

# Photometric study of a metal-poor planet-host candidate: synergy between *K2* and HARPS

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Our team started in 2008 an ambitious radial velocity survey with the HARPS spectrograph (ESO-3.6m – La Silla Observatory, Chile) of a sample of bright metal-poor dwarfs. The main objective of this new radial velocity survey is to increase the statistics of planet occurrence towards the metal-poor regime, especially for low-mass planets. For all the details about this program and its scientific objectives see Santos et al. (2014) [1]. A total of 140 nights were granted to this program for the period 2008 – 2015. This survey contains 109 metal-poor ( $[\text{Fe}/\text{H}] < -0.4$  dex), relatively bright ( $V < 9.5$ ), and chromospherically quiet ( $\log R'_{HK} < -4.8$ ) targets [1]. Among these targets, one of them is located in the FOV #2 of *K2*: the star EPIC204490599.

We obtained so far more than 60 HARPS measurements of the target star EPIC204490599. They present a RMS above  $2 \text{ m s}^{-1}$  which is significantly larger than the radial velocity precision of HARPS for this target (down to  $50 \text{ cm s}^{-1}$ ). However, the low-but-significant radial velocity variations of this target are yet not well understood. They might be due to a multiple low-mass planet system (such as the large amount of those found by *Kepler*) and / or low-amplitude stellar activity [1]. However, for this star, we observed a mean value for the  $\log R'_{HK}$  of -4.94, which would indicate a particularly quiet star. Therefore, it would be really surprising that the star EPIC204490599 does not host planets.

During the campaign #2, *K2* will have an unique opportunity to perform a high-precision photometric follow-up of this target. This photometric follow-up would allow to: (1) search for planets transiting this multiple-planet-host candidate, (2) determine the level of stellar activity (e.g. the filling factor) of this target and further study the impact of low-level stellar activity on radial velocities, (3) determine the star's rotational period that will be used then to improve the radial velocity analyses and planet detection efficiency, (4) determine the stellar fundamental parameters with an outstanding precision thanks to asteroseismic techniques that will be used then to characterize precisely and accurately the detected planets.

For these four reasons, we propose that *K2* observes the star EPIC204490599 during campaign #2. To derive asteroseismic constraints on the star, it is however mandatory to have short-cadence data. Moreover, short-cadence data would also improve the transit detection and modelling as well as the study of the chromospheric activity of the star. We therefore propose the star EPIC204490599 to be observed by *K2* in the short-cadence mode.

This proposal also aims at developing a new synergy between two highly-efficient exoplanet-hunter instruments: the *Kepler* space telescope and the HARPS spectrograph.

## References

- [1] Santos, N. C., Mortier, A., Faria, J. P., et al. 2014, A&A, in press, arXiv:1404.6135

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