

Owens College
Manchester

15/75

22nd Oct 1896.

Dear Professor Fitzgerald

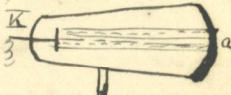
I am working away here again. I was sorry to have seen you in Dublin before leaving.

So many questions are cropping up one on top of the other, that it becomes bewildering if one tries to grapple with them all, and still I am confining myself merely to those connected with my own subject of fluorescence. I shall simply talk now of the peculiar phenomenon of Kather's ray deflections, or "Kathode Ray Spectrum" as Birkeland in the last number of the "Electrician" chose to call it. It seems questionable whether the word spectrum

About - the explanation however as there does not appear to be any evidence that the spectrum of the fluorescent light emitted by a substance depends upon the ^{intensity of the} ~~intensity of the~~ rays upon it. The spectrum of the light emitted by the gas itself of course depends upon the rays. What is more I find that Crookes Proc. Roy. Soc. May 1887 that ruby and many many other substances give out the same spectrum whether illuminated by Kather's rays or by sunlight so that the ~~fluorescent~~ light seems to depend upon the substance and not upon the way in which it is excited.

My explanation of the rings is therefore unsatisfactory. They might have been interference effects like Priestley's rings produced by the ^{unusual} oxidation due to the unequal electrification round the dark spot symmetrical round it but

ought to be applied to it, but at any rate it is an interesting observation and seems to bear upon a thing I noticed one day I was in at Dr. Mollay's in Stephen's Green when he was working a Crookes tube of the form shown in the annexed figure.



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Right opposite the Kathode on the wall of the tube there was a black spot, which I had often observed before, but round it there were a number of coloured rings, clearly due to the Kathode rays. I have a similar tube here which gives a very ill defined dark spot and does not show the rings at all. The explanation I gave him at the time for the dark spot was that as the Kathode rays repelled one another it was natural to suppose that something of the kind would ~~ever~~ ^{exist} be possible. The Kathode was quite flat with the exception of a very small dimple when

the wire was soldered into the Kathode. Now even if none of the rays coming from this dimple fell within the dark spot the other rays coming &ly to the surface of the Kathode would have shown perhaps a small dark spot the projection of the dimple but the spot observed was many times the size of the little dimple so that the explanation ~~that~~ the rays repelled one another seemed to me to be more likely ~~to be~~ correct. But as to the coloured rings I could give no explanation except that the more slowly moving Kathode rays gave rise to a different kind of luminescence & or fluorescence after glass and since they were moving more slowly their electro-magnetic attractions would be less and therefore their repulsion ~~electrostatically~~ greater consequently would appear in more or less blurred rings outside the region of the dark spot. There is some difficulty

Kathode rays are not radiant matter at all as the German school maintain, but until we are driven to the wall I don't see the necessity of departing from the old faith which has survived everything upto the present.

We are thus ^{to either (A) or} I think led ^{to either (A)} Some oscillations not quite manifest otherwise are set up or ^{that} (B) the gas is impure which I think could hardly be accepted as an explanation ^{since} ~~because~~ the lines due to the ^{preponderately} ~~impurity~~ would differ very much from those due to the slight impurities or (C) the masses of the atoms are different - either by the formation of the groups of oscillating or independently.

I find my letter has run to a great length than I intended it - to be of hope you will excuse me ~~and~~ I am sorry to put you to the trouble of reading so much of my abominable writing.

What do you think of I am sure your electric state of affairs?

P.S. My intent has been around & sincerely John Bracke.

different - at different distances from its centre. The rings would still move as I think we found them all to do by placing the finger on the surface of the tube, because the oxidation ~~of the glass~~ may be of short duration depending upon the bombardment - in extent and admitting also of being moved about - with the days. Still somehow I don't think it was due to interference flight either, because it would have depended ^{which} upon the way you looked at it & did not strike as ring at all the case.

Now about Birkeland's spectrum, it appears so far as I can gather from his paper to be all of the one colour. It is obtained in a magnetic field. The most obvious explanation for the number of lines he obtains is that a number of oscillations are set up, so that each interruption of the primary

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several oscillations correspond, each particle has its own line of rays.

The deflection of a ray will depend upon
 1^o Strength of the magnetic field, 2^o Velocity of the rays 3^o Charge carried by the ion.
 4^o Mass of the ion. — 2^o does not require any consideration.

2^o depends upon (a) vacuum in tube (b) smoothness of discharge (c) Nature of gas. He finds that the deflection depends upon both the vacuum & the strength of the current. These both point to dependence upon the velocity. But what is strange is that as the current is increased you don't get the breaking out of any one line but gradually more lines, more deflectable still, part in their appearance. (c) Nature of the gas,

The gas in the tube may not be pure; the passage of the current through the tube

would be enough to drive gas off the walls & electrodes, but still the preponderating gas in the tube will always manifest its presence most conspicuously and we should expect a perceptible change in the nature of the discharge if ^{the} influence of impurities were as great as we should expect it to be from the deflections.

3^o we might have aggregates which form according to ~~some~~^{of atoms} definite laws in odd numbers thus O or GOD or OOOOG. The extra negative ion giving the charge to the group and the even ones which ~~therefore~~ one another influencing the deflection by their mass; but this leads us to 4^o. The mass of the atoms definitely matter may not all be the same as Ramsey pointed out as probable in the case of helium at Liverpool.

There is a 5^o explanation and that is that