ON THE STATISTICAL LOSS OF LONG-PERIOD COMETS FROM THE SOLAR SYSTEM, I

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1. Summary

Description of the sun's family of comets, number, nature of orbits, is given first. At each return of a long-period comet, planetary action can change the binding energy which is itself small by amounts that must gradually lead to the systematic expulsion of comets from the solar system.

The distribution of perihelion (and aphelion) points of cometary orbits is found to be definitely nonrandom. It also shows strong evidence of association with the galactic plane. The mean position of the perihelion points is in striking agreement with what would be predicted by the accretion hypothesis of cometary formation.

The energy changes already calculated for some of the so-called "hyperbolic" comets are listed. For other comets the possible energy change at each approach to the sun as a result of Jupiter's action (or that of any other great planet) can be calculated by means of a restricted three-body method in which the motion of the sun and Jupiter are regarded as in fixed circles. By good fortune the very quantity that is needed, namely the change of energy, can be found by means of the Jacobi integral, without it being necessary to investigate any other orbital changes. The formulas for the energy change are reduced to the forms that have actually been utilized for the necessary machine integrations.

2. Object of the paper

The object of this paper is to show that the distribution of the orbits of the comets of the solar system must be changing with time, and by a study of the main causes of these changes to obtain an estimate of the decay period associated with a defined group of comets.

3. Introduction

The problem leads first of all to consideration of the dynamical evolution of individual cometary orbits. But as this cannot be followed out in full detail for