The Nearby Brown Dwarf WISEP J060738.65+242953.4

One of the nearest brown dwarfs happens to lie within the possible K2 Campaign 0 region at an ecliptic latitude of 1.07 degrees. WISEP J060738.65+242953.4 is a recently discovered (Castro & Gizis, 2012, ApJ, 746, 3) L8 dwarf with a trigonometric parallax distance of 7.2 parsecs (Castro et al., 2013, ApJ, 776, 123). This makes it the third closest known late-L dwarf (after Luhman 16A and DENIS 0255-49) and I believe the second-nearest brown dwarf of any kind observable by K2. However, W0607+24 requires a small shift (along the ecliptic) from the nominal bore sight.

K2 monitoring would provide a unique dataset to investigate 1400K substellar atmospheres. There is now overwhelming evidence of variability in the near-infrared and mid-infrared with periods of 3-10 hours for many L and T brown dwarfs, probably due to rotation of inhomogeneous atmospheres (Apai et al., 2014, AAS 223, 425.05; Radigan, 2014, AAS 223, 425.05). New studies of the recently discovered two-parsec L8/T0 system Luhman-16 (Burgasser et al. 2013, MdSAI, 84, 1017) show that the "optical" (far-red) light-curve can change from rotation to rotation, which suggests that long observations are indeed needed. Such changes are usually attributed to rapid cloud evolution, though Marley (2014, AAS, 223, 425.02) has recently suggested thermal perturbations. A continuous photometric campaign by K2 would be of great value in understanding these photospheric variations. In addition, K2 can in principle detect a large rocky planet transiting the Jupiter-sized brown dwarf. There has been considerable interest in the possibility of habitable planets around brown dwarfs (Belu et al. 2013, ApJ, 768, 125; see also the 2013 Kepler White Papers) because they would have short periods and relatively high transit probabilities.

The expected precision is $\sim$ 1.2% per observation in long cadence mode, adequate for the proposed science. I compute the expected count rate and signal-to-noise by scaling from the Kepler observations of the L1 dwarf WISEP J190648.47+401106.8 (Gizis et al., 2013, ApJ, 779, 172), using the observed spectra and relative SDSS photometry. W1906+40 had 660 "counts" and precision of 0.5% in long cadence; W0607+24 is fainter and redder but should have 110 counts and 1.2% precision in long-cadence mode. Short cadence mode has a predicted precision of $\sim$ 6% which would allow white light flares (as in W1906+40) to be detected and may be desirable if a planet is transiting. Such flares are probably unlikely (there is no chromospheric emission) but would be a dramatic discovery. The attached coordinates include proper motion; the SDSS AB magnitude is $i = 20.0$. Pixel-level modeling will be necessary due to the presence of background stars with centroids a few pixels away. I believe even observations for a few days would be valuable.

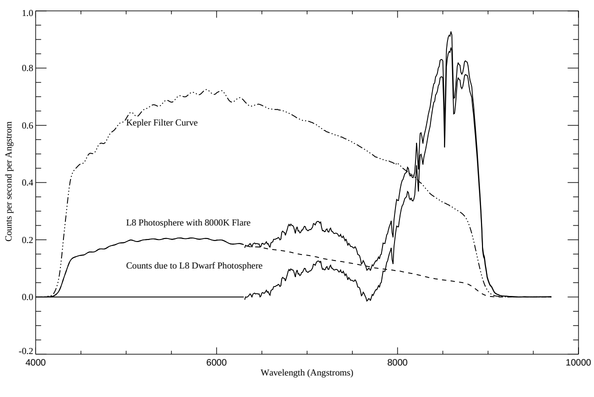

Figure 1: Observed spectrum of W0607+24, folded through the Kepler response; the L8 dwarf contributes significant flux through the reddest parts of the Kepler filter with an effective wavelength of 832 nm. A hypothetic flare (hot blackbody continuum) of the kind observed in W1906+40 is also shown.