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Context and Goals:

Comet Hale-Bopp is one of the best-observed comets. Thus, there is a large set of observational data available, including water, dust and CO production rates covering a large range of heliocentric distances (see [1], [2], [3], [4], [5], [6] and [7]).

So far, several thermophysical models have been applied to simulate Hale-Bopp behavior in order to extract relevant and useful information ([8], [9], [10], [11]). Nevertheless, to our knowledge, there is no thermophysical model that successfully reproduce the full set of observational data.

The goal of this study is to explore to what extent is possible to simultaneously model all available production rates of Hale-Bopp starting with simple and homogeneous initial conditions. With this we pursue to see if it is possible to place constraints on some of the key mean magnitudes defining nucleus characteristics.

Method:

We have developed a thermophysical cuasi-3D model for cometary nuclei. It takes into account, crystallization of amorphous water ice (when present) and possible release of trapped carbon monoxide, sublimation and recondensation of water and carbon monoxide, thermal solid sate conduction, gas fluxes through the nucleus, and dragged dust release. Thus, we can obtain (among other results) estimated production rates for water, carbon monoxide and dust.

One of the problems of thermophysical models is that they depend on a large number of physical parameters that are presently poorly constrained. The specific water ice phase present in the nucleus is an example of relevant but missing information, and dust to ice ratio or thermal conductivity are examples of poorly constrained parameters. Thus, in order to try to overcome this shortcoming, we will systematically explore the parameter space comparing our results with the observations.

Results:

Preliminary results of our study show the comparatively strong impact on the simulations of magnitudes such as dust to ice ratio, dust size distribution, thermal inertia or the argument of the rotational axis. By trying to simultaneously reproduce water, dust and CO production rates it is possible to put some constraints on these magnitudes.

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