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Non-gravitational Forces and Torques of Comet 67P/Churyumov-Gerasimenko and Resultant Changes in its Orbit and Rotation

Nalin Samarasinha (1), Björn Davidsson (2) and Davide Farnocchia (2)

(1) Planetary Science Institute, Tucson, AZ, USA

(2) Jet propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA

(nalin@psi.edu)

Abstract

We will present the initial results based on modelling that incorporates non-gravitational forces and torques caused by outgassing from comet 67P/Churyumov-Gerasimenko and resultant changes in orbital and rotational motions of the comet.

1. Introduction

The first rendezvous mission to a comet, Rosetta mission to comet 67P/Churyumov-Gerasimenko (hereafter 67P/C-G), enabled us to derive detailed gas and dust production rates from the comet as well as to monitor orbital and rotational changes of the cometary nucleus over many months. The non-gravitational forces and torques due to sublimating gases cause changes to the orbital locations and the rotational state of the comet, respectively.

2. Methodology & Goals

We will present the initial results from an investigation focused on modelling orbital and rotational changes to the nucleus of comet 67P/C-G caused by non-gravitational forces and torques due to sublimating gases. The gas production rates from the nucleus based on the thermophysical model, NIMBUS, developed by Davidsson[1] and consistent with the Rosetta observations are used to estimate the non-gravitational forces and torques. The resultant non-gravitational forces and torques will be integrated and compared with the observed orbital and rotational changes of the comet as measured by the Rosetta mission. With this investigation, ultimately we aim to obtain a self-consistent picture that will explain the nuclear activity and orbital and rotational changes of comet 67P/C-G.

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References

[1] Davidsson, B.J.R. 2019. In Preparation.