Abstract IT-4b-1

Modeling

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Abstract CT-4b-1

DUST MORPHOLOGY OF COMET HALE-BOPP (C/1995 O1) IN 1996 AND 1997: I. PRE- AND POST-PERIHELION COMA STRUCTURES

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In 1996, comet Hale-Bopp exhibited a porcupine-like coma with straight jets of dust emission from several active regions on the nucleus. The multi-jet geometry developed in the coma during the first half of 1996. Despite a likely fast rotating nucleus (Lecacheux et al. IAUC 6560, 1997) the orientation of the jets remained almost constant over months. However, the relative intensity of the jets continued to change with time. By using the embedded fan model of Sekanina and Boehnhardt (IAUC 6542, 1997) the almost steady jet pattern in comet Hale-Bopp can be interpreted as boundaries of dust emission cones (fans) from at least 4 active regions on the nucleus. A quantitative analysis of the persistent multi-jet phenomenon using numerical dust coma modelling is presented by Sekanina and Boehnhardt as part II of this project during this conference. While during perihelion passage in spring 1997 a great variety of rapidly variable coma structures was observed, the comet again exhibited a persisting porcupine-like coma in autumn 1997 resembling very much the appearance from 1996.

Abstract CT-4b-2

JETS OF COMET HALE-BOPP AT THE HELIOCENTRIC DISTANCE ABOUT 7 AU

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The movement of two jets which were observed in 1995 is analyzed. Both events were observed ana measured at the Tide Observatory. One of them during August and September and another one month later.

A simple model is developed. It is supposed that a single localized source of matter generated a jet which got a spiral shape due to rotation of the nucleus. A method of solution of the inverse problem is proposed to obtain the kinematic parameters of the model.

Energetics of jets generation at such large heliocentric distances is discussed taking into consideration the radioastronomical data on the carbon monoxide atmosphere which expanded with an extremely high velocity ~400-500 m/s. It is shown that this velocity cannot be obtained neither by collimation nor by simple heating. Even crystallization of amorphous ice gives the energy which is four times less that necessary. A hypothetic more power source of energy is discussed.

Abstract CT-4b-3

THE DUST TAIL OF COMET HALE–BOPP BEYOND 4 AU

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Comet Hale–Bopp 1995O1 showed a strong activity at large heliocentric distances, where the sublimation rate of water is negligible compared to that of more volatile species, such as CO or CO_2. Therefore, the monitoring and the analysis of such activity allows us to obtain information on the comet dust environment due to gas drag different than water, an opportunity offered by very few other comets. For example, this information may be crucial also for future space mission visiting short period comets at about 4 AU from the sun, where the comet activity should be dominated by CO. In this paper we analyse the dust tail of C/1995O1 built–up by the CO drag at heliocentric distances larger than 4 AU. The dust tail data are extracted by six wide field photographic plates taken with the UK Schmidt Telescope operating at Siding Spring, Australia, between 16 and 28 May, 1996. The plates are linearized by means of proper calibration wedges, and absolutely calibrated by means of GSPC photometric fields available on the same plates. The dust tail data are then fitted by means of the inverse dust tail model, and the obtained results are compared with the only other similar results obtained so far about a dust environment due to CO sublimation: those of the giant short period comets Schwassmann–Wachmann 1 and Chiron.

Abstract CT-4b-4

AN EARLY INVESTIGATION OF THE STRIATED TAIL OF COMET HALE-BOPP (C/1995 O1)

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The fragmentation model for the striated tails of dust comets (Sekanina & Farrell 1980) has been applied to two images of comet Hale-Bopp to study the motions of 12 striae in the time span of 12–15 March 1997. The model was found to fit the measured points virtually perfectly, indicating that particles in the striae had originated from outbursts in the period of time from the end of January to the second half of February 1997, or some 60 to 40 days before perihelion. The radiation pressure accelerations of the parent particles are determined to have been in the range of $0.3 < \beta_p < 1.0$, with a median value of $\langle\beta_p\rangle = 0.55$. The sequence of ejection times t_e for the individual striae derived by forcing β_p to coincide with the median value show clear evidence of a periodicity of $11^{\rm h}\,21^{\rm m}$, consistent with the results derived from jets. On the other hand, the fragmentation times t_f exhibit a more complex behavior, with the fragmentation lifetime $t_f - t_e$ of the parent particles generally decreasing with decreasing heliocentric distance. However, when corrected for the varying exposure to solar radiation, the normalized fragmentation lifetimes for 11 out of the 12 striae are nearly constant, from 12.6 to 14.8 days at 1 AU from the Sun. The peak fragment accelerations are mostly in the range of $1.0 < (\beta_f)_{\rm peak} < 3.0$, only occasionally exceeding 3. Our limited analysis of Watanabe *et al.*'s (1997) measurements of striae on their images from three days in the period of 5–9 March 1997 shows that four of our striae were detected by them as well. We identify and follow the motions of additional six of Watanabe *et al.*'s striae throughout the 4-day period, establishing that the normalized fragmentation lifetimes of dust particles in the striae observed in the period of March 5–9 are systematically shorter, only 7–11 days, than in the striae observed in the period March 12–15. Our investigation of the striated tail is continuing.