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Chemical Stratification and Molecular Production Rates in Comet Hale-Bopp.

S. D. Rodgers[1], S. B. Charnley[1], and P. Ehrenfreund[2]

[1]Space Science Division, NASA-Ames Research Center, Moffett Field, CA 94035, USA,

email: rodgers@dusty.arc.nasa.gov

[2]Leiden Institute of Chemistry, PO Box 9502, 2300 RA, Leiden, The Netherlands

Abstract.
We present the results of our model of the thermal and chemical evolution of a cometary nucleus, as applied to comet Hale-Bopp. As in previous models, we assume that the nucleus consists of a porous ice/dust matrix. In addition to water ice, we also consider the presence of several additional species, including CO, CO_2, H_2S, CH_3OH, and HCN. Each species may be present in a pure ice phase, or trapped within the H_2O ice, or a mixture of the two. We calculate the temperature and pressure gradients within the nucleus, and follow the subsequent diffusion of heat and matter throughout the nucleus. The upper layers of the nucleus become rapidly depleted in volatiles, and the relative production rates of different molecules entering the coma are controlled by the depth of the sublimation front of each species. This in turn depends on the sublimation temperature of each ice, and on the global heat transport within the nucleus. By comparing the results of our model with the observed evolution of molecular ratios in the coma of Hale-Bopp, we expect to gain valuable information on the molecular mixing ratios and the nature of the ices in the nucleus of this comet.

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