MASTER

PHOTOMETRIC DETERMINATION OF MASS OF INTERSTELLAR DUST CLOUDS

This research project provides a means for determining the mass of interstellar material independently of dynamic factors. For more than half a century, the evidence of scattering of light by molecules and small particles with radii about one third the wavelength or about one micron has been an accepted fact. The physical relation is known as either Rayleigh or Mie scattering.

Perhaps we could say that Rayleigh showed the relation of molecules and Mie for small particles. The general formula for the amount of light lost by scattering should be proportional to the inverse wavelength to the power "n" where "n" is unity for molecules and greater, from 1.2 to 2 for particles and aerosols.

We shall concern ourselves with particles larger than molecules, according to Mie's theory of scattering.

Our problem is to extrapolate from scattering in the earth's atmosphere to that caused by particles in interstellar space, and in making this extrapolation to carry the density of particles in the earth's atmosphere to interstellar clouds.

The best example of Rayleigh scattering by molecules is the blue sky. The best example of Mie scattering by particles is the red sunset. But besides the normal atmospheric molecules and dust there is the scattering phenomenon produced by volcanic eruptions which have a great effect on the irradiance on the surface of the earth. (Figure I)

In the last decade two volcanic eruptions took place. One was Mt. St. Helens in northwest United States and the other Chichon in Mexico. The dust plumes of these eruptions followed the general circulation of the air masses. The plume from Chichon moved westward with the trade winds across the Pacific and the Mt. St. Helens went eastward across the United States.

A few months after the Chichón eruption in March 1982, the dust plume appeared over Manila producing a red sky an hour before sunrise. This was not due to an unusual aurora glow in this low latitude but due to scattering by small dust particles. The absorption effect of this dust persisted for several months. (Figure II)

Eclipses of the moon are unusually good monitors for large scale