DUST PRODUCTION RATES IN EIGHT COMETS; P. D. Singh and A. A. de Almeida, Instituto Astronômico e Geofísico, Universidade de São Paulo, Cep. 04301 São Paulo, SP, Brazil, W. F. Huebner, Southwest Research Institute, 6220 Culebra Road, San Antonio, TX 78228–0510

The visible spectrum of the coma of a comet shows discrete emissions due to atomic and molecular species and continuum emissions due to dust grains. The analysis of cometary optical features is particularly useful for determining the size, composition, and total amount of gas and dust in the coma. The continuum fluxes at optical wavelengths have been measured by narrow–band photometry and relative production rates Q_d of dust in arbitrary units have been derived for some comets based on the simplest possible model: Spherically symmetric, uniform outflow, ignoring variations in particle sizes, scattering angles etc. (A'Hearn and Cowan, 1975).

The continuum emission at optical wavelengths is due to dust grains that are entrained by gas from the nucleus of a comet by the action of solar radiation. Assuming spherical dust grains, the dust mass production rate is given by

$$Q_{m,d} = \int_{a_o}^{a_m} (4\pi/3)\, a^3\, \rho(a)\, n(a)\, da \quad , \qquad (1)$$

where a is the radius of the grain that lies between a minimum size a_o and a maximum size a_m that can be lifted from the nucleus by gas drag forces, ρ(a) is a grain's density, and n(a) is a dust size distribution function (Hanner, 1983; Newburn and Spinrad, 1985; 1989)

$$n(a) = K\,(1 - a_o/a)^M\,(a_o/a)^N \qquad (2)$$

The parameter M locates the maximum in the distribution function and is a function of heliocentric distance of a comet. The parameter N defines the slope of the size distribution at large dust radii a. Following Newburn and Spinrad (1985), we have set N = 4.2 in Eq. (2) for the dust mass production rate determination in all comets and the value of M has been calculated according to the linear fit of de Freitas Pacheco et al. (1988). The minimum radius of the grain has been fixed to a value 0.1×10^{-4} cm in order to have a comparison with the infrared analysis of comets and the maximum radius of the grain has been calculated by the Eq. (19) of Newburn and Spinrad (1985). K is a normalization constant and is related to the product of "observed" area times geometric albedo and to the nucleus–centered circular area of radius s by the relation given by Newburn and Spinrad (1985). The "observed" value of area time geometric albedo is given by Newburn (1981) and Newburn and Spinrad (1985). Equation (1) was solved numerically to obtain the derived dust mass production rates.

We present detailed continuum flux analysis for Comets Thiele (1985m), Wilson (1986l), Borrelly (1987p), Liller (1988a), Bradfield (1987s), Hartley–Good(1985l), Giacobini–Zinner (1984e), and Halley (1982i) where we determine dust as well as gas mass loss rates in each comet. Where possible, we compare our dust mass production rates with those obtained by other workers.

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