This approximation introduces negligible error above 5 kv. The end points W_+ and W_- are taken from Tyler's data to be 2.29 and 2.13 mc^2, respectively. The energy W is in relativistic units, $Z=29$, $\alpha=1/137$. The quantity k is the ln of the ratio of the square of the matrix elements between the initial and final states of the heavy particle, for transitions yielding a positron and an electron. The value for best fit with Tyler's data is 0.8. The corresponding value from Backus' fit is 1.9.

Tyler's curves show deviation from straight-line Kurie plots at 350 and 320 kv for positrons and electrons, respectively, while his ratios show close agreement with theory down to 100 kv. An excess of positrons at low energies is evident in all cases. Using the theoretical curve which fits Tyler's data so well from 100 kv up to the end point, one finds discrepancy between Backus' results and theory greater than was estimated by a factor of 2.9 in the ratio $N+/N-$.

The suggestion of Backus that scattering of positives and negatives in the source and support will distort the separate spectra in a manner that should cancel in the ratio helps explain the extension of the range of agreement with theory. This suggestion does not apply with equal strength at the lowest energies. In the case of inelastic scattering, cancellation of effects is contingent upon the similarity of the true spectra. According to the Fermi theory, however, in the region 0–50 kv the electrons comprise 14 percent, but the positrons only 1.2 percent of their respective totals. Thus, since more nearly equal numbers will be scattered into this region from higher energies, the effect of such scattering on the ratio is in the same direction as the experimental deviation from theory. The smallness of the ratio predicted by theory (1/90 at 15 kv from the theoretical fit to Tyler's data) suggests special care must be taken to minimize the number of spurious low energy positrons from this and other sources.

Referring to Backus' separate spectra for electrons and positrons, Lewis and Bohm[4] note that whereas the positron spectrum conforms to theory, the electron spectrum decreases with decreasing energy, the theory requiring approximate constancy at low energy. The possibility of scattering effects compensating in one case but not the other should be reckoned with, however. Until the effects of scattering on the individual spectral shapes are better understood, the ratios offer a better means of checking the theory at lower energies than the individual spectral shapes, since some cancellation of scattering effects is to be expected.

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[2] A. W. Tyler, Phys. Rev. **56**, 125 (1939).
[3] A. A. Townsend, Proc. Roy. Soc. London **A177**, 357 (1941).
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Light Scattering in Supersonic Streams

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In many types of experiments carried out in wind tunnels or free jets it is often important to know the amount of turbulence or density variations in the air stream. In subsonic air streams the turbulence has been successfully determined by measuring the heat transferred from a small wire placed in the air stream.[1] However, in supersonic air streams an object placed in the stream usually gives rise to a shock wave which complicates these measurements. Schlieren and shadow photographs taken with a short duration light source (10^{-7} sec. duration) reveal the density variations in supersonic air streams, but unless great care is taken it is very difficult to determine just where they occur in the stream. For example, in shadow photographs the density variations in the boundary layer often are difficult to differentiate from those near the axis of the stream.

For some time we have been determining the density variations in supersonic air streams by means of light scattering. An intense beam of parallel light is directed, say perpendicularly, through the air stream and the intensity of the scattered light measured at several different angles to the air stream and the light beam, respectively. From these data it is possible to estimate the average density variation at any point in the stream. With sunlight incident at 90° on a particle-and-droplet-free, one-inch supersonic free jet sufficient light is scattered for good photographs to be taken with an F 2 lens in about one-tenth of a second. The polarization of the scattered light is found to be in close agreement with light scattering theory so that further information on the density variations in the air stream can be obtained from measurements of the characteristics of the scattered light. Under certain conditions the shock waves can be observed directly.

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[1] Dryden, *Aerodynamic Theory* (Durand, 1934), Vol. VI.

The Scattering of Protons by Deuterons

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In a recent number of The Physical Review, Sherr, Blair, Kratz, Bailey, and Taschek[1] have reported measurements of the absolute intensity of scattering of protons by deuterons. We have recently extended the calculations which we have carried out of neutron-deuteron scattering[2] to cover proton-deuteron collisions. These calculations include the case of 1.85-Mev protons which may be compared with values interpolated from the results of Sherr and co-workers who cover the energy range from 1.51 to 3.49 Mev. The results of the comparison are given in Table I.

The agreement with the calculated results assuming exchange-type forces is remarkably good and clearly better than is obtained with ordinary forces.

Just as for the neutron-deuteron calculations the interaction between the nucleons was taken to be of the form

$$V(r)=A(mM+hH+bMH+\omega)e^{-2r/a},$$

where M is the Majorana operator interchanging position