Astrophysics > Galaxy Astrophysics

Evidence of a thick disk rotation-metallicity correlation

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We analyze a new kinematic survey that includes accurate proper motions derived from SDSS DR7 positions, combined with multi-epoch measurements from the GSC-II database. By means of the SDSS spectro-photometric data (effective temperature, surface gravity, metallicity, and radial velocities), we estimate photometric parallaxes for a sample of 27,000 FGK (sub)dwarfs with [Fe/H]<-0.5, which we adopted as tracers of the seven-dimensional space distribution (kinematic phase distribution plus chemical abundance) of the thick disk and inner halo within a few kiloparsecs of the Sun. We find evidence of a kinematics-metallicity correlation, dVphi/d[Fe/H]=40-50 km/s/dex, amongst thick disk stars located between one and three kiloparsecs from the plane and with abundance -1 <[Fe/H]< -0.5, while no significant correlation is present for [Fe/H]> -0.5. In addition, we estimate a shallow vertical rotation velocity gradient, dVphi/d|z| = -19 +/- 2 km/s/kpc, for the thick disk between 1 kpc < |z| < 3 kpc, and a low prograde rotation, 37 +/- 3 km/s for the inner halo up to 4 kpc. Finally, we briefly discuss the implications of these findings for the thick disk formation scenarios in the context of CDM hierarchical galaxy formation mechanisms and of secular evolutionary processes in galactic disks.

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