

Star Passages Close to the Sun Based on Hipparcos Data

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We have continued our analysis of Hipparcos data in order to search for stars which have encountered or will encounter the solar system (Garcia-Sanchez et al. *Astron.J.* **117**, 1042, 1999). Hipparcos parallax and proper motion determinations are combined with ground-based radial velocity measurements to obtain the trajectories of stars relative to the solar system. Our earlier work used rectilinear trajectories. We have now integrated all trajectories in the galactic potential using three different models: a local potential model, a global potential model, and a perturbative potential model. Agreement between the models is generally very good, in particular for encounter times less than ± 1 Myr from the present. Based on the Hipparcos data, we find a frequency of stellar encounters within one parsec of the Sun of 2.3 ± 0.2 per Myr. However, we also find that the Hipparcos data is observationally incomplete. By comparing the Hipparcos data with the stellar luminosity function for stars within 50 pc of the Sun, we find that only one-fifth of the stars were detected by Hipparcos. Correcting for this incompleteness, we obtain a value of 11.7 ± 1.0 Myr⁻¹ stellar encounters within one pc of the Sun. We examine the ability of two future missions, FAME and GAIA, to extend the search for past and future stellar encounters with the Sun. This work was performed in part at the Jet Propulsion Laboratory and was supported by NASA.