MEASURING THE MASSES AND RADII OF THE LOWER MAIN SEQUENCE II: IDENTIFICATION OF NEW ECLIPSING M-DWARFS

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We propose to continue to use Kepler to search for new low-mass main-sequence eclipsing binaries and characterize intrinsic M dwarf activity. Recent studies of eclipsing low-mass stars, (which allow the determination of individual masses and radii to better than 1%), have shown that the radii of late-type dwarfs are consistently 10% larger than predicted by stellar models. The cause for this might be enhanced magnetic activity due to their binarity, and thus artificially enhanced rotation rates. If so, such an effect should diminish with increasing semi-major axis and thus period. Unfortunately, only a single known system has a period > 3 days, and thus this hypothesis cannot be tested. Additional eclipsing low-mass dwarfs, especially with long periods, are needed. Kepler is ideally suited to find these long-period systems, whereas ground-based surveys are cadence and/or magnitude limited. We present an optimal sample of 1,200 currently unobserved M dwarfs to monitor for eclipsing systems. We will use NMSU resources at Apache Point Observatory to obtain follow-up photometry and spectroscopy to determine the fundamental parameters of the components in each system in conjunction with the Kepler data. Additionally, we propose to study low-mass star rotation periods, flare rates, and spot cycles for all stars which turn out not to be binaries. In relation to the Kepler Mission and broader impacts, the knowledge of how the radii of low-mass stars depend on their intrinsic properties is critical to accurately determining the radii of transiting planets around such stars. As well, characterizing M dwarf variability at the mmag level is needed to understand how this variability affects planetary transit signatures over time in low-mass systems.