Pulsating variables in the globular clusters Messier 4 and 80

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Field 2 of the *K2* mission contains two globular clusters, M4 and M80. Globular clusters represent a fairly homogeneous sample of variable stars in age and metallicity. Although *Kepler* was never intended to observe very dense stellar fields, we believe that it can provide reliable photometry for at least the outer regions of both clusters.

M4 is one of the closest globular clusters to the Sun, therefore its members are bright and the cluster is fairly spread out with a half-light radius of 260" or 65 pixels. In contrast, M80 is much more compact, with $R_h = 36$" or 4 pixels only, but it is also fainter, so its core will be less saturated than of M4 [1].

Aims

- Several pulsating variables were identified in the two clusters. Although only the northern edge of M4 falls on silicon, 16 RR Lyrae stars (11 RRab and 5 RRc) and two semiregular variables can be observed.
- M80 is a treasure trove of pulsating variables: a single Type II Cepheid, 9 fundamental-mode and 10 first-overtone RR Lyraes, 2 possible semiregulars, 4 SX Phe stars (two of which are blue stragglers) and two unclassified variables were identified in the cluster [2]. The two clusters contain more RRc stars than any *Kepler/K2* field we surveyed so far.
- The two clusters have distinctly different metallicities: the [Fe/H] index is -1.16 and -1.75 for M4 and M80, respectively [1]. Together with the field stars and that of the metal-poor galaxy Leo IV we proposed for Field 1, we will have four different RR Lyrae populations observed with *Kepler* to compare.
- The two clusters also differ in the average pulsation properties of the RR Lyrae population. M80 belongs to Oosterhoff type II (longer average periods) while M4 is considered either to be Oosterhoff type I (shorter average periods) or an intermediate cluster [3]. *Kepler* will provide an unprecedented opportunity to compare the detailed pulsation properties of the two types.

Targets We ordered our target list according to the distance from the center of the clusters. The highest-priority stars are the ones farther than $2R_h$ from the center of the cluster where crowding is expected to be the slightest. Stars of M4 are followed by stars of M80. Next are the stars between $2R_h$ and R_h for M4 and then for M80, and finally the stars that lie within R_h and will suffer from severe blending. The brightness of the individual stars are between 12-15 magnitudes in M4 and 13-20 magnitudes in M80.

References:

[1] Harris, 1996, AJ, 112, 1487
[2] Kopacki, 2013, AcA, 63, 91
[3] Stetson et al., 2014, submitted