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DUST EMISSION OF COMET HALLEY AT LARGE HELIOCENTRIC DISTANCES.

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Comet Halley is currently approaching the inner solar system. Four spacecrafts (NASA's ICE spacecraft, two Russian VEGA probes and the Japanese MS-T5 spacecraft) have already been launched to encounter the comet in March 1986. Two additional Halley probes (the European Giotto spacecraft and another Japanese Planet-A probe) will be launched in mid-85 to join the armada. In order to accurately guide these spaceprobes to their meeting point with the comet, its trajectory has be known precisely; e.g. to aim the Giotto spacecraft, which will come closest (approximately 500 km) to the comet nucleus, the position of the Comet has to be known with an accuracy of 100 km. Therefore, ever since the rediscovery of Comet Halley in 1982, astronomers have followed its course with the largest telescopes in order to improve the knowledge about its orbit.

In December 84 and January 85 when the comet was still 650 million kilometers away from the earth (at about the distance of Jupiter's orbit), it was observed with the 2.2 m telescope of the German-Spanish Astronomical Center at Calar Alto, Spain. At that distance individual observations yield a positional accuracy of only about 1000 km, but major improvements are expected by future observations when the comet is much closer to the earth.

The nucleus of Comet Halley is believed to be a "dirty snowball" of about 6 km diameter (according to a model of Fred Whipple from the Smithsonian Astrophysical Observatory, Cambridge, Mass.). When it comes close to the sun, its temperature rises and the ices start to evaporate releasing large amounts of gas and dust which eventually form an atmosphere of about 100 000 km diameter and a tail of several 10 million km length.

Fig. 1: CCD image (negative) of Comet Halley (spot near center of the frame) obtained with the 2.2 m meter telescope at Calar Alto, Spain, on December 17, 1984. At this time the comet was at a distance of 650 million kilometers. The image was obtained by tracking the comet's motion with the telescope for 30 minutes. Therefore images of stars are stretched to lines.

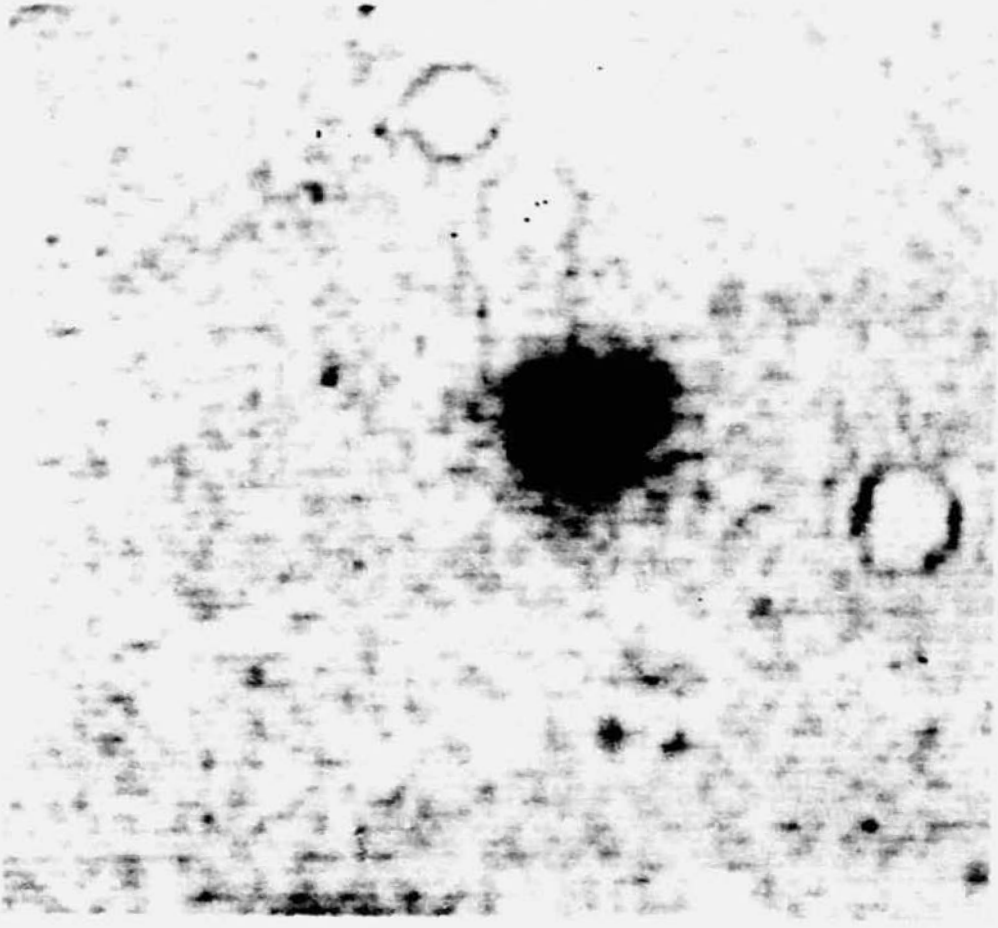

Fig. 2: Blow-up of an image (negative) of Comet Halley indicating a diffuse halo around the central nucleus.

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Before 1984 the comet had a starlike appearance and no direct sign of evaporation activity. However, by the end of 1984 when the comet was observed from Calar Alto the image showed a significant extension. The width of the image corresponds to a halo of 3000 to 10 000 km diameter around the nucleus. The formation of a halo indicates the onset of evaporation of cometary ices. From an estimated surface temperature on the nucleus of -160 to -140 °C (corresponding to -256 °F to -220 °F) it is concluded that the evaporation of ices more volatile than water ice (e.g. carbondioxide) causes the emission of particulates from the nucleus. The emitted dust grains in the halo become visible because of the reflected sunlight. The study of dust emissions from Comet Halley will eventually determine the fly-by strategy of the Giotto spacecraft by taking into account the distribution of dust in the vicinity of the nucleus and the associated hazard for the spacemission.

The observations were performed at the German-Spanish Astronomical Center, Calar Alto, Spain, which is operated by the Max-Planck-Institut für Astronomie, Heidelberg, jointly with the Spanish National Commission for Astronomy.