A THREE-DIMENSIONAL COMPUTER REPRESENTATION OF THE NUCLEUS OF COMET HALLEY; D. C. Boice and W. F. Huebner, Southwest Research Institute, and J. V. Lambert, AVCO Research Laboratory

Many unique characteristics of the nucleus of Comet Halley were revealed on the images from the Halley Multicolour Camera (HMC) aboard Giotto (1) and the television systems (TVS-1 and TVS-2) aboard the Vega spacecraft (2). The nucleus was seen to be an irregular avocado-shaped body about twice as long as it is wide. The Giotto images show a variety of surface features to the resolution limit of the camera: gas- and dust-producing source areas, hills, crater-like structures, and depressions. However, the Giotto flyby was brief and HMC did not function on the outbound trajectory so these high quality images exist for a very limited viewing angle. The TVS images, while of lower resolution, were acquired over a longer time period and a larger viewing angle. Combining information from these data sets, we present a three-dimensional computer representation of the nucleus.

The mathematical model that we use was developed for the simulation of the lightcurves of irregularly shaped bodies with complex surface scattering functions and has been successfully applied to the shape of 2 Pallas (3). The model approximates a triaxial ellipsoid by a large number of triangular patches. This basic figure can be modified by planar cuts, spherical craters, spherical mounts, and other surface structures. It allows arbitrary illumination and viewing angles, taking into account scattering functions which may vary over the surface and shadowing.

Observational constraints imposed by the two-dimensional images are used to refine the computer model. The HMC images show the most surface detail but are limited to less than half of the nucleus. Projection effects make it difficult to determine surface relief, surface activity obscures part of the nucleus, and little is seen on the nightside. The viewing angle varied ~ 160° for the TVS cameras and the flyby duration allowed the nucleus to rotate through several periods. The TVS images improve the surface coverage but are of lower resolution, useful only as a guide for the cross-sectional area.

The model can be useful in the analysis and interpretation of the Comet Halley data. Assuming a uniform density distribution, the moments of inertia can be calculated and the solid body rotation determined. This can be used to put constraints on the different rotation schemes that appear in the literature. The model is also useful for investigating various scattering functions appropriate to dark surfaces. In addition, variability of photometric data taken at large heliocentric distances and unobscured by coma activity can be analyzed within the context of this model.

(1) Keller, H. U., et al. (1986) Nature *321*, 320.
(2) Sagdeev, R. Z., et al. (1986) Nature *321*, 262.
(3) Lambert, J. V. (1985) Ph.D. Dissertation, New Mexico State University.