This is peculiarly fortunate at such an epoch when similar societies in Europe must be greatly reduced in membership and activity.

Having secured the approbation and support of the National Academy of Sciences for the coming year, through a further grant from the J. Lawrence Smith fund, it is hoped that the results for 1916 will surpass those for the previous year, and indeed a good start has been made in that direction. We still need and desire the help of other persons interested in such work and a cordial invitation is again extended to them.

THE LIGHT EXCITATION BY SLOW POSITIVE AND NEUTRAL PARTICLES

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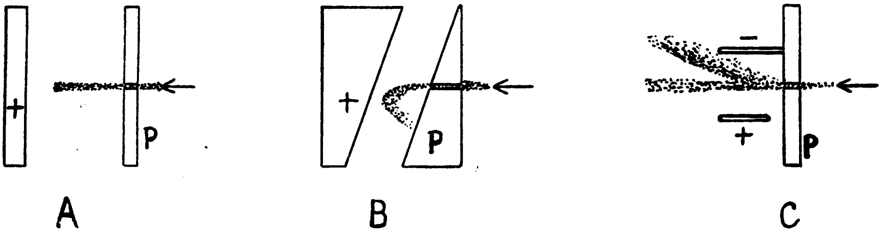
The speed at which an electron begins to excite light, and the character of the light emitted by slow electrons has formed the subject of several recent papers;[1] the corresponding problem for slow positive rays has not been carefully investigated. The only papers on the subject are those by Stark[2] and Wehnelt[3] who detected a luminosity probably due to positive rays with potential differences as low as 50 volts on the tube.

The light excitation by positive and neutral rays of greater energy is included in the many papers on the light emission of canal rays. These particles have energies corresponding to a fall of potential of from 500 volts up, depending on the pressure, the low speeds necessarily being at a relatively high pressure. The Doppler effect in these canal rays in hydrogen shows a dark space between the displaced and undisplaced lines, and this may be explained by assuming that those particles in the rays which have less than a certain speed (corresponding to 50–80 volts fall of potential for the hydrogen atom) are unable to excite light.

The method used in the present experiments was to ionize hydrogen by electrons from a Wehnelt cathode and to allow the positives thus made to pass through a slit in a plate behind the cathode (P in the figures) into a second chamber where their light emission and the deflection of their path by electric fields could be studied undisturbed by the light and the electric fields in the main tube. In one tube (*A*) a plate was placed in the second chamber at right angles to the beam of rays so that by charging it positively the positive rays could be stopped and turned back; in a second arrangement (*B*) the rays were allowed to enter an oblique retarding field so that the paths of the positive particles would be parabolas; and in a third experiment (*C*) the particles passed between the plates of a condenser which would deflect any charged particles sideways out of the beam.

The phenomena depended greatly on the pressure of the gas in the tube. If the pressure were very low so that the positives made practically no collisions with the molecules of the gas, the rays, which were followed by the luminosity they make in the gas, could be stopped entirely by the directly opposing field or bent into a parabolic path by the inclined field or deflected sideways by the cross electric field. *A* and *B* indicate the appearance with high vacua. The rays could be detected with potentials as low as 30 volts on the tube, although they were then very faint. To stop the rays, or rather to reduce their speed so that they are unable to cause light, opposing potentials were required which were practically the same as those which originally gave the particles their speed. We conclude that *very slow positive rays are still able to excite light, certainly with a speed corresponding to less than 5 volts.*



This fact needs to be considered in connection with the above mentioned experiments on the lower limit at which electrons excite light.

If the pressure of hydrogen is taken a little higher so that some of the positives make collisions, the phenomena are more complicated. If the positives are then deflected out by a cross field, there is an undeflected bundle of light left, due to the neutral rays which have been formed from the positives. *C* indicates the appearance at about 0.005 mm. of mercury pressure when the two bundles are of approximately equal intensity. With the arrangements *A* and *B* there is superimposed on the deflected beam a luminosity continuing up to the opposing electrode. If the pressure is taken higher still, the positive bundle becomes fainter till finally the neutral bundle alone is present. Two things are of special interest. First, *the neutral rays can also excite light at very slow speeds.* The lowest speed at which the neutral bundle has been detected is 50 volts, and it is possible that that is a lower limit at which the neutrals begin to excite light. With potentials of 1500 volts, when the light is much stronger, photographs of the spectra of the positive and neutral bundles showed the hydrogen series lines in both.

The second point is that there is a sharp separation between the two bundles at the proper pressure. This shows that light is not emitted only during the return of a corpuscle to a positive centre, as very often assumed, for the neutrals cause light in a region where all free corpuscles have been swept out by the field. Also the sharp separation of the bundles shows that at these pressures changes take place slowly, so that if a positive were formed in the neutral bundle it would be deflected out before becoming neutralized again. We are thus led to conclude that *light excitation may occur directly because of the collision of a neutral particle with a neutral molecule of the gas.* We may regard the light emission as taking place during the rearrangement of the electrons in the atom after one has been detached by the collision (Stark's theory), or we may retain the picture underlying Bohr's theory, if we regard the displaced electron as not leaving entirely the centre to which it is attached.

[1] E. Gehrcke and R. Seeliger, *Verh. D. Physik. Ges.*, **15**, 897 (1913); H. Rau, *Ber. Phys.-med. Ges., Würzburg*, Feb. 1914; J. Frank and G. Herz, *Verh. D. Physik. Ges.*, **16**, 512 (1914); J. C. MacLennan and J. P. Henderson, *London, Proc. R. Soc.*, A., **91**, 485 (1915).

[2] J. Stark, *Leipzig, Ann. Physik.*, **13**, 390 (1904).

[3] A. Wehnelt, *Ibid.*, **14**, 464 (1904).

AN APPARENT DEPENDENCE OF THE APEX AND VELOCITY OF SOLAR MOTION, AS DETERMINED FROM RADIAL VELOCITIES, UPON PROPER MOTION

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The position of the solar apex which had been derived from the stars of class B both from proper motions and radial velocities differed so much from the apex derived from radial velocities of A stars, that an investigation was undertaken of the radial velocities of all of the spectra classes. The discordances were not only between the spectral classes as a whole but appeared to be between the results from northern and southern stars as well.

In the course of the work it was observed that frequently there appeared to be marked discordances between the radial velocities of stars whose proper motions also differed in size and sign. This, and the desire to test the effect of differences of distance as evidenced by