

# CARMENES KARMENES, the K2+CARMENES alliance

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The main goal of the CARMENES instrument is to perform high accuracy measurements of stellar radial velocities (1 m/s) with long term stability. It will be installed on Calar Alto in 2015 and will be equipped with two spectrographs covering from the visible to the near-infrared. The *Kepler* K2 mission uses *Kepler* spacecraft operating with only two reaction wheels to achieve high precision photometry of thousands of objects along the ecliptic. The CARMENES Consortium is proposing M dwarf targets to be observed in each K2 pointing, with the main aim of detecting transiting planets around late-type M dwarfs and pulsations.

The *Kepler* K2 mission (<http://keplerscience.arc.nasa.gov/K2/>) will perform twelve different pointings around the ecliptic from March 2014 to December 2016, observing each field during about 75 days. Currently, the fields 0 and 1 have been observed and the campaign 0 data public release is foreseen at any time.

The CARMENES Consortium has responded to K2 call for proposals with a double program for the low cadence (30 min) and high cadence (1 min) sampling, which suits and complements CARMENES science objectives:

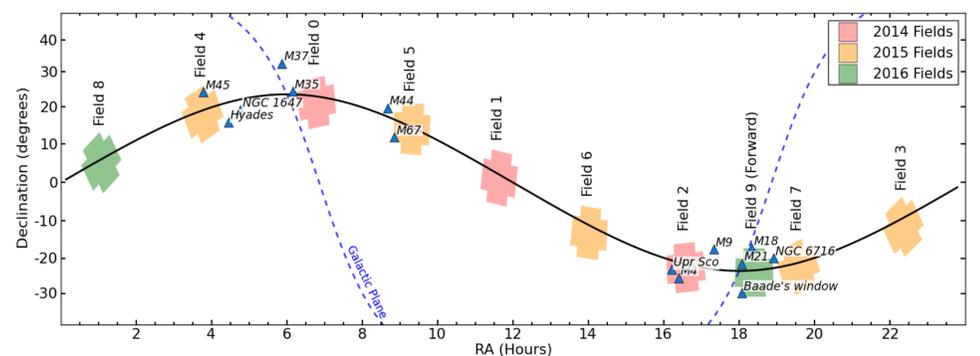
1) **The Low Cadence program** requests observing faint late-type nearby M dwarfs to detect transiting planets.

Late-type M dwarfs show larger flux in the optical red and near IR than earlier types (M0V to M3V) around which most planet candidates lie (Muirhead et al. 2012, *ApJ*, L750, 37). The enhanced NIR flux makes the expected-to-be-detected transiting planets amenable to be confirmed and followed-up by the unique capabilities of CARMENES. Besides, the K2 high-precision photometry will help to anticipate and improve the accuracy of Doppler measurements of very late-type stars.

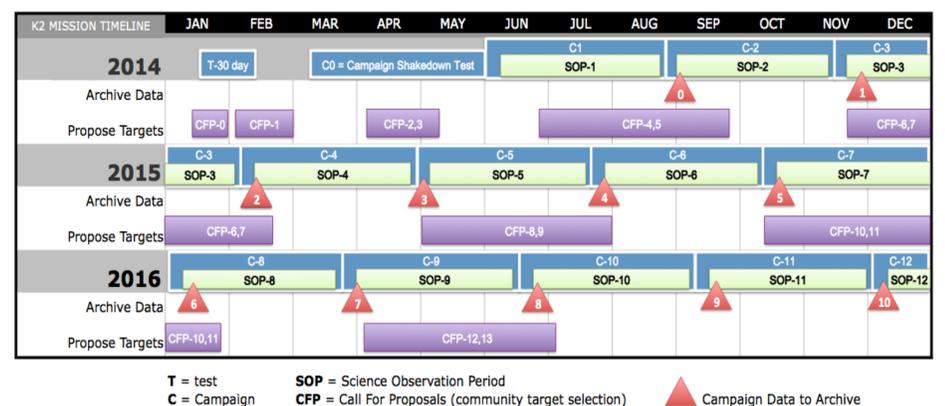
2) **The High Cadence program** aims at discovering pulsations and very short period, small planets around nearby M dwarfs.

High cadence sampling is non-negotiable to discover theoretically predicted radial and non-radial oscillations in M dwarfs in the 20min to 3h range (Rodríguez-López et al. 2014, *MNRAS*, 438, 2371). Pulsations allow the precise determination of i.e. density and age of the star, through mode identification, resulting in increased precision of the fundamental parameters of any possible hosted exoplanets. High cadence is also essential to increase the number of transiting small close-in planets with orbital periods of just a few hours, as KOI-1843b with a 4.25h period (Ofir & Dreizler, 2013, *A&A*, 555, A58).

Moreover, all targets will be subject to characterization of possible photometric variability due to flares and magnetic activity modulated by stellar rotation.



K2 observing scheme. Field 0 & 1 have already been observed and the data release for field 0 is expected to be in any moment (see operations milestones below).



K2 operations milestones. Currently, field 2 is being observed. Data products are estimated to be archived and made public 3 months after data collection for a particular field ends. Data from field 0 are due at any moment!

Campaign 0 data are about to be released. While the degree of processing to which the data will have been subjected is yet unknown, our group has the necessary tools to tackle the analysis from the very basic raw data: extraction of the light curves and processing through SARS pipeline (Ofir et al. 2010, *MNRAS*, 404, L99), search for planet candidates using Optimal Box-Least-Squares (Ofir 2014, *A&A*, 561, A138), and search for pulsations using Fourier transform analysis with Period04 (Lenz & Breger, 2005, *Comm. Aster.*, 146, 53).

We expect that the KARMENES program will result in multiple fully characterizable small planets around M dwarfs, including Earth-likes in the habitable zone, and in the discovery of pulsations in this object class.

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