Multispecies Gas Flows in the Interior of Comets

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A theoretical comet nucleus mode] has been written which employs 3 volatiles; CC), CO_2, and H_2O. It allows variations for equation of state; the Clausius/Clapeyron equation as well as other equations based on the latest thermodynamic data; the Brown/Ziegler [1989] relationship for CO_2 and CO at low pressure and the Lowe [1977] expression for water vapor at low pressure. It allows for variations in the physics of the outflow, from an essentially throttling mechanism (pure sublimation to space), to the Knudsen regime, to the Dusty-Gas Dynamic model (Cunningham and Williams, [1980], Mason and Malinauskas, [1983]). Variations in density, porosity, friability, tortuosity, ice phase, pore radius size, and orbital parameters ate explored. Results arc compared with data from Halley's come.t, comet Tempel2, and comet Bradfield (J 'eldman, et al, [1987]). None of the variations in parameter space produce a result that compares well with the comet data, All models yield a total gas production bet ween 10^{27} and 10^{28} See 1 (low). This suggests that secondary mechanisms peripheral to this mode.ling effort, such as the opening and closing of cracks, a conductivity expression which depends upon porosity as well as temperature, etc., may pla y a more impel tant role in the cometary efflux process than previously thought.

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