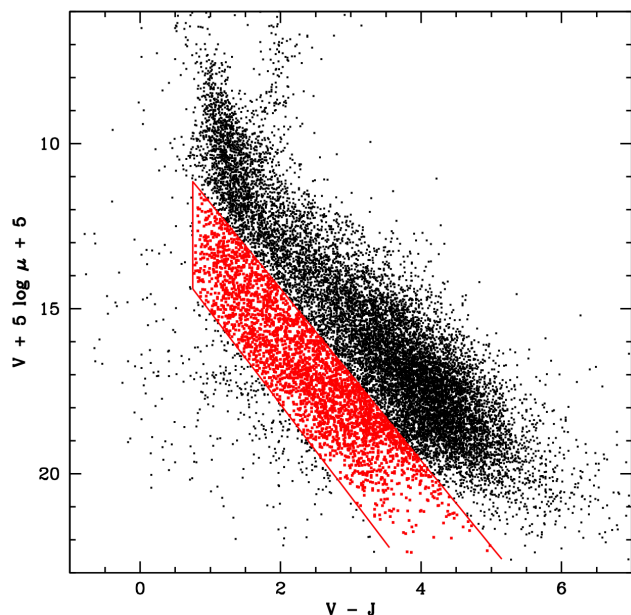


K2 Campaign 1 Target Proposal

Title: A KEPLER-K2 search for exoplanets orbiting main-sequence stars of the local Galactic halo population.

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Scientific Justification: To date, the local halo population has not been systematically searched for exoplanets. It remains unclear whether the oldest stars in our Galaxy formed planets in significant numbers or not, or whether these planets are physically different from the planets that formed in more metal-rich environments. The only way to answer these questions is to conduct a systematic survey of a large number of halo main-sequence stars. Few halo stars were accessible in the original Kepler field, which was situated at low Galactic latitudes. However now that the planned K2 mission is observing fields at high Galactic latitudes, it is becoming easier to identify and target stars from the local halo population.

The K2 Campaign-1 field has been entirely searched for high proper motion stars as part of the SUPERBLINK proper motion survey (e.g. Lépine & Shara 2005, AJ 129, 1483; Lépine & Gaidos 2011, AJ 143, 138), which lists 17,431 stars with proper motion $\mu > 40$ mas/yr within 8.5 degrees radius of the proposed Campaign-1 field center. A reduced proper motion diagram (see figure) identifies a population of high-velocity halo stars, sandwiched between the main locus of field main-sequence stars (upper right) and the bluer population of white dwarfs (lower left). This Galactic halo locus is confirmed by spectroscopic follow-up observations (Lépine, Rich, & Shara 2007, ApJ 669, 1235). A total of 3,073 halo candidates are identified based on color and reduced proper motion cuts (red dots). This suggests that the final, 105 sq. deg. K2 field should contain about 1,400 main-sequence dwarf halo targets.

Interestingly, about 55% of the proposed target are expected to be K-type and M-type main sequence stars, based on $V-J$ color ($V-J > 2.5$), which means Earth-sized planets could potentially be detected transiting those stars.

Of the 3,073 stars included in the target list, 759 were found to have incorrect proper motions in the Kepler EPIC input source catalog (either these are listed as 0 in the catalog, or the proper motion has a large error). The correct proper motions, measured from the SUPERBLINK survey, are listed. In addition 18 stars were found to be missing from the EPIC catalog altogether. These stars have positions and proper motions listed as well. All positions are given at the J2000 equinox and for the 2000.0 epoch. The latter makes it critical to apply the appropriate proper motions to extrapolate the positions to the present ~ 2014.5 epoch.