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Finding the lost siblings of the Sun

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Abstract. We have performed a spectral analysis on 18 stars solar sibling candidate. We found that only one one of the candidateshas solar metallicity and at the same time might have an age comparable to that of the Sun.

Keywords. Sun: general–Stars: abundances–fundmental parameters–Galaxy: solar neighbourhood

1. Introduction

The Sun has likely been born in an open cluster consisting of a few thousand stars with a radius of about 1–3 pc (Portegies Zwart 2009). It was likely located not far from the cluster centre (Adams 2010). The parent cluster of the Sun dissolved quickly in the Galactic potential. Portegies Zwart (2009) found from simulations that about 10–60 solar siblings could still be within 100 pc of the Sun. It should be possible to identify them by obtaining accurate measurements of their kinematics, metallicities, elemental abundances and ages.

2. Spectral analysis of solar sibling candidates

The stars were selected from the Hipparcos Catalogue using the selection criteria from Brown *et al.* (2010). Young stars were excluded using a colour cut at (B–V) $\leqslant$ 0.4. High resolution spectra of 18 candidates were obtained with the FIES/NOT in 2012. We used the Sun and four other stars to construct a line list and determine astrophysical log(gf) values. We selected 102 Fe, 3 Mg, 17 Si, 19 Ca, 42 Ni and 31 Ti lines for our analysis. SME (Valenti & Piskunov 1996) is used to determine stellar parameters and elemental abundances by fitting the stellar spectrum. All elements show solar values with small scatter. Using our final $T_{\rm eff}$ and log g, we found that most of our candidates fall to the left of the solar isochrone. Although 5 objects [Fe/H] very close to solar, only one might have the same age.

Since the candidates have small space velocities and are within 100 pc of the Sun, they should be thin disk stars. Given constraints on the stellar parameters, HIP 40317 could be a potential candidate. However, we have to take into account systematic errors which makes the age very uncertain.

It appears that the selection criteria are not optimal for finding the solar siblings. The scheme in Brown *et al.* is quite simple. More detailed modeling of stellar orbits in a realistic potential could potentially prove more efficient at finding solar siblings.

References

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