LETTERS TO THE EDITOR

Prompt publication of brief reports of important discoveries in physics may be secured by addressing them to this department. Closing dates for this department are, for the first issue of the month, the twenty-eighth of the preceding month; for the second issue, the thirteenth of the month. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents.

An Unusual Spectral Series

The recent measurement by Selwyn (Proc. Phys. Soc. London **41,** 361, (1929)) of certain copper arc lines in the Schumann region have led to the identification of the following terms (mostly known as levels previously) of the ordinary $d^{10}np\ ^2P$ series of Cu I.

Designation	*Level*	*Interval*	*Ryd. denominator*
$4p^2P$	31772.8		1.858
		248.4	
	31524.4		1.865
$5p$	21925.0	−0.3	2.913
$6p$	7523.9		3.818
		−243.6	
	7280.3		3.881
$7p$	4889.4		4.737
		+530.6	
	4358.8		5.016
$8p$	3031.9		6.015
		− 47.0	
	2984.9		6.063

It is not surprising that such an array was not previously considered to form a series, but the evidence is now quite conclusive. The appearance of intervals of both signs from a configuration in which only one electron is not in a closed group is at variance with our ordinary ideas of the production of spectral terms. The explanation will probably be found when the wave mechanics is able to account for the occurrence of inverted ^2D and ^2F terms in the simple doublet spectra of the alkali metals. Such an explanation has not as yet been given.

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On the Possibilities of a Gravitational Drag of Light

I suggested in a recent paper[1] that the well known velocity distance relation for extra-galactic nebulae might possibly be accounted for by a gravitational drag of light. In this paper I discussed the momentum which a particle m moving in a straight line with the velocity v transfers to a mass M initially at rest. The velocity c was assumed for the gravitational waves. For the change of momentum of m along its path an expression of the following type was obtained:

$$\Delta G = (fmM/v)\left[g_0 + g_1 v/c + g_2 (v/c)^2 + \cdots\right] \quad (1)$$

where g_0 is due to the static gravitational potential and the rest of the terms represent the retardation, g_1 not being equal to zero. Now Professor Eddington kindly informs me in a letter that g_1 should be zero on account of the following consideration. The retarded potential can be represented as this series[2]

$$\Phi(r, t) = \left.\frac{\text{const.}}{r(1 - v_r/c)}\right|_{t'=t-r/c} = \left.\frac{\text{const.}}{r}\right|_{t'=t} + (2)$$

terms of second and higher order in v/c. As the forces are derived from Φ they do not contain any terms in v/c and ΔG should therefore not contain any such terms either. This is actually so provided that the particle m is moving along the straight line without being started or stopped. But if it is started from rest at P_1 and stopped at P_2 a term in v/c appears as given in my paper. This is due to the fact that at the time t_0 at which the signal from the start at P_1 has reached M, the mutual distance of the two particles

[1] F. Zwicky, Proc. of the Nat. Acad., Oct. 1929.

[2] A. S. Eddington, Phil. Mag. **46** 1112 (1923).