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Written in the stars: spectral synthesis on CARMENES GTO M-dwarf spectra.

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Abstract

We present the results recently published by Marfil et al. (2021, A&A, 656, A162) regarding the determination of the stellar atmospheric parameters ($T_{\rm eff}$, $\log g$, and [Fe/H]) of 343 M dwarfs observed with CARMENES. We employed StePar Syn, a Bayesian spectral synthesis implementation particularly designed to infer the stellar atmospheric parameters of late-type stars following a Markov chain Monte Carlo approach. We made use of the BT-Settl model atmospheres and the radiative transfer code Turbospectrum to compute a grid of synthetic spectra around 75 magnetically insensitive Fe I and Ti I lines plus the TiO γ and ϵ bands. To avoid any potential degeneracy in the parameter space, we imposed Bayesian priors based on the photometric data available for the sample. We find that this methodology is suitable down to M7.0 V, where refractory metals such as Ti are expected to condense in the stellar photospheres. Although our $T_{\rm eff}$ scale is in good agreement with the literature, we report large discrepancies in the [Fe/H] scales, which might arise from the different methodologies and sets of lines considered. However, our [Fe/H] is in agreement with the metallicity distribution of FGK-type stars in the solar neighbourhood and correlates well with the kinematic membership of the targets in the Galactic populations. Lastly, excellent agreement in $T_{\rm eff}$ is found for M dwarfs with interferometric angular diameter measurements, as well as in the [Fe/H] between the components in the wide physical FGK+M and M+M systems included in our sample.

The StePar Syn code (Tabernero et al. 2022, A&A, 657, A66) is available at GitHub: https://github.com/hmtabernero/SteParSyn/.

My poster is available at https://doi.org/10.5281/zenodo.6973999