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Resonant Behaviour of Comet Halley and the Orionid Stream

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Abstract

Many previous works have shown the importance of mean motion resonances in the long term dynamical evolution of meteoroid streams. It would be interesting to look at the orbital evolution of comet 1P/Halley in the near past and try to develop an elaborate ejection model which can correlate the ancient and present observations of the Orionids wherever possible. This work aims to present a few interesting aspects related to this.

1. Introduction

It is well known that comet 1P/Halley has the unique distinction of having a detailed observational record (which helps in constraining theoretical models) for almost all the perihelion passages from 240 B.C. [1]. In this work, we aim to describe the results of a numerical study which shows the significance of the 1:6 & 2:13 mean motion resonances of the comet itself and the Orionid stream particles with Jupiter. Earlier works [2][3] on 1:6 resonant Orionids showed that such dust trails could cause meteor outbursts for many years like in the case of considerably enhanced zenithal hourly rates seen during 2006-2010 and the indication of a similar activity profile between 1933-1938 from the historical records [4] of past observations. We show how these and other recorded outbursts are related to the past resonant behaviour of the parent comet. Our present work quantifies the timescales over which stream particles, and 1P/Halley itself, can survive in these resonances. This determines the long term dynamical evolution and stream structure, influencing the occurrence of Orionid and eta-Aquariid meteor outbursts. Further numerical integrations reveal analogous resonant behaviour of other solar system bodies, so that there is a lot more to be understood about this fascinating phenomenon.

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