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Abstract:
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The Kepler satellite has provided spectacular optical photometric light-curves of unprecedented precision and duration that allow detailed studies of stellar magnetic activity on late-type stars that were difficult previously. Kepler's multi-year duration light-curves allow investigation of how activity phenomena -- such as the growth, migration, and decay of star-spots, differential rotation, activity cycles, and flaring -- operate on a wide variety of single and binary stars. The Kepler dataset contains light-curves for many rapidly rotating stars with few day periods that allow study of stellar magnetism at its most intense.

Short rotation periods and high levels of magnetic activity are strongly correlated. However, there are only two basic reasons why stars with rotation periods of a few days possess such high angular momentum --- either they are close binaries or they are young stars. During Kepler GO Cycles 1 through 4 we have studied the Long-cadence (30 minute sampling) photometry of hundreds of active late-type stars and as an essential complement we have obtained high resolution optical spectra to understand the physical properties of these stars. We describe results from our spectroscopic survey using the MMT Hectochelle multi-object echelle of 5 square degrees of the Kepler Field. We have discovered a significant population of young stars with Li I absorption indicating ages of ~600 Myr or less (some at ages of ~tens of Myr) at a spatial density of at least 20 stars per square degree. Roughly one sixth of the stars observed are young and a similar number short-period binaries based on 2-5 radial velocities. We have used detailed spectral synthesis and modelling using the SME code to measure the basic physical properties of these stars to establish their evolutionary status and show how the rotational properties of the stars and their physical properties are related. We speculate on the origin of these young stars by comparison with other nearby young diffuse populations.

(This work is based on data obtained with the NASA Kepler satellite and the MMT Hectochelle spectrograph using NOAO community access time. Supported by NASA Kepler grants to the University of Colorado and by NSF grant to the College of Charleston.)