Numerical comparison of the precision of the two methods is given, as well as the dependence of the estimate on n , the number of stars.

Davis, H. T. 1933, *Tables of the Higher Mathematical Functions*, Vol. I (Bloomington, Ind., Principia Press).

*University of California,
Berkeley, Calif.*

Sen, Hari K. Radiation broadening of a shock front.

The material hydrodynamics of the structure of the shock front has been extended to include the propagation of energy by diffusion of radiation. Radiation by, and subsequent absorption in, the shock front is found to make the shock front wider than when the dissipation is by viscosity and heat conduction alone. The radiative contribution to the width of the shock depends primarily on the ratio of the mean free path of radiation to that of the material particles. The overall effect can be represented as a diminution of the Prandtl number. The proportional increment in width is a function of the Mach number of the shock and increases with it.

The analysis confirms and extends the physical intuition that absorption of radiation would tend to make the shock front broader. The widening of the front extends the range of validity of the Stokes-Navier equations towards higher Mach numbers. Experimental measurement of the shock width in the laboratory—in a shock tube, for example—should give an estimate of the mean absorption coefficient.

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Smith, Henry J. and Smith, Elske v. P. Chromospheric spectra outside eclipse.

Certain obvious advantages are to be expected from high dispersion spectral studies of the chromosphere outside eclipse, such as more accurate wave-length determination and the possibility of measuring line profiles with high precision. On the other hand, certain photometric problems greatly complicate the interpretation of results.

In early summer 1956 we obtained a series of such chromospheric spectra at Sacramento Peak Observatory. Visual inspection of such spectra reveals only a few of the chromospheric lines as emission features. The flash lines are for the most part engulfed and subdued by the corresponding Fraunhofer lines of the limb spectrum, which is of course superposed on the chromospheric spec-

trum through seeing excursions of the limb beyond the occulting disk. The true flash spectrum is revealed only after careful densitometry to remove the spurious background. We have been able to do this photometry by means of a direct intensity or log-intensity photometer designed by E. W. Dennison. The advantage of the logarithmic presentation is that a given line depth corresponds to a unique deflection regardless of the continuum density.

Thus far, the wave-length regions 3880–4090Å, 4290–4380Å, and 4830–5099Å have been studied. In these regions the following ionized rare earths are predominant in the flash spectrum, Ce_{II} , La_{II} , Nd_{II} , Sm_{II} , Y_{II} , Eu_{II} , Gd_{II} , and Dy_{II} , roughly in that order of prominence. Then follow Ti_{II} , Sc_{II} , Sr_{II} , Fe_{II} , Ba_{II} , Zr_{II} , and very faintly Mg_{II} . Finally certain neutral metal lines are salient, such as Al , Ti , and Ni . The spectra of neutral Fe , V , and Mn are inconspicuous. This confirms the finding of Adams and Burwell (1915). We plan to extend this study to greater wave-length coverage. Profiles of selected lines will be obtained from higher dispersion plates. Exploitation of the coronagraph should enable us to obtain spectra of the high as well as the low chromosphere.

Adams, W. S. and Burwell, C. G. 1915, *Ap. J.* **41**, 116.
*Sacramento Peak Observatory,
Sunspot, N. Mex.,
and Harvard College Observatory,
Cambridge, Mass.*

Spitz, Armand. Professional cooperation with the visual satellite observing program.

The personnel, instrumentation and observational techniques required for visual tracking of the satellite rule out project "Moonwatch" as a part of the program of most professional astronomers. However, some may wish to help as technical advisers to volunteer groups. They may be able to offer a site and physical facilities for an observing station. Some may accept the responsibility of training and leading teams of observers. All must certainly be prepared to accept the responsibility of interpreting the entire satellite program to the lay public in their communities.

*Smithsonian Astrophysical Observatory,
Cambridge, Mass.*

Sterne, Theodore E. A suggested analytical treatment of the orbit of a close satellite.

An analytical treatment of the motion of a particle near an oblate earth would be useful in