

## **PROPOSAL for Kepler-2 Campaigns 2 and 3**

### **Planetary systems at young ages with Kepler-2**

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The high scientific potential of Kepler-2 observations on young stars have been already demonstrated in the white paper by Lloyd et al. 2013. First, observations of young stars will provide clues on the timescales of planet migration that carries the Hot Jupiters from their likely site of formation beyond the snow-line in the protoplanetary disk to the location close to the central stars observed. Furthermore, the eccentricity of the planet orbit (which can be measured through RV follow-up) will provide clues on the tidal evolution of the system and then on the planet structure (Quinn et al. 2013). Finally, the planetary radius is expected to change with stellar age due to the contraction. The direct measurement of planetary radii at young age will be then of paramount relevance for the characterization of giant planets.

Lloyd et al. 2013 proposed dedicated searches of young stars in the Kepler 2 fields, using e.g. GALEX UV observations and additional age diagnostics. In this proposal we are instead doing the other way for Kepler-2 target selection, that is propose well-known young stars (in most cases members of young moving groups) that are or will be part of planet search surveys using direct imaging, radial velocity, or both. This has the advantage that the targets are already characterized, in terms of high-resolution spectroscopy and deep imaging observations, then strongly decreasing the chance of astrophysical false positive from Kepler-2 observations. The synergy with other planet-detection methods will also allow a comprehensive view of the occurrence of giant planets, from the few-day period explored with photometric observations to the very wide orbits probed by direct imaging. These latter may be linked to planet-planet scattering events that also causes the migration of an Hot-Jupiter in close orbits. Most of the proposed targets are going to be included in the target list of the SPHERE GTO survey (Beuzit et al. 2010) and/or were observed with LMIRCAM at LBT as part of the LEECH program (Skemer et al. 2014) or NACO at VLT. Some stars are also being observed as part of the on-going Radial Velocity Large Programs on young stars (PI A.M. Lagrange) using HARPS at ESO 3.6m and SOPHIE at 1.9m Haute-Provence (see Lagrange et al. 2013, note that we have the capability of obtaining high-precision RV also for early type stars). All the stars are of late spectral type and with Kepler magnitude  $K_p > 8$ . Most of these stars have ages between 50 to 500 Myr, the complementing the sample of very young stars from Upper-Scorpio association which is included in Field #2. This will enhance the possibility of the study of the evolution of planetary systems. Kepler-2 photometry will provide, beside detectability of short-period transiting planets, very useful information for the characterization of young stars, as e.g. rotation periods. The simultaneous RV and photometric observations will also allow to improve the techniques for correction of activity effects from RV time series (cfr. e.g. Lagrange et al. 2010; Lanza et al. 2011).

#### References:

- Beuzit et al. 2010 ASPC 430, 231
- Lagrange et al. 2010 A&A 512, A38
- Lagrange et al. 2013 A&A 559, A83
- Lanza et al. 2011 A&A 533 A41
- Lloyd et al. 2013 arxiv 1309:1520
- Quinn et al. 2013 arxiv 1310.7328
- Skemer et al. 2014 arXiv:1401.0481