Note on the Value of the Electric Charge

The new value of e obtained by Bearden from the wave-length of x-rays agrees nearly with the value obtained from Eddington's theoretical equation $hc/2\pi e^2=136$ but is about one percent greater than Millikan's oil drop value[1] 4.774×16^{-10}.

The oil drop method involves extrapolation from the observed values by means of the empirical equation $10^8 e^{2/3}=61.13+1/26.2pa$ where e_1 is the observed value, p the gas pressure and a the radius of the drop. The true value of e is taken to be that given by this equation when $1/pa=0$ so that $10^8 e^{2/3}=61.13$. This equation represents the observed values extremely well so that there would be no reason to doubt its validity if other estimates of e agreed with the oil drop value.

However in view of the discrepancy just mentioned it seems to be worth while to see if an empirical equation can be found which will represent the oil drop results and also give a value of e more nearly equal to that found by Bearden and Eddington. I find that the equation $10^8 e_1^{2/3}=61.48+1/(26pa+350p^2a^2)$ represents Millikan's values of e_1 very well and it gives $10^8 e^{2/3}=61.48$ when $1/pa=0$. This gives $e=4.82\times 10^{-10}$ in good agreement with Bearden's and Eddington's values.

The following table gives some values of $10^8 e_1^{2/3}$ calculated by means of the two empirical equations.

$1/pa$.	$61.48+1/(26pa+350p^2a^2)$	$61.13+1/26.2pa$
10	61.64	61.51
20	61.94	61.89
30	62.28	62.28
50	63.00	63.04
100	64.87	64.95
200	68.68	68.77
300	72.52	72.58
400	76.35	76.38
500	80.21	80.21
600	84.06	84.03
700	87.88	87.83

It appears that the two equations give practically equal values of $10^8 e_1^{2/3}$ for the range of values of $1/pa$ covered in the oil drop experiments. We may therefore conclude that the oil drop experiments do not definitely exclude the higher value of e.

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[1] Probable Values of the General Physical Constants. R. T. Birge, Physical Review Supplement, **1**, 1 (1929).

Reflection of Protons from Crystals

I have recently found that hydrogen canal rays give a complex reflection pattern when they are allowed to fall on a cleavage face of a calcite crystal at almost grazing incidence.

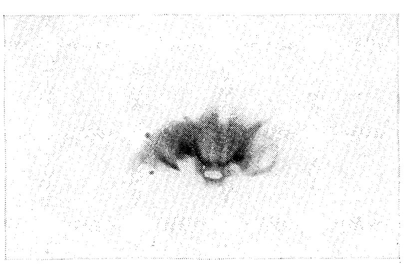

Fig. 1.

Fig. 1 shows one of these patterns (enlarged three diameters). The crystal was placed horizontally and was held by a wire spring bearing on the top. A narrow bundle of the rays struck the crystal underneath the wire, which was not in absolute contact with the crystal at the center point. Secondary electron emission from the wire could be depended on to prevent any charging up of the surface. Some of the canal rays passed over the surface of the crystal without hitting it and fell on the photographic plate 15.5 cm distant, giving rise to the central spot seen at the bottom of the first photograph. This spot appears white because of solarization of the plate due to the concentrated neutral bundle. The upper part of the figure shows positive particles reflected from the surface of the crystal. It consists of a series of curved and straight lines forming a regular pattern which is not perfectly symmetrical about the vertical axis. By increasing the angle of incidence the central spot was cut off and the figure was considerably altered. The figure has a certain resemblance to the secondary