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# Some properties of the distribution of long period comets.

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## Abstract

The scope of the present study is to compare the flux of observable long period comets obtained numerically to the observed flux of long period comets. Such comparison should give us some hint about the incompleteness of the observed flux with respect to the perihelion distances, the validity of the injection scenario toward the observability, and to make some hypothesis on the recent past history of the observed long period comets. In addition, if our numerical data are statistically reliable it should be possible to investigate some fading laws for these comets.

## 1. Introduction

We have modelled the dynamics of $10^7$ Oort cloud comets over the age of the solar system using the model described in [1, 2, 3]. The final flux of observable comets with original semi-major axis greater than 10 000 AU has been computed. This flux has been weighted considering a present flux of 4 comets per year for perihelion distance smaller than 5 AU with a total absolute magnitude HT < 11 over 25 years [5] (from 1990 until present time).

For comparison, the JPL Horizon system [4] has been used to compute the original barycentric orbital elements, i.e. at 150 AU from the Sun before perihelion, of all long period comets discovered after 1990, January 1st, with perihelion distance smaller than 5 AU and original semi-major axis greater than 10 000 AU.

## 2. Preliminary figures

Fig. 1 shows the shape of the Oort peak, i.e. the distribution of orbital energy of observable comets, and Fig. 2 the distribution of perihelion distances. For both figures, the bin are coloured according to the proportion of comets in the following four different dynamical classes : the *jumpers*, for which the preceding perihelion passage was at more than 15 AU from the Sun (in red on the figures), otherwise the comet is a *creeper*. In addition if at the preceding perihelion passage a planetary perturbation has significantly increased the orbital energy of the comet then the comet is classified as a *Kaib and Quinn jumper* or *Kaib and Quinn creeper* comet.

On each plot, the distribution obtained from the JPL Horizon system [4] is also plotted.

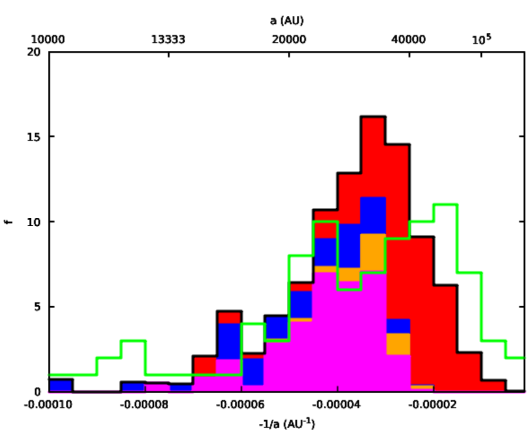


Figure 1: Distribution of orbital energy of observable long period comets. The coloured are of each bin is proportion to the proportion of comets in the corresponding classes : red for jumpers, orange for Kaib and Quinn jumpers, magenta for Kaib and Quinn creepers, and blue for creepers (see text the main text for the definition of the classes). The green line corresponds to the distribution obtained from the JPL-Horizon system [4].

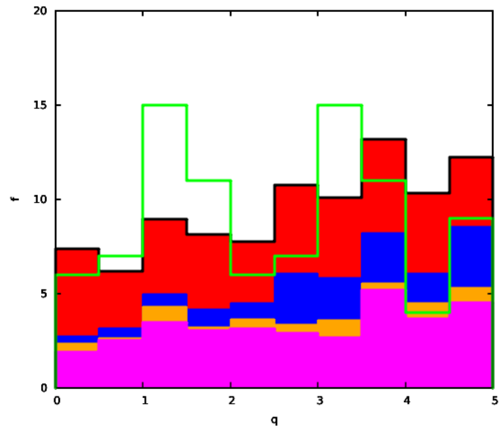


Figure 2: Distribution of perihelion distance for observable long period comets. The color are the same as for Fig. 1.

# 3 Perspectives

We aimed to used such kind of comparison to deduce some information about the completeness of detection of long period comets with respect to perihelion distance and to make some hypothesis on the recent past history of individual known long period comets. Considering also the observable long period comets with semi-major axis smaller than 10 000 AU, it should be possible to estimate some fading law for these comets.

# References

[1] H. Rickman, M. Fouchard, Ch. Froeschlé, G. B. Valsecchi, Injection of Oort Cloud comets: the fundamental role of stellar perturbations, Celest. Mech. and Dynam. Astron. 102 (2008) 111–132.

[2] M. Fouchard, Ch. Froeschlé, S. Breiter, R. Ratajczak, H. Valsecchi, G.B. Rickman, Methods to Study the Dynamics of the Oort Cloud Comets II: Modelling the Galac- tic Tide, in: D. Benest, C. Froeschlé, E. Lega (Eds.), Top- ics in Gravitational dynamics, vol. 729 of Lecture Notes in Physics, Berlin Springer Verlag, 271–293, 2007.

[3] M. Fouchard, H. Rickman, C. Froeschlé, G. B. Valsecchi, Planetary perturbations for Oort Cloud comets. I. Dis- tributions and dynamics, Icarus 222 (2013) 20-31.

[4] Giorgini, J.D., Yeomans, D.K., Chamberlin, A.B., Chodas, P.W., Jacobson, R.A., Keesey, M.S., Lieske, J.H., Ostro, S.J., Standish, E.M., Wimberly, R.N., "JPL's On-Line Solar System Data Service", Bulletin of the American Astronomical Society 28(3), 1158, 1996.

[5] P. J. Francis, The Demographics of Long-Period Comets, APJ 635 (2005) 134-1361.