Kepler Input Catalog and Selection of Asteroseismic Targets

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Kepler Input Catalog

- Used to select optimum targets
- Includes all known stars in Kepler FOV
 - ~ 20 million stars (USNO-B)
- Photometry
 - 2MASS JHK + SDSS griz + D51
 - ~ 2 million stars down to K~14.5 mag
- Astrophysical characteristics
 - Teff, log(g), [Fe/H], reddening; Mass, Radius
 - Radial and rotational velocities







Gliese 436: $R=3.8 R_{Earth}$, $M=23 M_{Earth}$



Photometric Classification

- Observing: mostly with scripts

 Observers: Gil Esquerdo, Jose Fernandez
- Pipeline: magnitudes and astrometry
 - Mark Everett, Planetary Science Institute
- Database: extinction correction, photometry

 Tim Brown, Las Cumbres Global Telescope
- Astrophysical characterization
 - Tim Brown, Søren Meibom, Dave Latham

Spectroscopic Classification

- CfA Digital Speedometer 1979
 - Single order echelle: 45 Å at 5187 Å
 - 8.5 km/s resolution
 - Single object
- Hectochelle on the MMT 2005
 - Single order echelle: 150 Å at 5225 Å
 - 8.5 km/s resolution
 - Multi-object: 240 fibers, 2 robot positioners

Synthetic Spectra

- Old library 32,000 spectra

 150A, tuned to CfA Digital Speedometers

 New Library 1,100,000 spectra

 300A, full resolution (useful to everyone)
 First 50,000 spectra in beta test
 - Solar metallicity, FGK stars, all gravities



Hectochelle on the MMT

- 6.5-m telescope on Mount Hopkins, Arizona
- 8000 spectra of promising Kepler targets

Hectochelle: Teff & log(g)

- Old open cluster M67

 Solar metallicity, solar age
 Magnitude range 8 < V < 14
 Well studied by others

 Adopt solar metallicity
 - solve for Teff & log(g)



Solving for Metallicities

- Adopt Teff from photometry
 - Solve for [m/H] and [α /H]
 - Extensive experience with Digital Speedometer
 - Recently implemented for Hectochelle





TRES - 2007

- Tillinghast Reflector Echelle Spectrograph

 Multi-order, single object: 3850-9000 Å
 Fiber fed: best resolution of 5 km/s
 Good stability (10-20 m/s ?)

 2-3 mag faster than CfA Digital Speedometer

 Reasonable exposures for 15th mag targets
 - Workhorse for follow-up of Kepler candidates
 - Available to characterize asteroseismic targets



Follow-Up Spectroscopy

- Initial reconnaissance spectroscopy
 - Identify stellar imposters
 - Characterize host star
 - TRES at FLWO will be the workhorse
- Precise radial velocities for orbits/masses
 HIRES, HET, HARPS-North

New Earths – HARPS North

- Collaboration with Geneva
- Ready for Kepler follow-up in 2010
- ~100 nights/year goal on WHT (La Palma)



Harvard University Origins of Life Initiative



• Formally approved with funding profile, May 2006

• Synergy between 5 areas at Harvard, 3 new facilities

- Pre-biotic Chemistry
- Extraterrestrial Samples
- New Earths
- Led by Dimitar Sasselov