LI ABUNDANCES IN THE METAL-RICH OPEN CLUSTER NGC 6253

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1. Introduction

NGC 6253 is an old open cluster (age $\sim$ 3 Gyr, d $\sim$ 1.8 kpc) with a metallicity significantly higher than solar: measured values range from [Fe/H]= +0.36 (Carretta et al. 2000; Sestito et al. 2007) to [Fe/H]= +0.46 (Carretta et al. 2007; Anthony-Twarog et al. 2010). The cluster reddening is uncertain, with reported values ranging from E(B – V) = 0.15 (Anthony-Twarog et al. 2007; Montalto et al. 2009) to E(B – V) = 0.26 (Twarog et al. 2003).

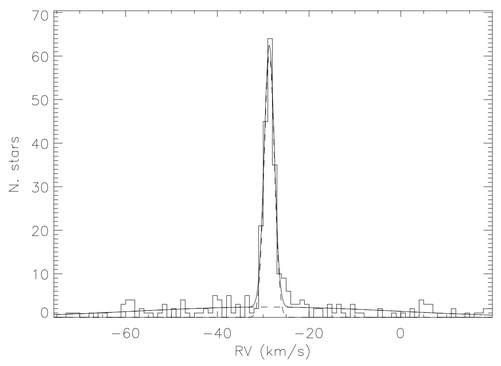
The cluster was observed using FLAMES/GIRAFFE at the VLT/UT2 telescope, in April 2004 (ID 073.D-0550) and April 2007 (ID 079.D-0825), using the HR15 and HR15N filters, respectively. The observations targeted a total of 377 stars covering the entire cluster sequence. The 2007 observations were split in different nights, allowing us to investigate radial velocity variations. 26 stars were observed in both runs.

2. Radial velocities and membership

Radial velocities (RVs) were derived for 371 stars. We found 17 SB2 stars and 19 SB1 stars; 3 probable long-term binaries were also identified from the comparison with previous observations.

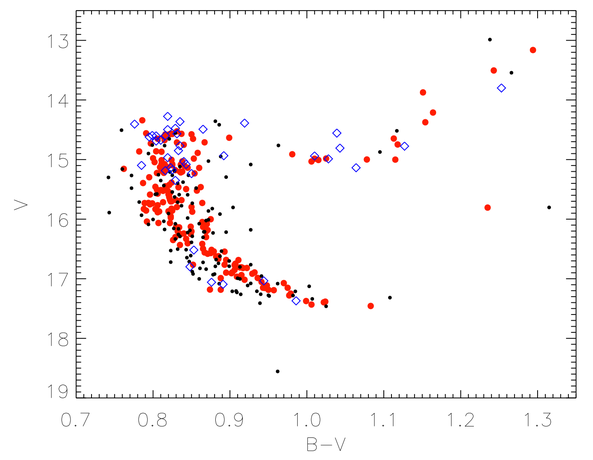
From the RV distribution of single stars we derive an average cluster velocity of v_C = –28.67 km/s with σ_C = 1.10 km/s, in agreement with previous results (Sestito et al. 2007; Anthony-Twarog et al. 2010; Montalto et al. 2011).

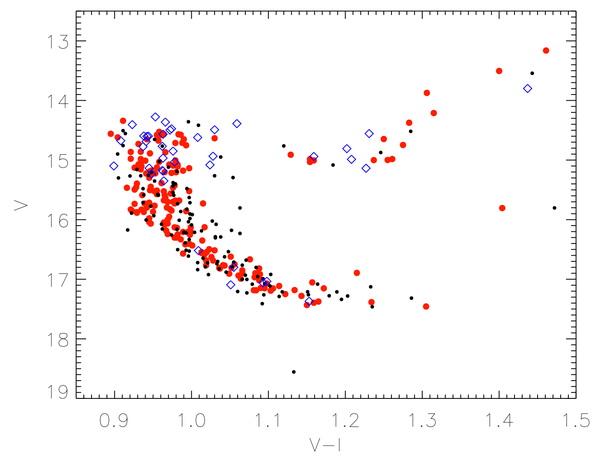
We consider cluster members 188 stars with RV within 3σ of the cluster mean, taking the errors into account. The expected number of field contaminants in our sample is of 16 objects.



RV distribution for single stars, fitted with two gaussians (cluster + field)

3. Colour-magnitude diagrams





Colour-magnitude diagrams of the observed sample. Red dots: RV members; blue diamonds: SB1/SB2 stars; small black dots: RV non members.

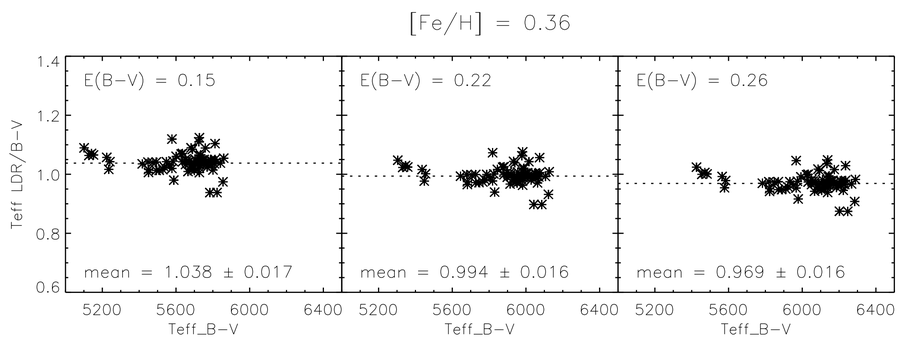
A few RV members have photometry inconsistent with the cluster sequence and are likely to be among the expected contaminants.

4. Effective temperatures

Effective temperatures were derived using two different methods:

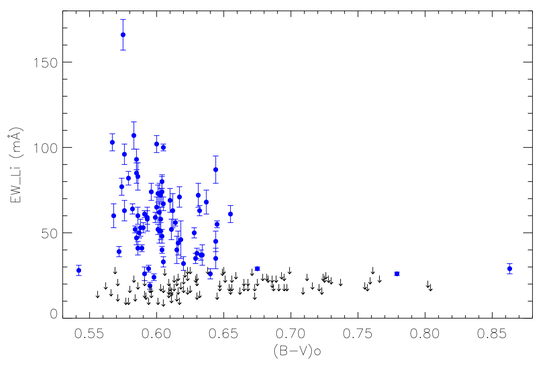
- from B – V using the relationships by Alonso et al. (1996), computed for [Fe/H]= 0.36 and [Fe/H]= 0.46, and for different values of E(B – V).
- from line depth ratios (LDR; e.g. Gray 1994) for spectra with adequate signal-to-noise. T_{eff} was derived only for stars for which at least three ratios could be measured.

The comparison of the temperatures derived with the two methods shows that the best agreement is obtained for E(B – V) = 0.20 – 0.23 for both metallicities.
In the following we adopt E(B–V) = 0.22.



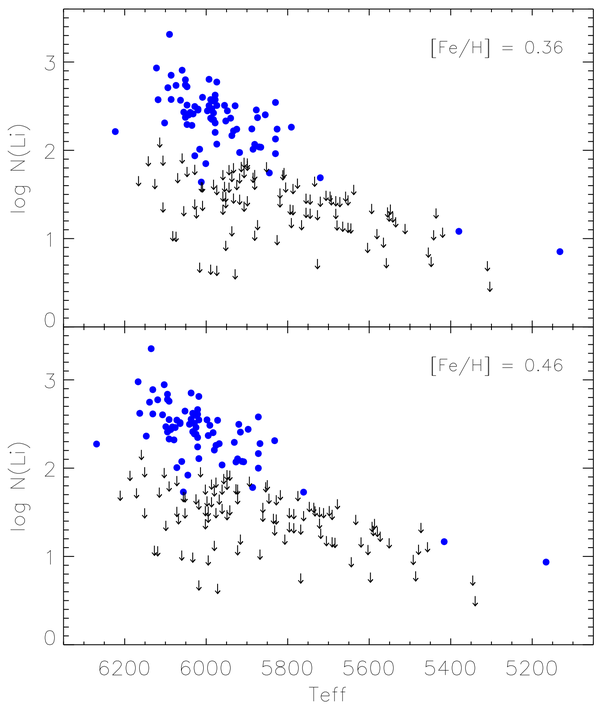
5. Lithium abundances

Equivalent widths (EW) of the Li I λ6708 line were measured for all main sequence and turnoff members. A significant spread is clearly present for $(B - V)_o$ = 0.55 – 0.67, even excluding the star with EW > 150 mÅ.

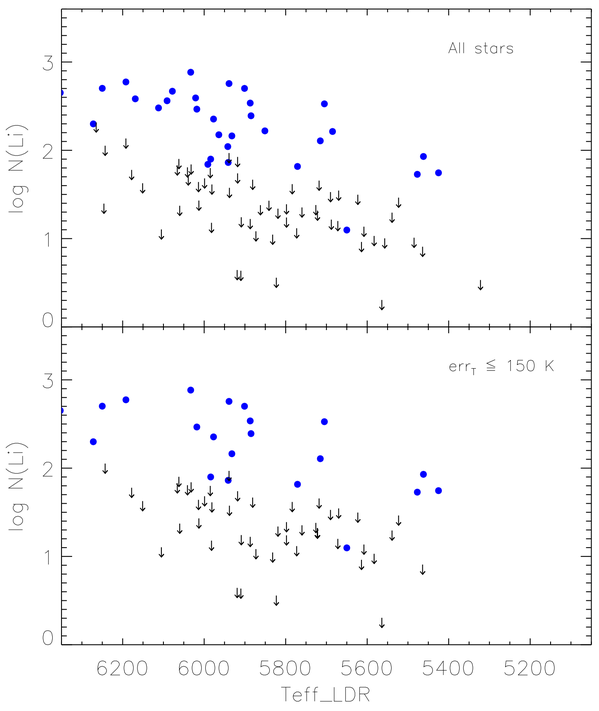


Li abundances were derived, after correcting the EWs for the Fe I λ6707 contribution, using the curves of growth by Soderblom et al. (1993) for the three different values of T_{eff} derived in the previous section. In all cases, we find a strong dispersion, of at least 1.5 dex, in the Li abundances at a given temperature.

The issue of the dispersion of Li in otherwise similar solar-type stars in open clusters is largely debated. Recent claims have been made that there is a strong correlation between Li depletion and age for 1 $M_\odot$ stars and that the observed spread may be due to the incorrect determination of T_{eff} from photometry (e.g. Meléndez et al. 2010). Our results for NGC 6253 show that a large dispersion is still present, even when an accurate estimate of T_{eff} is performed using a spectroscopic method.



Li abundance as a function of T_{eff} from Alonso et al. (1996). No significant difference is observed between the two cases, except for a shift towards higher T_{eff} with higher [Fe/H].



Li abundance as a function of T_{eff} from LDR. In the bottom panel we show only stars with temperature errors less than 150 K.

References

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