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K DWARF METALLICITY INDICATORS AND CHEMICAL EVOLUTION OF THE MILKY WAY

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We have developed several metallicity indicators for K dwarfs on the basis of 34 G and K dwarfs with high quality spectroscopic metallicities. A new metallicity distribution for K dwarfs in the solar neighbourhood has been measured for a near complete sample drawn from the Hipparcos catalog, and is compared to results of a recent model of Galactic chemical evolution (GCE).

We have developed three metallicity indicators based on accurate spectroscopic and photometric measurements for K dwarfs (for details see Kotoneva, Flynn, Chiappini and Matteucci, 2002), as well as an accurate metallicity index based only on a star's position in the colour-absolute-magnitude diagram (Kotoneva, Flynn and Jimenez, 2002). The error of the last indicator turned out to be very small, only 0.1 dex. The method demonstrates that stellar luminosity on the main sequence correlates very well with metallicity at a given colour, i.e. the displacement ΔM_V of K dwarfs from a fiducial isochrone in the M_V versus $B-V$ plane. The fiducial isochrone comes from Jimenez, Flynn and Kotoneva (1998), and was found empirically to be a good fit to solar metallicity K dwarfs. Isochrones have also been utilised to assign masses to the K dwarfs.

We have selected a near complete sample of 220 single K dwarfs from the Hipparcos catalog within a precise range of masses. Metallicities for this sample were computed and a new measurement made of the metallicity distribution for stars in the Solar cylinder. We have compared this to a recent GCE model.

The model (Chiappini et, 1997; 2002) assumes that the halo + thick disk and the thin disk are formed during two different infall episodes and it is normalized to the value of the metallicity after $14.0-14.5$ Gyr. The comparison between the data and the model is shown in the figure. The different panels show the unconvolved model ("No scatter"), and the model convolved by a Gaussian representing different amounts of observational and cosmic scatter. As seen in this figure, the model matches the data well, and the amount of cosmic scatter is small. This indicates that the disc was formed via infall processes over an extended time scale of order 7 Gyr.

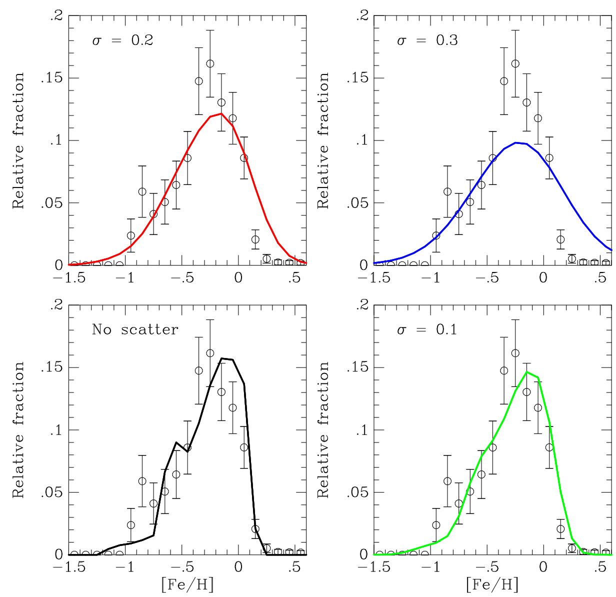

Fig. 1. Comparison of the model predictions and the metallicity distribution for K dwarfs. In all panels the data are shown by circles. The lower left panel shows the raw, unconvolved model. The remaining panels show the model convolved with different amounts of total observational and cosmic scatter (0.1, 0.2 and 0.3 dex). The observational scatter in the metallicities due to photometric errors is of order 0.1 dex.

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