The K2 M Dwarf Program: Fields 6-7

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Low-mass M dwarfs provide the highest probability of detecting small (~0.5 – 4 RE) transiting planets by virtue of the large transit depths seen for such small stars. These deep transits also increase the potential for subsequent atmospheric characterization. The extended Kepler K2 mission provides the opportunity to monitor tens-of-thousands of nearby, ecliptic M dwarfs with precise, long-cadence photometry and discover a new population of rocky and potentially habitable planets and larger sub-Neptunes that are amenable to transit spectroscopy. We propose to observe 3733 M dwarfs in the K2 campaign 6 and 7 fields (as verified by K2fov) to continue our successful K2 program that we call the K2 M Dwarf Project (K2-MDP). We estimate hundreds of small planets around M dwarfs from the full K2-MDP program, with ~50 in Fields 6 and 7. This new population of planets will drastically increase the number of known M dwarf planetary systems, improve planet frequency statistics, inform theories of planet formation, evolution, interiors, and atmospheres, and provide new targets for follow-up with current and future observatories.

Our M dwarf targets are selected from the SUPERBLINK proper-motion database on the basis of high proper-motion and photometric colors. This selection method captures the majority of M dwarfs within 100pc of the Sun from this deep (95% complete to V =19) catalog with little contamination. Our targets extend down to Kp=16, most are M3-M4 dwarfs, and all are in EPIC. We prioritize our targets using expected transit S/N, determined by comparing K2's photometric precision to predicted transit depth for a nominal transiting planet. We estimate transit depths by converting DSS, PanSTARRS 1, 2MASS, and WISE photometry to spectral type and then to radius and temperature. Our team exploits knowledge gained from analysis of Kepler light curves to search K2 pixel data for planet transit signals. Spectroscopic observations of candidate planet hosts will provide fundamental parameters such as temperature, metallicity, surface gravity, and age. Where feasible, new systems will be proposed as targets for radial velocity monitoring for full characterization. Our full program, from target selection, to planet discoveries, to host characterization, aims to provide the largest and most reliable sample of small, transiting M dwarf planets to date.

The K2-MDP team has made steady progress toward these goals and draws on considerable experience from Kepler. We have so far had successful target proposals for K2 fields 0–4 (GOs 0120, 1036, 2107, and 3107), have been awarded a 70- night ESO Large Program for spectroscopic follow-up of candidate planet hosts (PID 194.C-0443) along with many nights of high-precision AO and RV followup at Lick, Palomar, LBT, and Keck, and 450 hours of time for Spitzer transit observations of our sample.

The proposed targets comprise a key portion of the K2-MDP program which aims to exploit the strengths of the K2 mission design to reveal hundreds of small planets around nearby M dwarfs. Discoveries of habitable zone, Earth-like planets and planets suitable for atmospheric characterization are primary science drivers for K2 and primary goals of NASA. Our program will provide both the small, rocky planets and key transit spectroscopy targets for early JWST Guaranteed Time Observations (GTO) leading up to the GTO proposal deadline in late 2016; months before the launch of TESS.