II. Characterisation of the stellar sample

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Abstract. In this contribution we summarise our ongoing project of characterisation of late-type M dwarfs aimed to define the input catalogue of CARMENES (Calar Alto high-Resolution search for M dwarfs with Exoearths with Near-infrared and optical Échelle Spectrographs), a next-generation instrument to be built for the 3.5 m telescope at Calar Alto Observatory (see Quirrenbach et al. 2010, 2012, Amado et al. 2012). Using low-resolution spectroscopy we have performed a spectral-type classification of the targets by comparing their acquired spectra with those of spectral type standard stars observed during the same observing runs, and using spectral indices well calibrated for M-dwarfs such as, TiO index. We have also derived chromospheric activity indicators. In addition, we plan to estimate the metallicity using our own calibration based on the accurate atmospheric parameters, metallicity and abundance of different elements determined with high-resolution spectroscopy of the primary components of physical binaries composed of an F-, G- or K-dwarf primary and an M-dwarf secondary. Our final goal is to choose the best candidates to be observed with this next-generation spectrograph and prepare the CARMENCITA (CARMENES Cool star Information and daTa Archive) database (see Caballero et al. 2012).

Low-resolution spectroscopic characterization.

Observations and input sample. Low-resolution spectroscopic observations were obtained at the 2.2-m Calar Alto Telescope (Almería, Spain) with the CAFOS spectrograph. The spectral resolution is 1500, and the wavelength range covers from 4000 to 8000 Å (see **Fig. 1**). Until now, we have observed 362 stars, mostly taken from Lépine & Gaidos (2011) and the Gliese and Luyten catalogues. Of them, 50 stars are standard stars (K5 to M7 for both dwarf and giant classes) from which we retained only the most representative one for each spectral type (SpT). The rest of the sample will be observed in forthcoming CAFOS runs.

Spectral typing. By least-square minimisation: we look for the best matches between normalised spectra and our standards. (**Fig. 1**: in red, target spectrum; in orange, the best match; in black, other standard spectra). **By calibration with spectral indices:** we derive the spectral types of our stars by interpolating the relation between one given spectral index and the spectral type (e.g. TiO5 see **Fig. 2**). The indices studied until now (TiO1-5, CaH1-3, CaOH and H!) come from Reid et al. (1995), but more indices will come later (e.g. Lépine et al. 2003). The accuracy between our two methods is ±0.5 subtypes. Our results show that the SpTs of the 312 target stars mainly range from M3V to M5V.

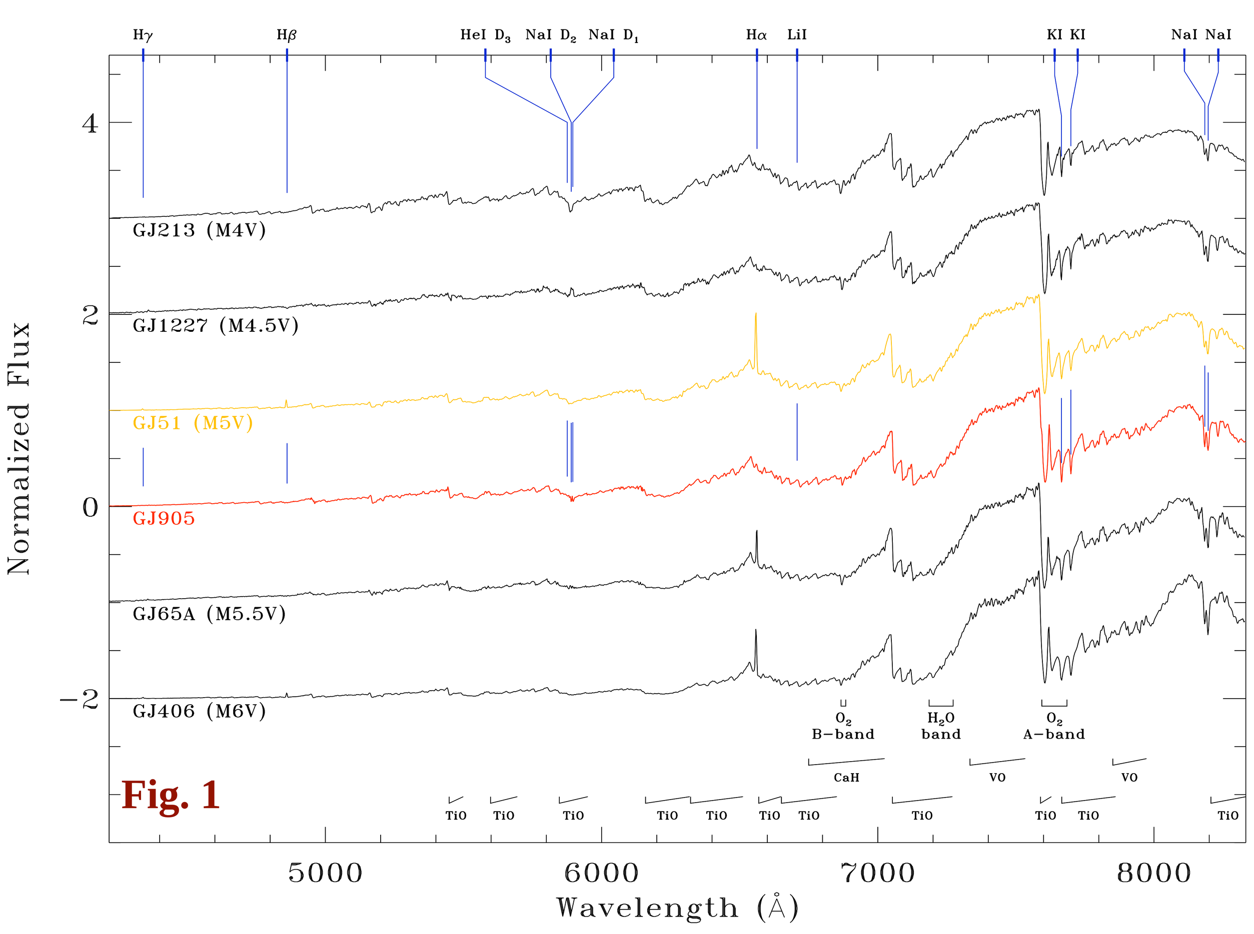

Fig. 1

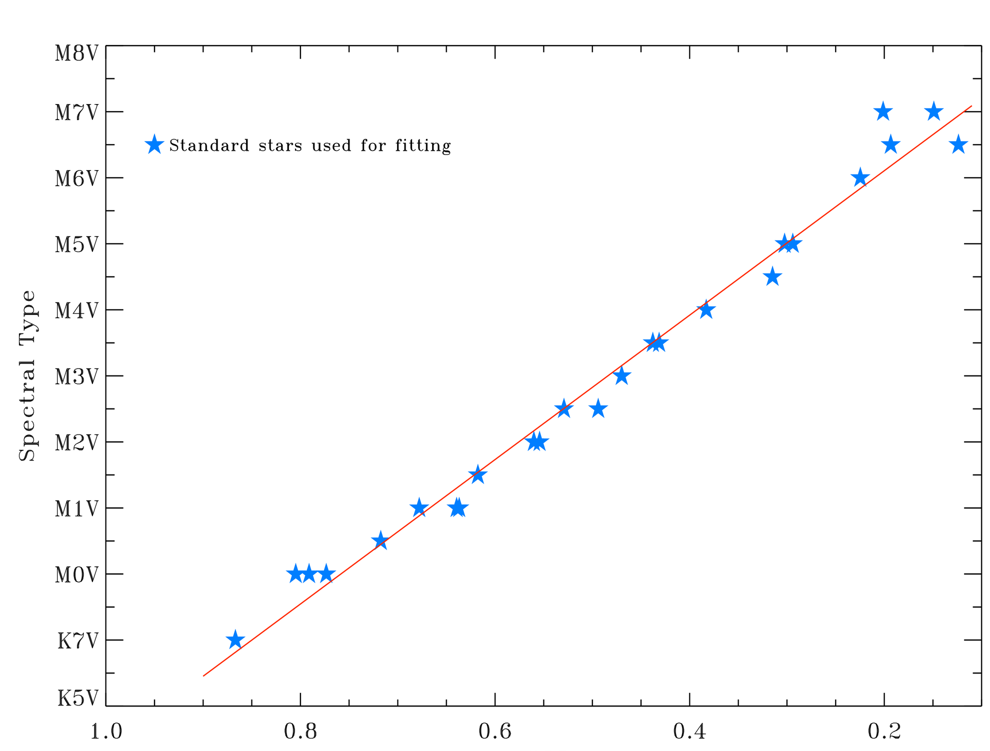

Fig. 2

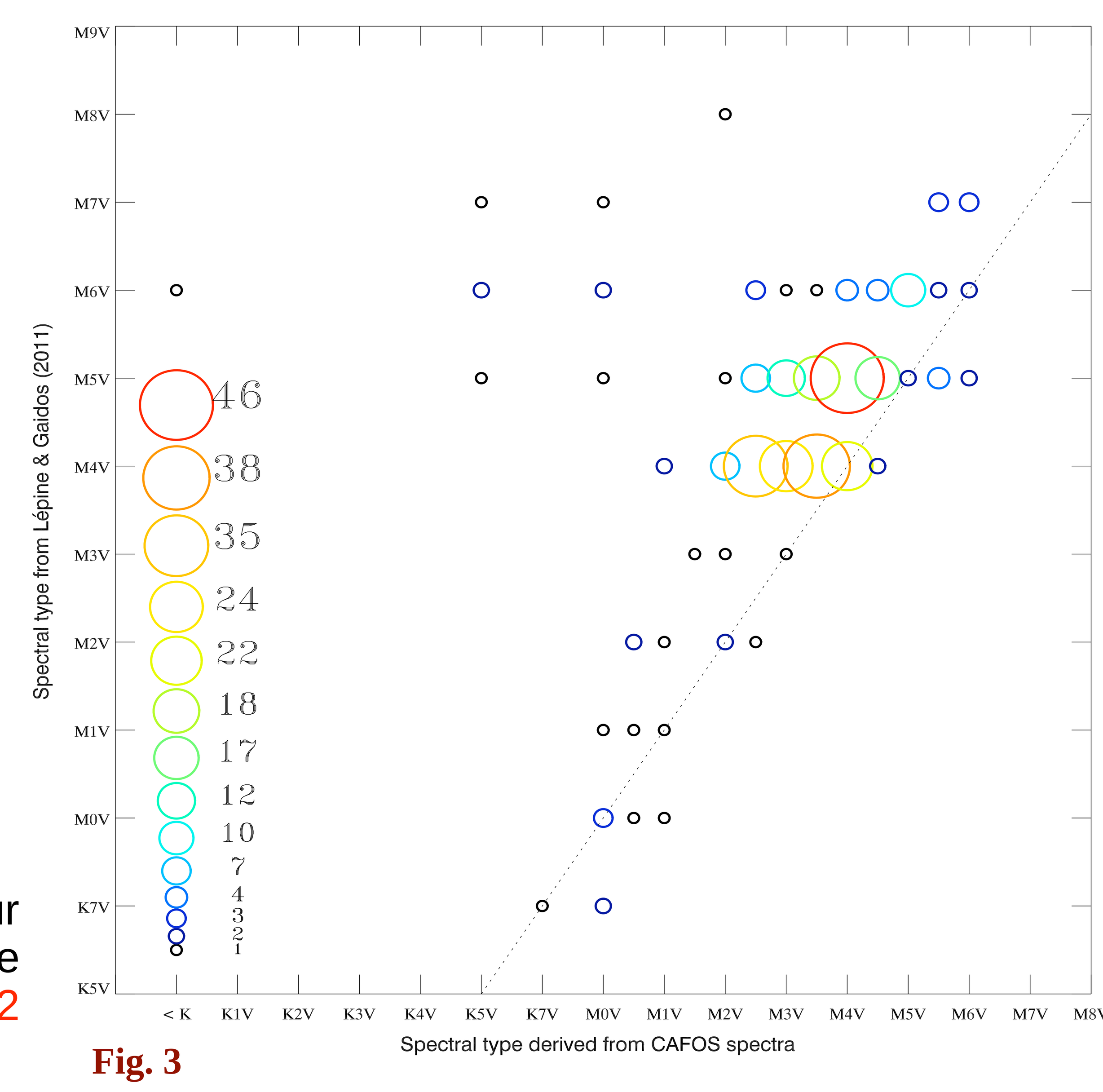

Fig. 3

Comparison. Most of the standard stars, which are both in PMSU catalogue (Hawley et al. 1996) and in our sample, have the same SpT, with an accuracy of ±0.5 subtypes. We also compared our SpTs with those estimated by Lépine and Gaidos (2011; **Fig. 3**). We found that SpTs derived from optical-nIR colours are 1-2 subtypes later than SpTs derived from our spectra (and over 5 subtypes in some cases).

Relative metallicity and calibration with wide visual binaries.

Relative metallicity. We have determined relative metallicities using the method described by Lépine et al. (2007), where ς = [1-TiO5]/[1-TiO5$_{\odot}$]. None of our targets are classified as subdwarfs (**Fig. 4**).

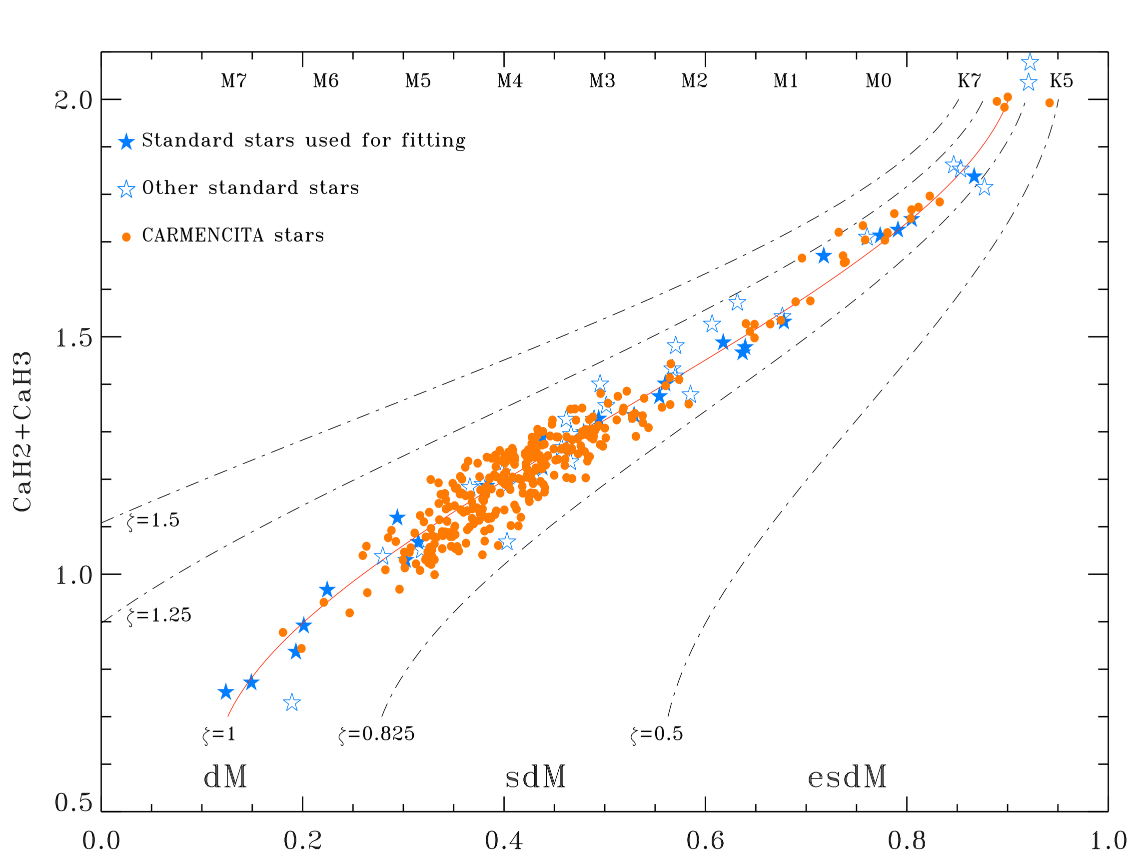

Fig. 4

Calibration of the metallicity. We have selected a large sample of physical binaries composed of an **F-, G- or K-dwarf primary** and an **M-dwarf secondary**. High-resolution spectra of the primary components are being analysed in order to determine, in an uniform way, accurate atmospheric parameters, metallicity and abundance of different elements (Tabernero et al. 2012). Low-resolution spectra of the secondary components allowed us to determine good spectral types and metallicity-dependent spectral indices (Alonso-Floriano et al. 2012).

The spectral indices (TiO1-5 and CaH1-3, Reid et al. 1995) determined in our spectra of the M companions allowed us to analyse in detail the metallicity-dependent relation between **TiO5** and **CaH2+CaH3** (see **Fig.5**) by means of the parameter ! $_{Tio5/CaH}$ defined by Lépine et al. (2007):

! $_{Tio5/CaH}$ = [1-TiO5]/[1-TiO5$_{\odot}$]

Using the **[Fe/H]** abundances of the FGK companions derived by us with our high-res spectra is possible to calibrate this relation (see **Fig. 5**). Note the dependence on [Fe/H] of the parameter ! $_{Tio5/CaH}$ in **Fig. 6**. For more details see Montes et al. (2012).

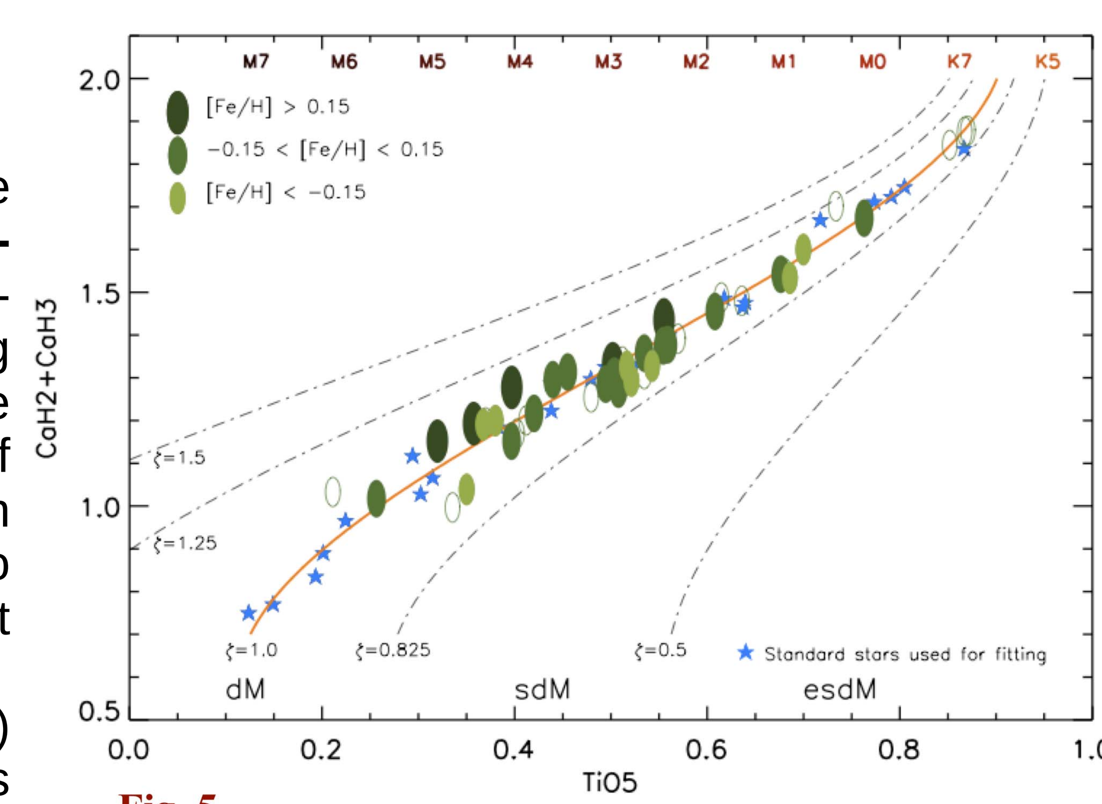

Fig. 5

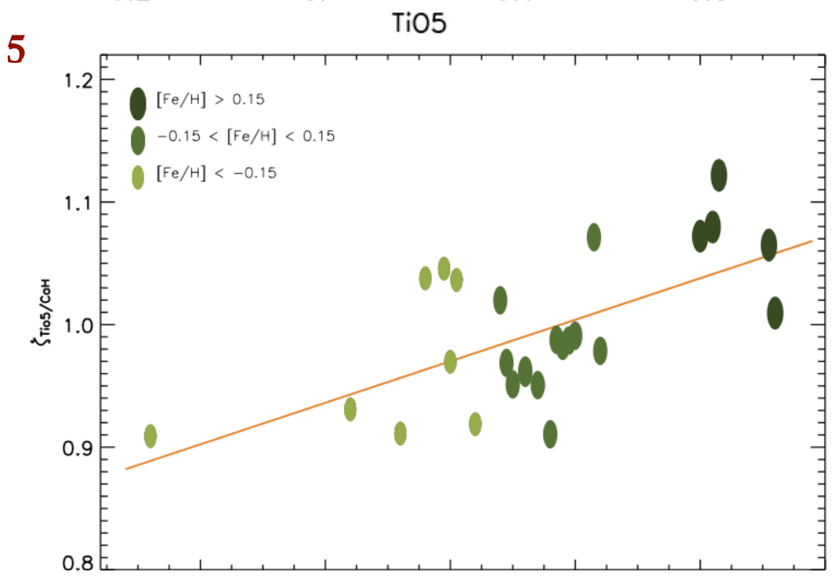

Fig. 6

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