Astrophysics > Solar and Stellar Astrophysics

Stripping a debris disk by close stellar encounters in an open stellar cluster

Jean-Francois Lestrade (Observatoire de Paris), Etienne Morey (Observatoire de Paris), Antoine Lassus (UPMC), Naron Phou (UPMC)

(Submitted on 5 Jul 2011 (v1), last revised 8 Jul 2011 (this version, v2))

A debris disk is a constituent of any planetary system surrounding a main sequence star. We study whether close stellar encounters can disrupt and strip a debris disk of its planetesimals in the expanding open cluster of its birth with a decreasing star number density over 100 Myrs. Such stripping would affect the dust production and hence detectability of the disk. We tabulated the fractions of planetesimals stripped off during stellar flybys of miss distances between 100 and 1000 AU and for several mass ratios of the central to passing stars. We then estimated the numbers of close stellar encounters over the lifetime of several expanding open clusters characterized by their initial star densities. We found that a standard disk, with inner and outer radii of 40 and 100 AU, suffers no loss of planetesimals over 100 Myrs around a star born in a common embedded cluster with star density <1000 pc^-3. In contrast, we found that such a disk is severely depleted of its planetesimals over this timescale around a star born in an Orion-type cluster where the star density is >20 000 pc^-3. In this environment, a disk loses >97% of its planetesimals around an M-dwarf, >63% around a solar-type star, and >42% around an A-dwarf, over 100 Myrs. We roughly estimate that two-thirds of the stars may be born in such high star density clusters. This might explain in part why fewer debris disks are observed around lower mass stars.

Comments:	7 pages, 4 figures, accepted for publication in Astronomy and Astrophysics ; v2 abstract complemented
Subjects:	**Solar and Stellar Astrophysics (astro-ph.SR)**; Earth and Planetary Astrophysics (astro-ph.EP)
Cite as:	**arXiv:1107.0970 [astro-ph.SR]**
	(or **arXiv:1107.0970v2 [astro-ph.SR]** for this version)

Submission history

From: Jean-Francois Lestrade [view email]

[v1] Tue, 5 Jul 2011 20:00:01 GMT (56kb)

[v2] Fri, 8 Jul 2011 13:20:08 GMT (56kb)

Which authors of this paper are endorsers?