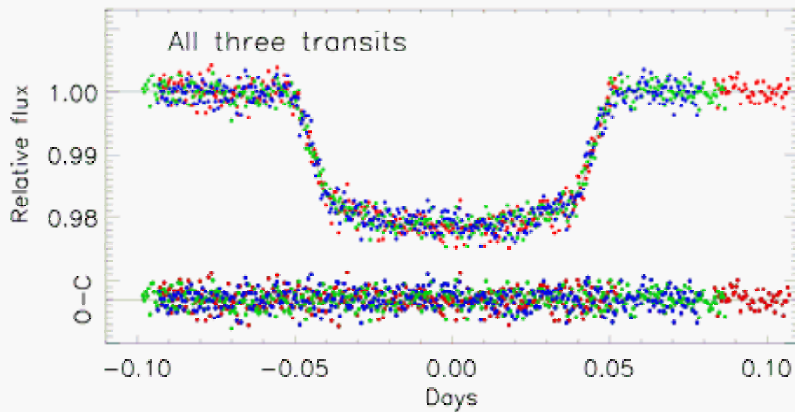
Direct Detection



- Young Systems
- Many planned instruments
- Path laid out
- Developing New Tech.
 - Broadening AODP to include high contrast imaging

Planet Characterization

1.3m telescope



Transit Follow-Up

- IR Photometry
- Astrometry
- Optical/NIR Spectroscopy
- **Precision Photometry**
 - Radii
 - Transit Timing
 - Moons/Rings

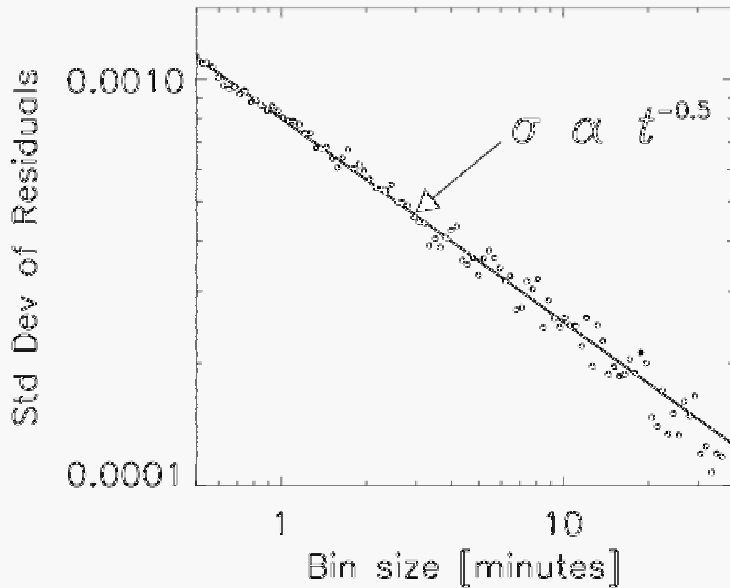
(Winn et al. 2006)

Planet Characterization

- 10^{-4} in 30-minutes

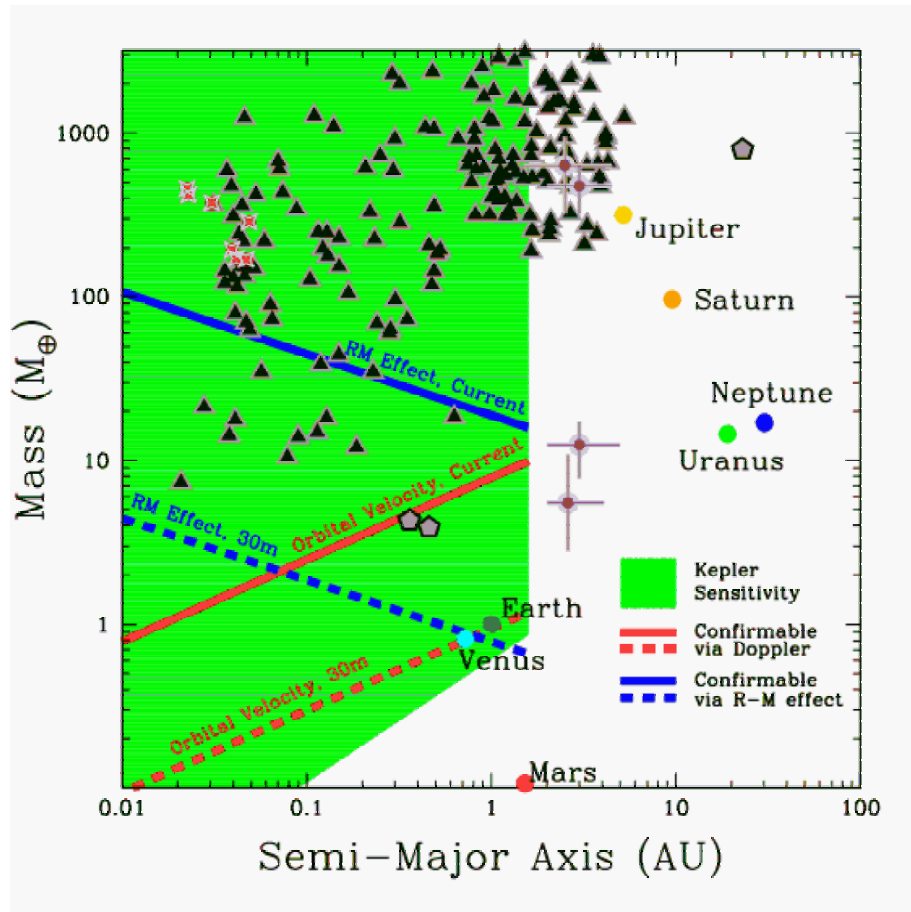
$$\frac{\delta F}{F} \approx 9 \times 10^{-5} \left(\frac{R_p}{R_{\odot}} \right)^2 \left(\frac{R_*}{R_{\odot}} \right)^{-2}$$

- High-precision, High Cadence on LT



(Winn et al. 2006)

Kepler Follow-up



(Gaudi & Winn 2006)

- PRV on LT/ELT
- Lots of Time!

Recommendations - I

Programmatic Suggestions

- **Scheduling Flexibility**
 - ToO, both routine and disruptive.
 - Non-traditional scheduling and access
- **Intensive, Dedicated & Coordinated**
 - More time for a census
 - Coordinated efforts to maximize science
 - 4-6m facility for RV planet-hunting

Recommendations - II

Instrumental Capabilities

- “Diversity of Instrumentation”
- Near-IR Spectrometers for PRV
- High-speed, ultra-precise photometers
 - QUOTA, ODI
- LT/ELT Polarimeters
- LT/ELT High-resolution Spectrometer

Recommendations - III

Direct Imaging

- Path laid out
- Develop new technologies
- Broadening AODP to include high-contrast imaging

Astrometry

- Integrating Scientists with Experts