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Probing the Gaia atmospheric parameters of stars in globular clusters

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Numerous stellar surveys have been or will provide photometric, astrometric, and spectroscopic data for a large number of stars in the Milky Way and neighbouring galaxies. Modern data processing tools and analysis methods are needed to deal with these data sets and obtain accurate and precise results. In this context, we are developing a new spectroscopic analysis pipeline based on the differential analysis method that is also assisted by machine learning techniques. This pipeline, called CHESS (CHEmical Survey analysis System), aims to automate the steps needed to obtain high-quality stellar parameters and abundances from large samples of spectra. Precise chemical abundances for as many elements as possible are key to the study of Galactic archaeology. For initial tests of CHESS, we are focussing on a reanalysis of high-resolution archival UVES spectra of stars in clusters. Here, we concentrate on a discussion of about 1000 stars that are members of globular clusters and have been observed with UVES. To automatically identify the spectra of similar stars that are suitable for a differential analysis, CHESS first performs what we call a similarity analysis by directly using the observed spectra. This step of the analysis uses unsupervised machine learning algorithms (such as clustering and dimensionality reduction methods). To validate the findings, we used atmospheric parameters from several catalogues (in particular those available in Gaia DR3). Alternatively, such a similarity analysis also serves as a consistency check of the atmospheric parameters in these catalogues. The stars that CHESS identifies as very similar should have almost the same values of effective temperature, surface gravity, and metallicity. In this talk, we present our method to find similar stars and discuss some limitations of its use in the case of globular clusters (related to abundance correlations among the stars).

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