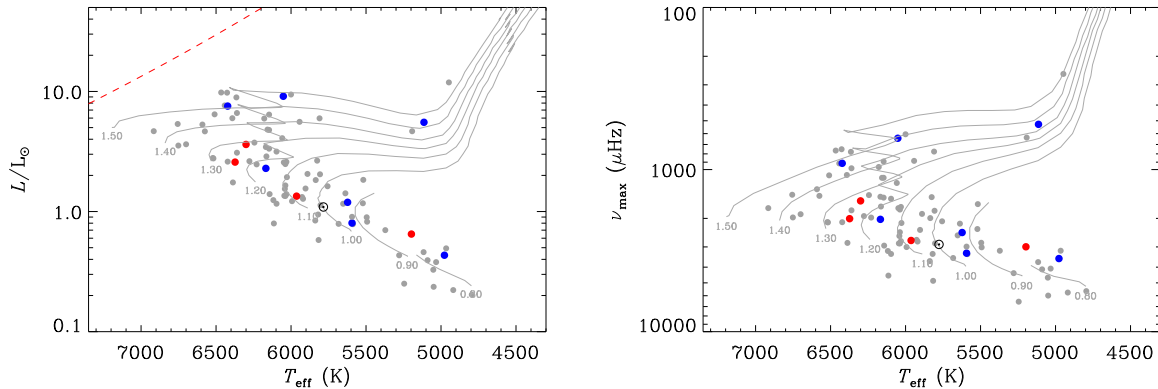


# Solar-Type Stars for Asteroseismology in Short Cadence

*KASC Working Group 1: K2 Target Proposal* (Point of contact: Bill Chaplin, w.j.chaplin@bham.ac.uk)

*Science Case:* This document proposes a selection of very bright solar-type stars, including cool main-sequence dwarfs and sub-giants, for asteroseismic observations in K2 Field 0. These stars show detectable solar-like oscillations with periods of the order of minutes. SC data are therefore a pre-requisite for detecting the oscillations. Our list comprises stars that will be prime targets for one of the main goals of K2, the detection of exoplanets around bright solar-type stars, for which precise RV follow-up will be possible. We seek to take advantage of the opportunity to have *Kepler* observe targets for asteroseismology that are typically much brighter than those observed in the nominal Mission. Because the targets are significantly brighter, much more accurate and detailed prior constraints (e.g., from parallaxes, detailed spectroscopy, interferometry, etc.) will be available on these stars than was usually the case for asteroseismic targets in the original field. It will therefore be possible to bring the full potential of asteroseismology to bear to test stellar interiors physics (e.g., to place constraints on convective overshooting). This is particularly true for the binaries in our list. It will also be possible to go beyond studying stellar structure, to put constraints on the evolution of the solar neighbourhood. The Field-0 targets, along with the targets in future fields, will allow us to constrain the age-metallicity relation of nearby field stars in a manner that has not been possible before. Note that asteroseismic data can constrain stellar ages much better than any other method. By providing asteroseismic ages of stars with detectable surface rotation periods we will also provide additional calibrators for gyrochronology. And of course, asteroseismology will allow us to better characterize targets that have detected exoplanets, including any new detections made by K2 and also already-known hosts that are on our list.



*Target List:* Our list is based primarily on targets from the Hipparcos catalogue, but also includes known exoplanet host stars. Selecting targets with good prior constraints is at a premium to avoid wasting SC slots and to get a good understanding of the asteroseismic capabilities of K2. We selected a sample of solar-type stars having parallax uncertainties  $\leq 10\%$ . We then applied procedures used to select targets for SC asteroseismic follow-up on exoplanet host stars in the nominal Mission (e.g., see Chaplin et al., 2011, ApJ, 732, 54) to estimate seismic parameters and relevant performance metrics. Whilst absolute asteroseismic SNR levels for K2 are uncertain, we can get good information on the relative, rank-order SNR (and avoid selecting targets that would have been too faint even under the nominal Mission performance). The figure shows the selected targets ( $T_{\text{eff}}$ -luminosity in the left-hand panel, and  $T_{\text{eff}}$ - $\nu_{\text{max}}$  in the right-hand panel, where  $\nu_{\text{max}}$  is the predicted frequency of maximum oscillations power). Seven known bright SB2 binaries are plotted in blue. There are also five known solar-type exoplanet host stars in the 12-degree search radius. HD 50554 and HD 45652 are very bright stars, and excellent targets. WASP-12 and HAT-P-24 are significantly fainter, and while prospects for asteroseismology are more uncertain the cost in pixels is modest. The other host, HAT-P-20, is too faint. The four selected planet hosts are shown in red on the plots.

Our list (attached) is divided into two cohorts based on estimated K2 pixel usage (Barclay, private comm.; see second attached list with additional information). Cohorts A and B contain, respectively, stars with estimated usages above or below 3000 pixels per star. We recommend selecting stars as follows: (i) select the brightest target from cohort A; then (ii) select stars in order from cohort B until the combined pixel usage equals that of the cohort A star; (iii) take the next brightest cohort A star, and (iv) repeat from cohort B; and so on down both lists. If the cost in pixels means the choice is between, say, taking one or two of the most expensive stars (over  $10^4$  pixels) and nothing else, *or* having a good selection of the next brightest targets down, we prefer the latter option.