Report from Breakout Group on Exoplanet Searches

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Science Drivers

- Census of Exoplanets
- Habitable Planets
- Planet Characterization
- Direct Detection
Detecting Planets (Ground, O/IR)

• Methods
  – Transits (Timing)
  – Microlensing
  – 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

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

\[ K \propto M_*^{-3/2} \]
Direct Detection

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

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

- PRV on LT/ELT
- Lots of Time!

(Gaudi & Winn 2006)
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