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Non-LTE Abundances of Sodium in the Atmospheres of Red Giants of the Thick and Thin Galactic Disks

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Abstract. We determined NLTE abundances of Na in the atmospheres of 80 red giants including the 33 stars of the thin disk, 35 stars of the thick disk and 12 stars of Hercules stream.

Keywords. line: formation, stars: abundances, stars: atmospheres

1. Results

Stellar effective temperatures range between 3931 K and 5142 K and $\log g$ between 1.25 and 3.21. Stellar parameters and kinematic properties of all stars have been determined by Antipova *et al.* (2005), Pakhomov *et al.* (2009a), Pakhomov *et al.* (2009b), Pakhomov *et al.* (2011), Pakhomov (2012, 2013). For Na I 6154, 6161 Å NLTE abundance corrections amount to –0.06 to –0.24 dex. We found no difference in mean Na abundance between the thick disk and thin disk. For most red giants, the mean Na abundances are close to the solar one. The obtained results can be used to constrain the nucleosynthesis models for Na. We detected a weak excess of Na in the barium stars. Stars of the Hercules stream reveal Na abundances close to the solar one. In case of the thin disk, we found the hint of the dependence of Na abundances on the luminosity ($\log g$). Using improved atomic data, we placed 80 program stars of the various Galactic populations on acquired absolute scale of Na abundances. Average values of [Na/Fe] ratios are listed in Table 1.

Table 1. Average values of [Na/Fe] ratios with LTE and NLTE assumptions for stars of various subgrups

Stars	$[Na/Fe]_{LTE}$	$[Na/Fe]_{NLTE}$
Red Giants of Thick disk	$+0.10 \pm 0.10$	-0.02 ± 0.08
Red Giants of Thin disk	$+0.14 \pm 0.14$	-0.01 ± 0.11
Barium Stars	$+0.22 \pm 0.13$	$+0.07 \pm 0.11$
SMR stars	$+0.20 \pm 0.15$	$+0.06 \pm 0.13$
Stars of Hercules Stream	$+0.09 \pm 0.18$	-0.04 ± 0.17

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