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STUDY OF THE ANTI-TAIL OF COMET KOHOUTEK FROM AN OBSERVATION ON 17 JANUARY 1974

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Abstract. As part of our program of observation of Comet Kohoutek at Pic-du-Midi Observatory, we obtained, on January 17.8 UT, 1974 a photograph in polarized light showing dramatically the (dust) anti-tail extending for almost 1° from the Comet's head (reported in Sky and Telescope, June 1974); indeed the comet is visible in polarized light further away than in total light as noticed by Weinberg and Beeson (IAU Colloquium No. 25, 1974) for Comet Ikeya-Seki. A photometric and polarimetric study was performed (Bücher, A., Robley, R., and Koutchmy, S., 1975, Astron. Astrophys. 39, 289) showing that the anti-tail is strongly polarized (up to 50 %). These large degrees of polarization are of the same order of magnitude as those reported for the tail of Comet Ikeya-Seki by Matjagin Sabitov and Kharitonov (1967, Astron. Zh. 44, 1075) and by Weinberg and Beeson (op. cit.). As discussed by these latter authors, particle alignment is precluded as a significant contributor to polarization in the tail of comets. Polarization by large spheres as obtained from the Fresnel reflection coefficients applies only in the case of perfect surface, a circumstance very unlikely in interplanetary space; the scattering is in fact controlled by the surface microstructures (Van de Hulst, private communication). Therefore we hypothesized that submicronic grains should play an important role in the anti-tail. The classical method of Finson and Probstein (1968, Astrophys. J. 154, 327, 353) was used to draw the sky plane view of the syndynes for the day of observation. Since the ratio ß of the radiation pressure force to the gravitational attraction is proportional to the third power of the grains' radius s for $s \lesssim 0.1\ \mu$, submicronic grains with typical radii of $0.02\ \mu$ may indeed be present in the anti-tail and provide a straight-forward explanation of the observed polarization. This size is of the same order of magnitude as that inferred for interstellar

https://doi.org/10.1017/S0252921100051964 Published online by Cambridge University Press

grains which may well be embedded in the comet's nucleus as well as meteorites for which there exists good evidence. Our conclusion does not rule out the presence of millimeter-size grains as proposed by Sekanina and Gary and O'Dell in their preliminary investigations (1974, Icarus 23, 502, 519) which did not take into account the polarimetric result; such grains may well coexist with the submicronic ones. Finally, the line of maximum intensity is close to a synchrone corresponding to a time of emission 100 days before perihelion passage. This supports the synchronic formation of anomalous tails and possibly of tails as proposed by Vsekhsvyatsky (1932, Astron. Zh. 9, 166).

https://doi.org/10.1017/S0252921100051964 Published online by Cambridge University Press