

COMETARY CAPTURE RATES AND EXTRA-SOLAR OORT CLOUD ENCOUNTERS, S.A. Stern, Laboratory for Atmospheric and Space Physics, Univ. of Colo, Boulder, CO, 80309.

Torbett [1] has recently demonstrated that interstellar comets approaching the sun at $V=20$ km/sec (the solar apex velocity) can be captured by three body interactions between the approaching comet, the sun, and Jupiter, and that such comets will be preferentially captured into short period orbits. The present upper limit on the population of interstellar comets in the solar neighborhood was then employed to estimate the frequency of capture events and the total number of interstellar comets which may have been captured into orbit around the sun. Performing this calculation, Torbett found a capture frequency of one comet/62 million years, and estimated the number of captured interstellar comets to be ~ 70 .

While the mechanics of Torbett's derivation are sound, the numerical results appear underestimate the actual capture rate because (a) encounters between our sun and the Oort clouds of other stars [2] were not considered, and (b) gravitational focusing by Jupiter and the Sun was not included.

Taking gravitational focusing into account first, [2;3], I find that Jupiter's presence should enhance the capture rate by a factor of ~ 3.5 .

More importantly, if other stars possess Oort-like comet clouds, then some stars will pass sufficiently close to our sun to induce an influx of extra-solar Oort comets through our planetary region. About 500 encounters with extra-solar inner Oort clouds and our sun may have taken place; similarly, $\sim 12,000$ such encounters may have taken place with the outer Oort clouds of other stars. If our sun's Oort cloud is typical, then inner comet clouds should display significantly higher population densities than outer Oort clouds.

Taking gravitational focusing and the Extra-Solar Oort Cloud (ESOC) source into account, and under the assumption that all stars possess Oort clouds, I estimate ~ 1300 captures of extra-solar inner Oort cloud comets and ~ 24 captures of extra-solar outer Oort clouds comets may have taken place. This corresponds to a significantly higher capture rate of ~ 1 comet/ 3×10^6 years. Under the assumptions mentioned above, each encounter with an inner Oort cloud from another star will result in the capture of a few comets into the planetary region (of course, in such encounters the sun can also lose a few comets due to extra-solar capture if the interloper possesses a giant planet or a stellar companion).

Even if only 5% of all stars possess Oort clouds, ESOC comets will double the frequency and number of interstellar comet captures over Torbett's estimate.

As has been pointed out [1,2], the presence of inter-stellar comets in the solar system presents an interesting and potentially important source of material exchange between planetary systems.

Torbett, M.V., (1986) Capture of $V=20$ Km/sec Interstellar Comets by Three-Body Interactions in the Planetary System. *The Astronomical Journal*, 92, No. 1.

Stern, S.A., (1986) Extra-Solar Oort Cloud Encounters and Planetary Impact Rates. *Icarus*, V63.

Singer, S.F. and Stanley, J.E., (1976) Interplanetary Dust Particles Near Jupiter. *Icarus*, 27.