removed from each other to cause any appreciable departure from this law. It is, at any rate, unreasonable to expect the law to hold good in the central galaxy itself because of the powerful gravitational field in it.

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THE recession-law, $v = r/t$ in combination with the density-distribution law $ndxdydz = Btdxdydz/(t^2 - r^2/c^2)^2$, can be shown to be a valid description of a certain system of particles in motion on *any* relativistic law of gravitation. This was the subject of my lecture to the London Mathematical Society, "World-Gravitation by Kinematic Methods", delivered on May 17 last (see NATURE, May 26, 1934, p. 789). A full discussion of this subject is given by me in a volume now passing through the press.

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Rotational Raman Effect in Gases: Carbon Dioxide and Nitrous Oxide

IN the course of a detailed investigation of the rotational Raman effect in gases, we have obtained the following significant results with carbon dioxide and nitrous oxide. In Fig. 1 are shown photomicrometric records of the rotational wings obtained with carbon dioxide gas at pressures of about 6 and 50 atmospheres respectively. The exposure times are so adjusted that the intensity of the wing is nearly the same in both cases. It may be noticed that in the low pressure record, the wing exhibits distinctly a position of maximum intensity, shown by the arrow, and then fades off until it merges into the Rayleigh line.

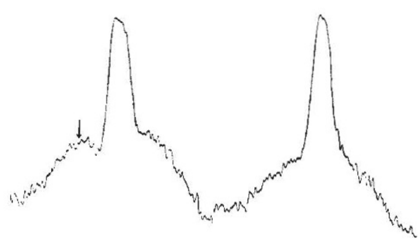

FIG. 1. Photomicrometric records of the rotational wings with carbon dioxide at pressures of 6 atmospheres (left) and 50 atmospheres (right).

A quantitative investigation reveals that both the position of the intensity maximum and the distribution of intensity within the wing are in good agreement with theory. On the other hand, in the high pressure record, no such maximum is visible and the wing is relatively more intense in the region lying between the position of the maximum and the Rayleigh line. It is of significance that these features which are characteristic of liquids[1] make their appearance also in gaseous carbon dioxide, but only at the higher pressure. Exactly similar results are obtained by us with nitrous oxide working at 6 and 40 atmospheres respectively. Such phenomena are evidently connected with the fact that, at the higher pressures, the gases investigated are very near their critical states, thus resembling the liquids in certain respects.

It may be of interest to note here that our measurements of the intensity maxima at low pressures give 69×10^{-40} and 62×10^{-40} respectively for the moments of inertia of CO_2 and N_2O molecules, as against $70{\cdot}1 \times 10^{-40}$ and $59{\cdot}4 \times 10^{-40}$ deduced earlier from infra-red absorption[2].

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[1] *Ind. J. Phys.*, **8**, 437; 1934.
[2] Adel and Dennison, *Phys. Rev.*, **44**, 99; 1933. Plyler and Barker, *Phys. Rev.*, **38**, 1827; 1931.

Development of the Lightning Discharge

SOME months ago, B. F. J. Schonland and H. Collens[1] published several important photographs of lightning discharges taken by a Boys' camera, that is, two lenses fixed at opposite points of a circle and revolving rapidly about its centre. In a further communication, with D. F. Malan, published in NATURE[2], a brief account is given of some further results with their camera. The most important point which emerges from a consideration of their new photographs is that there is a characteristic difference between the predischarges of the first stroke of a lightning flash and those of the subsequent strokes of the flash along the same track. While the latter predischarges are of a continuously moving character and travel from cloud to ground generally in less than 1/1,000 of a second, the former move from the cloud in a discontinuous step by step manner and take a comparatively long time to reach the ground, sometimes more than 1/100 of a second.

I would remark here that this manner of the first development of the track of an electric discharge through normal air was shown by me for the laboratory spark so long ago as 1898[3] and for the lightning discharge in 1902[4], in both cases using moving photographic plates to analyse the discharges.

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[1] *Proc. Roy. Soc.*, A, **143**, 654; 1934.
[2] NATURE, **134**, 177, Aug. 4, 1934.
[3] *Ann. Phys. und Chem.*, **6**, 636; 1898. **68**, 776; 1899.
[4] *Ann. Phys.*, **10**, 393; 1903. A more detailed account appeared in *Jahrbuch d. Hamburg. wiss. Anstalten*, **20**; 1903.

Moulting and Replacement of Feathers

IN a recent publication, Dr. Lowe[1] has described the peculiar moulting of penguins as due to new feathers pushing out their predecessors in rather widespread areas, and regards this as a unique feature of Sphenisciformes. Moulting in patches is certainly a rare occurrence under normal conditions in the majority of birds, but a new feather growing at the base of the old feather is the usual method of replacement during the moulting period. Dr. Lowe further says: "the intrusion of the tip of the new feather through the lower umbilicus of the old is interesting, because in birds in general as soon as the growth of the feather becomes an accomplished fact the lower umbilicus at the base of the calamus is definitely sealed, making the entry of a new feather an impossibility". He continues by using this as one of the reasons for regarding the penguin as primitive rather than degenerate, and quotes Gadow that the