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The Dust Trail of Comet 67P/Churyumov-Gerasimenko in 2008

J. Agarwal (1), H. Böhnhardt (2), E. Grün (3,4), R. Laureijs (1), W.T. Reach (5), J.A. Stansberry (6), M.V. Sykes (7)

(1) European Space Research and Technology Centre, Noordwijk, The Netherlands. (jagarwal@rssd.esa.int), (2) Max Planck Institute for Solar System Research, Katlenburg-Lindau, Germany, (3) Max Planck Institute for Nuclear Physics, Heidelberg, Germany, (4) Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, USA, (5) Infrared Processing and Analysis Center, California Institute of Technology, Pasadena, USA, (6) Steward Observatory, Tucson, USA, (7) Planetary Science Institute, Tucson, USA.

Abstract

We present observations of the dust trail of the Rosetta target comet 67P/ Churyumov-Gerasimenko (CG) during 2008 in visible and mid-infrared light. Our observations allow us to constrain the dust colour temperature and – by comparison with simulated images – parameters of the emission of mm-sized and larger particles from the comet.

Introduction

Cometary dust trails consist of mm- to cm-sized dust particles emitted by a comet. Due to their low emission speeds and the weak influence of radiation pressure, these particles remain on orbits similar to that of the parent comet for many revolutions around the Sun, appearing to the observer as a thin extended structure along the cometary orbit. The emission of large dust particles is the principal mechanism by which a comet loses refractory mass to the interplanetary dust environment [1]. Trails of eight short-period comets were observed with IRAS in 1983 [2, 3], and a dedicated survey with Spitzer revealed that trails were associated to more than 80% of the observed Jupiter family comets [4]. The dust trail of comet CG was one of the IRAS-detected trails, and it has since been observed at both visible and mid-infrared wavelengths [5, 6, 7, 8, 9, 10].

Observations

We observed the trail of comet CG in visible light in July 2008 with the Wide Field Imager at the ESO/MPG 2.2m-telescope on La Silla, and in the mid-infrared (24 and 70 micron) in November 2008 with the MIPS instrument [11] on board the Spitzer Space Telescope of NASA. The comet was at heliocentric distances of 2.7 AU in July 2008 and 1.7 AU in November 2008. The observations shows the comet nucleus, developing coma, and sections of the dust trail.

Results

The simultaneous measurement of the infrared flux at 24 and 70 μm allows us to derive the colour temperature of the dust and thus the total dust cross-section along a line of sight. From iterative comparison of the observations to simulated images we constrain the dust size distribution, emission speeds, and production rates as functions of time.

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