ECLIPSING BINARIES IN THE OLD OPEN CLUSTER NGC 6791

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We propose 130 photometrically-selected targets with V < 17.3 within 14' of the center of the old, metal-rich open cluster NGC 6791 for Kepler 30-min long-cadence observations. Sixty-six of these were granted as targets to this program in Cycle 2. The goal is to detect eclipsing binaries suitable for determining the masses of the components, through future ground-based observations of radial velocities. Our targets are giants and subgiants, not main-sequence stars, in order to reduce confusion in the Kepler field and to provide feasible targets for spectroscopy. We need a large target sample to isolate favorable binaries, as some stars will be non-members, only half of the members will be in binaries, many of these will have merged, and only a few of those remaining are useful. Suitable binary systems should not be triple, and should include a giant and a main-sequence turnoff star so that both components can be detected spectroscopically. The components must not have previously exchanged or lost mass. Binary periods must be one to a few years, the orientation must be nearly edge-on, and the eccentricity will be finite but should not be large. Kepler is already looking at many targets near the cluster center, where proper motions provide membership information. We are including a number of these, many of which were granted as targets to this program in Cycle 2, and most of which are brighter giants for which we have membership information from a decade-long radial-velocity survey. But we also need to go to the outer regions of the cluster and to fainter stars, to increase the binary sample, mitigate against possible binary interactions at high cluster density and large stellar radii, and include a wider range of evolutionary stage. Consequently we are including many more targets, those relatively uncrowded stars that fall on the cluster color magnitude diagrams defined by the inner members. From this sample we expect to detect roughly a half-dozen binaries from which meaningful masses can be obtained. Follow-up ground-based high-resolution spectra will derive their parameters and confirm cluster membership, as well as define the primary velocity curve, the secondary velocity offset, and the system period. This should stringently constrain comparisons of observed color-magnitude diagrams to produce meaningful cluster parameters. Such constraints would have major significance for the derivation of age and metallicity from the broadband colors and integrated spectra of old elliptical galaxies, for which NGC 6791 is a critical resolved template.