The fragmentation index χ is not easy to determine because it involves the second-time derivative of the velocity. Since χ is, however, the quantity that best describes the fragmentation, it is very helpful for correcting data. Its meaning lies in its being approximately constant for each meteor during the detectable part of its flight. If fragmentation were absent we would find, in the limits of observational error, the same value of τ_p/ρ_m^2 for whatever point of the trajectory the decelerations introduced in equation (11) refer to. But the fragmentation introduces a variation in the computed values of τ_p/ρ_m^2. In fact, by using equations (11) and (20) we can easily find the relation between the values of log τ_p/ρ_m^2 computed in two different points of the trajectory corresponding to s and s_0:

$$(\log \tau_p/\rho_m^2)_s = (\log \tau_p/\rho_m^2)_{s_0} + 3\chi(s-s_0). \qquad (22)$$

We can immediately see the order of magnitude of the variation introduced by the fragmentation if we consider a meteor for which several decelerations have been determined and for which $\chi=0.25$, the mean value for sporadic meteors. The difference Δs between the values of s corresponding to the first and to the last determination of the deceleration is about 1. Therefore the fragmentation changes log τ_p/ρ_m^2 by 0.75. In case of larger χ the effect is, of course, larger. It is clear that all the present data should be reduced to the value of s corresponding to the beginning of fragmentation. Unfortunately, this value is not known, but we could refer the values of log τ_p/ρ_m^2 to a value of s near the beginning of the meteors. This value may be found by calibrating the results by means of the nonfragmenting meteors. This is not necessary for the purpose of this work, because the use of the weights p, which attribute greater importance to the decelerations in the first part of the trail, when fragmentation has not yet played its role, also satisfactorily accomplishes this task. In fact, for the purpose of empirically finding out the effect of fragmentation on the actual weighted values of log τ_p/ρ_m^2, all the sporadic meteors with $|\chi|<0.2$ have been selected and processed by the least-squares method. The solution, after the usual correction for Q, is $n=1.24\pm0.22$ and log $\tau_p/\rho_m^2=-11.214\pm0.040$ for log $v=6.421\pm0.011$. The mean values of log τ_p/ρ_m^2 as functions of velocity are listed in table 6 and plotted in figure 3 (p. 153) for comparison with the results of all the sporadic meteors. The value 1.24 for n agrees, within the limits of the error, with the value 1.01 afforded by the general solution; it is worth noting that if we remove from the general solution the slowest meteors ($10<v<15$ kms^{-1}), for which the average value of log τ_p/ρ_m^2 is smaller by about 0.3 than the expected one,[8] we would get a slightly smaller value of n. As a compromise between this value and that afforded by the low-fragmentation meteors, $n=1$ is really the best value for n. The agreement for the value of log τ_p/ρ_m^2 in the centroid of the distribution is actually very good. For log $v=6.42$ we get -11.213 and -11.268. Although we might expect a larger difference and in the opposite direction, as we shall see, τ_p depends on the degree of fragmentation, insofar as meteors that do not fragment seem to be more efficient in producing light. Anyway, the consistency of these results shows the reliability of Jacchia's weight system, which was used throughout.

We must remark that there are cases in which neither χ nor the weight system is sufficient to find out the correct value of log τ_p/ρ_m^2 by using equation (11). This is true when a meteor breaks up into N_F fragments of approximately equal mass before it is detected or before the earliest deceleration is measured. This is the case of the so-called "abrupt-beginning meteors," which appear suddenly at or very near the maximum light, and of the very short meteors, whose light curve is practically reduced only to a flare. In these cases the value of log τ_p/ρ_m^2 is overestimated, and it is easy to see that the difference between the correct and the computed value is log N_F. Fortunately, the number of these kinds of meteors is small, and most of them are among those rejected from the analysis because of the clearly anomalous value of log τ_p/ρ_m^2. Consequently, the reliability of the results does

[8] This is because of the presence in the group of some meteors that, although they do not clearly have the characteristics of the asteroidal meteors, appear to have a larger density. We cannot even exclude the possibility that the luminous efficiency decreases more rapidly than v^{-6} for meteors slower than 15 kms^{-1} (Jacchia, 1949). This last possibility seems, however, to be very unlikely.