INVESTIGATING LOW-MASS STARS: THE PERIODS OF SLOW ROTATORS AND THE LIFETIMES OF THEIR ACTIVE REGIONS, AND MODELING EVOLVING STARSPOT MORPHOLOGIES

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Analysis of the light curves for the 849 low-mass stars in our Cycle 1 program (Harrison et al. 2012) have lead to the discovery of many dwarf stars that have apparent rotation periods in excess of 90 days. According to theory, such stars should be quite rare. In addition, the active regions on these objects appear to persist for the duration of our Kepler observations (up to 270 d!). We seek additional, year-long, long cadence observations of these targets to both measure their rotation rates, as well as to investigate the longevity of their active regions. In addition to the discovery of the "slow rotators", we have found that low-mass stars often show two unexpected light curve morphologies: "flat minima" and "antipodal". Flat minima light curves require large bands of activity spanning 270 degrees of longitude. Antipodal light curves indicate spots on opposing hemispheres. Both of these types of light curves suggest persistent magnetic field structures that remain largely unaffected by the differential rotation expected to occur in these late-type stars. We seek new long cadence Kepler observations that span Cycle 4 for these objects to explore the formation and evolution of these light curve morphologies. Finally, we have identified 29 targets from our Cycle 1 program that clearly display evidence for differential rotation. Due to the changing spot morphologies on these targets, however, it is difficult to measure their relative differential rotation rates with only a single quarter of data. We request new observations of these targets that span Cycle 4 to allow us to confidently measure their differential rotation rates. Our program requests new data for 242 targets.