

Perturbation of the Oort Cloud by Close Stellar Approaches

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We combined Hipparcos proper motion and parallax data for nearby stars with ground-based radial velocity measurements to find stars which may have passed (or will pass) close enough to perturb the Oort cloud. We find the number N of close stellar approaches within distance D from the Sun (in parsecs) is $N \approx 4.2 D^2 \text{ Myr}^{-1}$, less than previously predicted values. This is the result of observational incompleteness in the Hipparcos data, which is complete to a visual magnitude of only ~ 7.3 - 9.0 . Two stars, Gliese 710 and SAO 128711, have predicted closest approach distances $< 10^5$ AU (0.5 pc), through the outer Oort cloud. The minimum distance for GL 710 is 71,000 AU, 1.36 Myr in the future. For SAO 128711 the values are 57,000 AU, 1.2 Myr in the past, though the uncertainties are quite large. Both stars are red dwarfs with masses of ~ 0.4 - $0.7 M_{\odot}$. The absence of major stellar perturbers in the recent past is consistent with an analysis of the semimajor axis distribution of the long-period comets by Weissman (1993) who determined that we are not currently in a cometary shower. Based on dynamical simulations, the closest predicted stellar passages may result in an increased flux of Oort cloud comets of $\sim 50\%$.