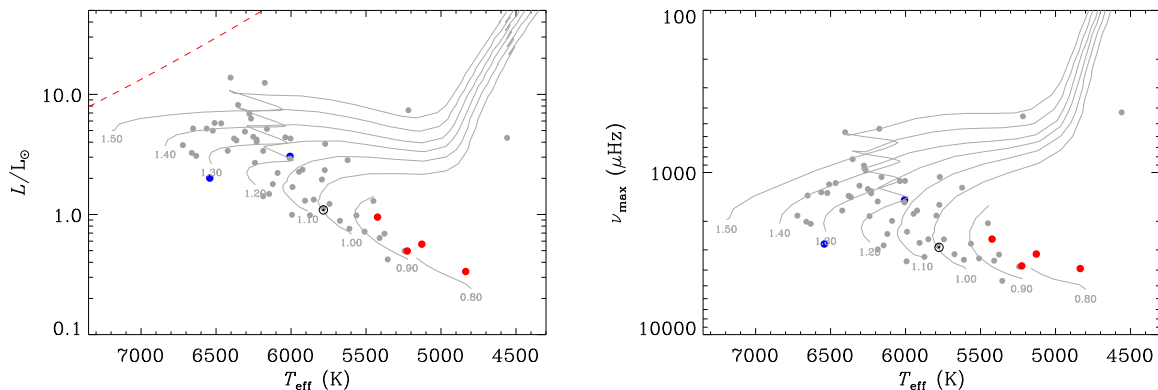


Solar-Type Stars for Asteroseismology in K2 Short Cadence

KASC Working Group 1: K2 Field 1 Target Proposal

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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 1. 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 brighter than those observed in the nominal Mission. Because the targets are 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. These Field 1 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 comprised of targets from the Hipparcos catalogue, and only includes targets that are predicted to fall on silicon. Selecting targets with good prior constraints is at a premium to avoid wasting SC slots. Most of the stars in our sample have fractional parallax uncertainties $\leq 10\%$; a small number of the fainter targets have uncertainties up to 14%. We applied procedures used to select targets for SC asteroseismic follow-up on exoplanet hosts 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_{eff} -luminosity in the left-hand panel, and T_{eff} - ν_{max} in the right-hand panel, where ν_{max} is the predicted frequency of maximum oscillations power). Four known exoplanet host stars—having HIP numbers 55848, 57370, 56572 and 55664—are shown in red on the plots. Two known bright SB2 binaries—having HIP numbers 55304 and 55022—are plotted in blue.

Our list includes some very bright targets. Our preference is for these to be observed. However, if including these stars in the Field 1 list is problematic (e.g., because the implications of observing saturated targets have yet to be fully assessed under K2 operations) then we recommend taking the fainter stars on the list. It might nevertheless be useful to include a couple of the very bright stars to help inform the construction of a good saturation model, with one good candidate being HIP 55848, the brightest of the four known planet-hosting stars on our list.