The flux of long-period comets and the initial orbital distribution of the Oort cloud

M. Fouchard[1], H. Rickman[2,3], G. Valsecchi[4,5], and C. Froeschlé[6]

[1]LAL/IMCCE, UMR 8028, Lille 1 University, 1 Impasse de l'Observatoire, F-59000 Lille, France
[2]PAS Space Research Center, Bartycka 18A, PL-00-716 Warszawa, Poland
[3]Dept. of Physics & Astronomy, Uppsala Univ., Box 516, SE-75120 Uppsala, Sweden
[4]IAPS, INAF, via Fosso del Cavaliere 100, I-00133 Roma, Italy
[5]IFAC-CNR, Via Madonna del Piano 10, I-50019 Sesto Fiorentino (FI), Italy
[6]Observatoire de la Côte d'Azur, UMR Lagrange 7293, Bv. de l'Observatoire, B.P. 4229, F-06304 Nice cedex 4, France

Several simulations have been performed on the evolution of the Oort cloud of comets over the age of the solar system using 10 different stellar encounter sequences. An innermost part of the cloud was also introduced (semimajor axes between 1,100 and 3,000 au). Attention is focused on the observable comets, i.e., comets passing at less than 5 au from the Sun, the end of the integrations representing the present time. We apply fading laws to returning comets when comparing with observations, and we use a final period of 30 million years for the numerical experiments on the flux of passing stars. These simulations allow us to place constraints on the initial and/or present Oort cloud distribution of orbital energy, and, possibly, on the ecliptic inclination distribution of the cloud. Moreover, we may highlight the dependence of the observable Oort spike and the present Oort cloud on the stellar sequence. Indeed, some preliminary results have shown that the energy distribution of the final Oort cloud is critically dependent on the few strongest stellar encounters that obviously differ from one sequence to another. One of our main goals is to evaluate, what is the most concentrated initial Oort cloud allowing to obtain an observable Oort spike consistent with the observations (the total initial mass of the cloud being the same).