

PPVI 1. Looking for exo-earths around M dwarfs

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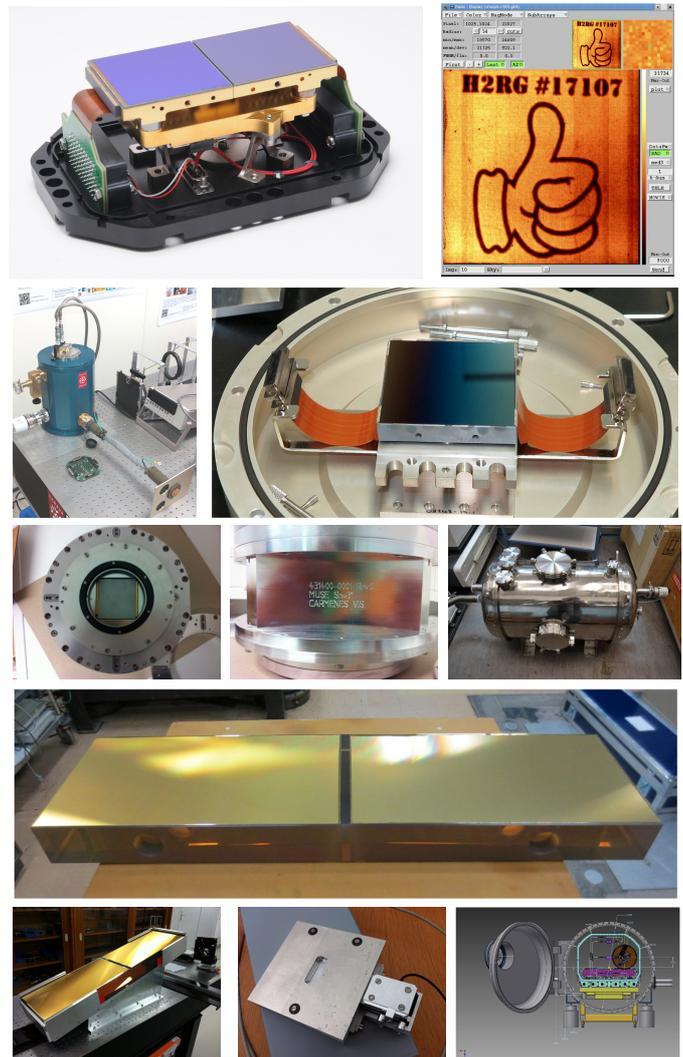
CARMENES (Calar Alto high-Resolution search for M dwarfs with Exo-earths with Near-infrared and optical Echelle Spectrographs) is a next-generation instrument being built for the 3.5 m telescope at the Calar Alto Observatory by a consortium of eleven Spanish and German institutions. CARMENES will conduct a five-year exoplanet survey targeting ~300 M dwarfs.

The CARMENES instrument consists of two separate échelle spectrographs covering the wavelength range from 0.55 to 1.7 μm at a spectral resolution of $R = 82,000$, fed by fibers from the Cassegrain focus of the telescope. For late-M spectral types, the wavelength range around 1.0 μm (Y band) is the most important wavelength region for radial-velocity work. Therefore, the efficiency of CARMENES will be optimized in this range. It is thus natural to adopt an instrument concept with two spectrographs, one equipped with a CCD for the range 0.55-1.05 μm , and one with HgCdTe detectors for the range from 0.9-1.7 μm .

Each spectrograph will be coupled to the 3.5 m telescope with its own optical fiber. The front end at the telescope Cassegrain focus will contain a dichroic beam splitter and an atmospheric dispersion corrector, to feed the light into the fibers leading to the spectrographs. Guiding is performed with a separate camera. Additional fibers are available for simultaneous injection of light from emission line lamps and two Fabry-Pérot wavemeters for radial-velocity calibration.

The spectrographs are mounted on benches inside vacuum tanks located in the coudé laboratory of the 3.5 m dome. Each vacuum tank is equipped with a temperature stabilization system capable of keeping the temperature constant to within $\pm 0.01\text{K}$ over 24 h. The visible-light (VIS) spectrograph will be operated at near room temperature, the near-infrared (NIR) spectrograph will be cooled to 140 K.

Commissioning of the VIS channel is planned for the *second half of 2014*; the NIR channel will arrive early afterwards. At least 600 useable nights have been allocated at the Calar Alto 3.5 m telescope for the CARMENES survey in the time frame from 2014 to 2018.



From top to bottom: NIR detector science-grade 2x1 Hawaii 2RG sensor array mosaic and first image of NIR eng-grade detector; VIS detector eng-grade e2v CCD231-84 with ARC controller, cryo cables and test cryostat; VIS cryostat detector head and cooling unit heat exchanger; VIS échelle grating mosaic; NIR échelle grating mosaic, front-end shutter prototype and final drawings of the two identical vacuum tanks (being built).

