Kepler Campaign 0: potential targets in young clusters and associations

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We present a list of targets which could be observed as part of campaign 0 with the repurposed Kepler spacecraft, or K2. These targets are all known or likely members of relatively nearby young clusters and associations. The scientific motivation for observing such objects was set out in detail in a white paper entitled *Monitoring young associations and open clusters with Kepler in two-wheel mode* (Aigrain et al., `arXiv:1309.0737`), so we only briefly outline them here. Young associations and open clusters are very useful laboratories to study star formation and the early stages of stellar evolution, as they enable us to probe a specific set of properties for a group of stars sharing the same age and composition but spanning a range of masses. Time-series photometric observations of such systems, in particular, can be used to probe a host of important phenomena, including accretion (for the youngest star forming regions only), pulsations (from pre- to post-main sequence), rotation and activity. These observations can also be used to detect and characterise eclipsing binaries (EBs), and thus to constrain evolutionary models by measuring the fundamental properties (masses, radii, luminosities and temperatures) of their component stars in a model-independent manner. Finally, they can also be used to search for planetary transits, potentially offering a window into the earliest stages of the evolution of planetary systems.

The most significant cluster that may be included in the campaign 0 field is M35, a rich early main sequence, relatively nearby cluster (almost 2000 known members, ~ 100 Myr, ~ 800 pc; Barrado y Navascués et al., 2001, ApJ, 546, 1006; Kalirai et al. 2003, AJ, 126, 1402), which has been the target of recent large-scale rotation and kinematic studies (Meibom et al., 2009, ApJ, 695, 679; Geller et al., 2010, AJ, 139, 1383). This cluster lies just outside a cone of diameter 12° centred on the nominal pointing coordinates (06h 47m 00s, +21° 22' 47"), but could be observed by delaying the start of the run slightly compared to the nominal March 10 start date. We include 3 lists of targets for this cluster: 1729 stars candidate members from Barrado y Navascués et al. (2001), 115 additional objects from Geller et al. (2010), and a further 182 from Meibom et al. (2009). In M35 the magnitude range $13 \leq R \leq 21$ corresponds to $1.4 \leq M/M_{\odot} \leq 0.35$; 1428 of the targets listed fall in that range. We also included fainter candidate members (down to $R \sim 22$, $0.1\,M_{\odot}$) as these very low mass stars are particularly interesting for rotation studies and eclipsing binary searches.

We then searched both the nominal cone and the vicinity of M35 for other young open clusters and/or known members of young associations. One particularly cluster is NGC 2175, associated with the Jellyfish nebula (Jessy et al., 2013, MNRAS, 432, 3445). Many of the proto-stars in this region are still embedded but there are nonetheless 101 targets with $J < 16$, of which 78 have V and/or R counterparts in the NOMAD catalog (i.e. down to $R \sim 19$). We note that a few of the B stars in this star forming region are known to be variable (Zhang & Xiang, 2008, J. Phys. Conf. Ser. 118). We also include target lists for two pre-main-sequence clusters: NGC 2129 (10 Myr, 2 kpc, Carraro et al., 2006, MNRAS 365 867) and Collinder 89, (~ 30 Myr, ~ 1 kpc, Kharchenko et al., 2004, 325, 740). These are relatively poorly studied, so the membership lists are probably incomplete and contamination may be relatively high. We are aware of a deeper UBV survey of NGC 2129 by Tripathi et al. (2013, BASI, 41, 209), but the data is not yet publicly available.

Crowding may be important for K2 observations of rich clusters, particularly in M35. It may be advisable to prioritise targets which have at most one other target within the K2 PSF. We chose not to do this ourselves partly due to time pressure, but also partly because we do not know the pointing accuracy of K2 well enough. However, this factor affected our decision not to inlcude another relatively rich cluster located near M35, NGC 2158, because it is significantly more compact and hence crowding is likely to be even more problematic (this cluster is also signficantly older, 3.6 Gyr, and therefore less relevant to the science goals of this specific proposal).

Finally, we also identified 3 Hyades members (Schwan 1991, A&A, 243,386) and 1 low-mass young disk star (Montes et al., 2001, MNRAS, 328, 45), which lie in the potential field of view and are all very interesting because they are bright, nearby young stars. As these 4 objects have high proper motion, we opted to include them here with more details, rather than in a separte ASCII file:

Name	RA	Dec	pmRA	pmDec	Vmag	SpT	Association
HD 53532	07 06 16.80	+22 41 00.6	−92.0	−77.8	8.27	G0V	Hyades
HD 45688	06 29 37.43	+16 58 37.7	10.7	−31.6	13.85	G5D	Hyades
HD 256814	06 25 23.66	+21 35 02.5	3.5	−43.6	8.71	K0D	Hyades
GJ 232	06 24 40.00	+23 26 18.00	390.0	−300.0	13.06	M4.5V	young disk