of log τ_p/ρ_m^2 is that corresponding to the centroid of the distribution, for which we have

$$\log \tau_p/\rho_m^2 = -11.281 \pm 0.030;$$
$$\log v = 6.433 \pm 0.008. \quad (18)$$

For each other point, the error ϵ_p should be given by

$$\epsilon_p = 0.03 + 0.15 \times |\log v - 6.433|. \quad (19)$$

In the following, however, it is convenient to adopt $n = 1.0$, so that the error in log τ_p/ρ_m^2 will be constant and equal to 0.03. Equation (17) now reads

$$\log \frac{\tau_{op}}{\rho_m^2} = -17.71 \pm 0.03. \quad (17a)$$

By sorting the sporadic meteors into groups according to their velocity and computing the mean values of log τ_p/ρ_m^2, we obtain the results shown in tables 3 and 4 and plotted in figures 2 and 3, respectively. Since the residuals do not show any other definite dependence on velocity, the power law $\tau_p = \tau_{op} v^n$ is sufficiently close to reality. It is important to remember that the individual intensity in each wavelength is a function of velocity and that our τ_p corresponds to integrated light, which must depend on v in some complicated, almost certainly irregular manner. In order to have a check on the correction for the Q effect on the values of log τ_p/ρ_m^2, we have arranged 10 equally populated groups of sporadic meteors in order of increasing Q and have computed the averages of the residuals for each of them. The correlation coefficient between the average residuals and Q is -0.28, which shows a practical absence of correlation, because we are dealing with averages and not with individual values, for which the large scatter could lower the correlation coefficient. When Q increases, the residuals tend to pass from negative to positive values for meteors with $Q < 7$ a.u., but this cannot affect the results in any way. In fact, for meteors of the Jupiter family, there is no correlation between v and Q.

Figure 4 shows the average values of log τ_p/ρ_m^2 for each shower; the same data are listed with more details in table 5. As I have said before, it is unlikely that different showers have appreciably different composition to account for variations in τ_p; conversely, their different ages and distances from the sun may account for differences in density. Thus, the differences (log τ_p/ρ_m^2)$_{\text{shower}}$—(log τ_p/ρ_m^2)$_{\text{sporadic}}$, $v = v_{\text{shower}}$ are attributed only to a difference in density. With this assumption the ratios, contained in table 5, of the density of each shower to the average density of the sporadic meteors with $Q < 7$ a.u. have been computed. Northern and Southern Taurids, Southern ι-Aquarids and δ-Aquarids, Perseids, Lyrids and σ-Hydrids have density values close to that of the sporadic meteors of the Jupiter family. Conversely, Quadrantids, Orionids, κ-Cygnids and α-Capricornids have about the same density as the sporadic long-period meteors. As the reader can see from the indicative values of Q listed in table 5, however, some of the showers with $Q > 7$ a.u. have approximately the same density as the sporadic meteors with $Q < 7$ a.u. and vice versa. The members of the Geminid shower have a density four times larger than that of the sporadic meteors. This confirms a result that Jacchia obtained in his earlier work. The extremely low density of Draconids is also confirmed, but the figures in that case do not have much meaning because the effects of fragmentation are too large to be properly taken into account. The results confirm that each shower has its own peculiarities, as Jacchia found from his analysis of points near the beginning of meteors.

Effects of fragmentation.—Let us now discuss the effects of fragmentation on the computed values of log τ_p/ρ_m^2. Jacchia (1955) found that the anomalously large increases of the observed decelerations of the Super-Schmidt meteors are explained by progressive fragmentation. He introduced, as a measure of the phenomenon, the fragmentation index χ, defined as

$$\chi = \frac{d}{ds} \log \frac{a_{obs}}{a_T}, \quad (20)$$

where a_{obs} is the observed deceleration (a in the preceding equations); a_T is the deceleration computed from the drag equation by using the photometric mass; and s is the mass-loss parameter, defined as

$$s = \log \left(\frac{m_\infty}{m} - 1 \right). \quad (21)$$