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Elemental Abundances in the Galactic Disk

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Abstract

Here, we discussed our recent results of elemental abundance survey of Galactic disk based on 181 F- and G-type dwarfs (published by **Reddy et al. 2003, MNRAS, 340, 304**). Using high-resolution and high signal-to-noise spectra we obtained quantitative abundances for 27 elements: C, N, O, Na, Mg, Al, Si, S, K, Ca, Sc, Ti, V, Cr, Mn, Co, Ni, Cu, Zn, Sr, Y, Zr, Ba, Ce, Nd, and Eu. For the entire sample we have determined kinematic (U,V,W) and the orbital parameters (peri- and apo- Galactic distances).

The $alpha$-elements – O, Mg, Si, Ca, and Ti – show [α/Fe] to increase slightly with decreasing [Fe/H]. Heavy elements with dominant contributions at solar metallicity from the *s*-process show [*s*/Fe] to decrease slightly with decreasing [Fe/H]. Scatter in [X/Fe] at a fixed [Fe/H] is entirely attributable to the small measurement errors, after excluding the few thick disk stars and the *s*-process enriched CH subgiants. Tight limits are set on 'cosmic' scatter. If a weak trend with [Fe/H] is taken into account, the composition of a thin disk star expressed as [X/Fe] is independent of the star's age and birthplace for elements contributed in different proportions by massive stars (Type II SN), exploding white dwarfs (Type Ia SN), and asymptotic red giant branch stars.

By combining our sample with published studies, we deduced properties of thin and thick disk stars. Thick disk stars are primarily identified by their V_{LSR} in the range –40 to −100 km s^{-1}. These are very old stars with origins in the inner Galaxy and metallicities [Fe/H] ≤ -0.4. At the same [Fe/H], the sampled thin disk stars have $V_{LSR} \sim 0$ km s^{-1}, and are generally younger with a birthplace at about the Sun's Galactocentric distance. In the range $-0.35 \geq$ [Fe/H] ≥ -0.70, well represented by present thin and thick disk samples, [X/Fe] of the thick disk stars is greater than that of thin disk stars for Mg, Al, Si, Ca, Ti, and Eu. [X/Fe] is very similar for the thin and thick disk for – notably – Na, and iron-group elements. Barium ([Ba/Fe]) may be underabundant in thick relative to thin disk stars. These results extend previous ideas about composition differences between the thin and thick disk.