PERTURBATIONS OF COMETARY ORBITS

R. H. KERR
FERRANTI, LTD.

1. Introduction

The orbits of over 500 comets have been calculated from observational data obtained while the comets were visible from the earth. From these observations it is found that the orbits fall into two main groups:

(1) Those with parabolic or nearly parabolic orbits.

(2) Those that have definitely elliptic orbits.

The second group contains all comets with periods less than 100 years. It is found that of over 70 comets that go to make up this group only three have an inclination to the ecliptic of more than 30° and the average inclination is 13°. Also, apart from Halley's comet, all have the same direction of motion around the sun as Jupiter. These two facts lead to the conjecture that originally all these comets belonged to the first group and have, by one or several close encounters with Jupiter, been diverted into their present orbits. Comet Brooks (1889 V) was observed to undergo this capture by Jupiter.

Both Lyttleton's [1] and Oort's [2] theories on the origin of the comets assume that the short-period comets were forced into their present orbits by the perturbative effects of the planets (in particular Jupiter) and that originally these comets were in osculating parabolic long-period orbits.

Van Woerkom [3] investigated the perturbations of comets which came near to Jupiter and he found that the root mean square values of the change in the reciprocal of the semimajor axis of comets with perihelion distances of 1 and 4.5 a.u. was 78 and 128 a.u.$^{-1}$ $\times$ 10^{-5} respectively. The problem attempted in this paper is an extension of Van Woerkom's work. By a suitable choice of parameters the effect of Jupiter is evaluated for all parabolic comets whose distance of closest approach to the sun lies in the range 0.04 to 4 a.u. The lower limit of 0.04 a.u. is taken because Lyttleton's accretion theory postulates a stream of sun-grazing comets.

Jupiter's effect can be measured in terms of the change in the reciprocal of the semimajor axis of the orbit and an estimate of the distribution of this quantity is made for each value of the perihelion that is used.

Formerly with Manchester University Computing Machine Laboratory.