Rojas-Ayala et al. Proposal for Campaign 1

Transiting Planets Around M dwarfs in Field 1: The Hunt for The Small Planets!

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In almost 20 years of planet searches, more than 4500 exoplanets (candidates + confirmed) have been found in the Milky Way. However, the bulk densities and compositions for a large number of them are still unknown or unconstrained, and only few are very small planets with accurate masses and radii to infer their bulk density and "likely" terrestrial composition.

M dwarf stars are the most favorable targets to explore the regime of very small planets since they induce larger signals, than in more massive stars, in both photometric and radial velocity (RV) techniques (e.g. Nutzman & Charbonneau 2008). Furthermore, being small and cold, the habitable zones (HZ) are closer for M dwarfs, which facilitates the detection of earth-like planets orbiting them. Dedicated RV planet searches around M dwarfs have been done for more than 10 years (e.g. HARPS, Bonfils et al., 2013) unveiling ~ 10 very small planets, including 3 super-earths in the HZ of their hosts. Disappointingly, only two of them transit their host star and their bulk densities have been constrained: GJ 436 b (Butler et al. 2004, Gillon et al. 2007) and GJ 3470 b (Bonfils et al. 2012). Transit surveys have found two more confirmed planets: GJ 1214b (MEarth, Charbonneau et al. 2009), and Kepler-45b (Johnson et al. 2013), increasing the number of confirmed planets transiting M dwarfs of known bulk density to four, all with densities similar to the solar system giant planets.

Interestingly, recent studies based on RV surveys and Kepler data (Bonfils et al. 2013, Dressing & Charbonneau 2013, Kopparapu 2013) have concluded that M dwarfs may be the most abundant planet hosts in the Milky Way, with a terrestrial planet with P< 50 days for almost every M dwarf (!), and a frequency of earth-size planets in the HZ between ~0.15-0.48 per star.

We propose to search for these short-period terrestrial planets around 104 M dwarfs in the EPIC catalog present in Field 1 of the K2 Mission. The stars have been selected from the SUPERBLINK catalog (Lépine & Shara 2005), with Kp magnitudes from ~12 to ~13.6 mag, spectral types between M0 and M4, and [Fe/H]s within -1.0 dex and 0.5 dex (Rojas-Ayala et al. in prep.). We propose to observe the brightest M dwarfs in short cadence (first 10-15 stars of the list), to facilitate the detection of any candidate, as well as the characterization of stellar activity of the star and instrumental effects present in the K2 data, and the rest in long cadence. By choosing objects brighter than Kp~14, we are ensuring that RV follow up can be done with current instrumentation (e.g. HARPS-N, SOPHIE), and therefore, the candidate's bulk density can be obtained to constrain its nature and internal structure, which will allow the comparison with planets transiting solar-type stars. Considering the low number of confirmed planets transiting M dwarfs, any candidate will considerably improve the statistics of planets around the most numerous stars in the Galaxy. Our team has a strong expertise in transiting planet surveys (Kepler, CoRoT), RV characterization of planets, and determination of M dwarf physical properties, which will ensure the proper characterization of any planetary system found.

These observations will improve our understanding on the diversity, formation, migration, and evolution of planetary systems hosted by main-sequence stars.