**Finding transiting exoplanets in Upper Scorpius with Kepler K2**

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Transiting planets are "Rosetta Stones" because they provide clues on the contents of exoplanetary atmospheres, offering a great potential to molecules that may reveal the presence of life beyond our own planet Earth. The transit of a planet, combined with radial velocity measurements, provides the mass and the radius of the planet (Torres 2008, ApJ, 677, 1324), the planetary brightness temperature (e.g. Charbonneau et al. 2005, ApJ, 626, 523), the planetary day-night difference (e.g. Harrington et al. 2006, Science, 314, 623; Knutson et al. 2007, Nature, 447, 183), and absorption features of the planetary upper-atmosphere constituents like sodium, hydrogen, water, and methane (e.g. Charbonneau et al. 2002, ApJ, 568, 377; Vidal-Majar et al. 2003, Nature, 422, 143; Swain et al. 2008 Nature, 452, 329).

In our current knowledge of the Earth, little is known about its evolution during the first hundreds of million years. It is important to understand the evolution of exoplanets with time to provide key information in the early history and composition of our planet. This work aims at addressing important aspects such as (1) the frequency of planets in clusters, (2) the evolution of planet interiors as a function of age, and (3) planet formation models and the effect of migration. To address these questions, we plan to take advantage of the Kepler K2 mission that will monitor several clusters/regions with a wide range of age for 70–80 days continuously during the next two years: $\rho$ Oph (age $\sim$ 1 Myr; d = 131 pc), Upper Scorpius (d = 145 pc; age = 5–10 Myr), Pleiades (d = 120 pc; age = 125 Myr), Praesepe (d = 180 pc; age = 590 Myr), and the Hyades (d $\sim$50–70 pc; age = 625 Myr). We will be sensitive to short period super-Earths and larger planets around well-characterised young solar-type star and M dwarf members. If the current empirical frequency of planets hold at young ages, we expect to discovery at least one super-Earth per cluster. We would like to emphasise that the frequency of planets at young ages is currently unknown. Only two Jupiter-type planets have been announced in Praesepe with periods of 2.1 and 4.4 days (Quinn et al. 2012, ApJ, 756, 33). Looking at the hundreds of exoplanets known to date, only 2.8% of the host stars are younger than 600 Myr (http://exoplanet.eu).

Over the past decade our team has focused on young clusters ($\leq$600 Myr) imaged in an homogeneous manner with the UKIDSS (Lawrence et al. 2007; MNRAS, 379, 1599) Galactic Clusters Survey to identify photometric and astrometric bona-fide cluster members and derive the cluster present-day mass function. We have now completed our analysis for several clusters surveyed by UKIDSS, including three in common with the Kepler K2 mission: Upper Scorpius, Pleiades, and Praesepe (Lodieu et al. 2006, MNRAS, 373, 95; Lodieu et al. 2007, MNRAS, 374, 372; Lodieu et al. 2011, A&A, 532, 103; Lodieu et al. 2012, MNRAS, 422, 1495; Lodieu et al. 2012, MNRAS, 426, 3403; Boudreault et al. 2012, MNRAS, 426, 3419; Lodieu 2013, MNRAS, 431, 3222). These clusters span a wide range of ages, from 5 Myr up to 600 Myr and are younger than the field stars targeted by current radial velocity and/or transit surveys whose age and metallicities are very difficult to measure accurately. The main advantage of cluster members is that they are born in the same cloud at the time under the same environment. Hence, they represent ideal targets to look at the formation and structure of planetary systems and the evolution with time of the composition and atmosphere of exoplanets.

We have started an ambitious follow-up program to confirm spectroscopically the membership of all candidates and infer their physical properties such as temperature (derived from spectral types) and mass from state-of-the-art models. The intrinsic parameters of the host stars are crucial to infer the properties of any potential orbiting planet. We have already collected spectroscopic data for a large number of cluster member candidates in the Upper Scorpius, the Pleiades, and Praesepe using a wide range of telescopes and instruments (e.g. Lodieu et al. 2011, MNRAS, 527, 24). Moreover, we have also obtained lucky-imaging high-resolution images for more than 500 solar-type and M dwarfs in Praesepe and the Pleiades to complement studies in Upper Scorpius with large ground-based telescopes (Biller et al. 2011, ApJ, 730, 39). We typically achieved spatial resolution of 0.1 arcsec and depths of 4–5 mag at distances larger than 0.5 arcsec from the primary. Hence, we know the level of activity, spectral type, temperature, and multiplicity properties of our target stars.

For the Kepler K2 campaign #2, we focus our efforts on the nearest OB association to the Sun, Upper Sco. We have compiled the most up-to-date list of high-mass and low-mass members using the catalogue of Luhman & Mamajek (2012, ApJ, 758, 31) and our latest studies (Lodieu 2013, MNRAS, 431, 3222; Béjar et al. in prep). The full catalogue contains about 850 objects with a wide range of spectral types and magnitudes which lie within the Kepler K2 pointing towards Upper Sco.