in winter and high latitudes. The range is therefore correlated with the value of N, decreasing as N increases, and vice versa. Reasonable values for N and T show that this factor $e^{-\frac{4\pi c}{\rho}}$ has an appreciable effect in transmission over distances greater than about 1000 km.

At short distances the effect of increased bending, due to increased N, is most apparent. The strength of local stations received in England was considerably augmented at times during the magnetic disturbances.

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November 15.

Internal Rust Spot of Potatoes.

THE cause of sprain or internal rust spot on potatoes has long been a subject of speculation among mycologists, and the macroscopic resemblance of the disease to that of net necrosis, whilst adding to the interest of the problem, has still further increased its complexity. The disease is a very serious one in certain of the potato-growing areas in Yorkshire, and we have therefore been anxious to ascertain its true nature. A short preliminary announcement of the results of our investigation may be of interest.

Two organisms have now been isolated by my colleague, Mr. Sydney Burr, which in inoculation experiments have reproduced the disease in a very definite and characteristic way. The commonly accepted symptom of the disease is the appearance of rusty brown spots in the medullary and cortical parenchyma of the tuber which are closely invested by a thick layer of cork cells. It is now clear that in addition to this formation of disease 'islands,' the xylem of the vascular ring is frequently attacked, but in this case wound cork is not formed unless the adjoining cells of the pericycle are also involved. This xylem infection is sometimes invisible to the naked eye. So far as the infected tubers have been examined, it appears that the phloem bundles are not *directly* attacked, although ultimately they may be involved by the infection of the neighbouring parenchyma. Thus, net necrosis, which is primarily an infection of the phloem bundles, may now be definitely dissociated from rust spot disease.

Each of the organisms in question is an extremely short and motile rod which is cultivated on artificial media only with difficulty. They thrive best in liquid media, and have been grown in peat soil extract and in nutrient potato broth. On soil extract agar, each organism produces minute dew-like colonies in seven to ten days, which, later, become steely blue in colour. Slight growth has also been obtained on lactose agar and nutrient gelatine, and one of the organisms gives a poor thin growth on nutrient potato agar. There thus appears to be no resemblance between either of the organisms and the two variants of *B. solaniolens* isolated by Paine from potatoes showing similar symptoms of disease.

Further attempts to define the organisms are now in progress, and it is hoped to publish a detailed account of this work in due course, together with an account of the field experiments which have been carried out with the object of ascertaining some possible remedy for the disease.

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November 12.

The Double Normal State of the Arc Spectrum of Fluorine.

IN an earlier paper (*Proc. R.S.*, Amsterdam, June 1926) I have made a preliminary analysis of the arc spectrum of fluorine. I found it possible to arrange all strong lines in the red part of the spectrum in multiplets. The following terms are recorded:

$^4P_{123}$ $\Delta\nu = 160{\cdot}0$; $274{\cdot}5$.
$^4D_{123}$ $\Delta\nu = 83{\cdot}4$; $144{\cdot}4$; $176{\cdot}6$. (This term was found by Carragan, *Astr. Jour.*, 63, 145, 1926.)
^4S
$^4P'_{123}$ $\Delta\nu = 102{\cdot}1$; $122{\cdot}7$.
$^2P'$ $\Delta\nu = 325{\cdot}6$.
^2P $\Delta\nu = 145{\cdot}5$.
^2S ?
^2D $\Delta\nu = 250{\cdot}3$.

The structure of the FI spectrum resembles that of NI (C. C. Kiess, *Jour. Opt. Soc., America*, vol. 11, 1, 1925) and OII (A. Fowler, *Proc. R.S.*, London, vol. 110, 476, 1926). Doublet-quartet intercombinations are not found in the red part of the spectrum. Millikan and Bowen (*Phys. Rev.*, 23, 1, 1924; *Phil. Mag.*, 48, 259, 1924) have investigated the fluorine spectrum in the extreme ultra-violet. This spectrum has only two strong lines:

(7) 606·9 (Fine structure: 605·64; 606·23; 606·83; 607·43; 607·99).
(5) 656·4 (Fine structure: 656·00; 656·34; 656·84; 657·69; 658·31), indicated as L_α.

The purpose of the present note is to identify the line 606·9 as a $^4P^2P'$ combination and the lines 657·69, 658·31, as a ^2P combination. We assign one of the ^2P term differences 145·5 (expressed in volts, 0·02) or 325·6 (expressed in volts, 0·04) to the double normal state (*Grundterm*) of the fluorine atom. These values agree well with the value predicted by Franck (0·025 volt). More details will be given in a forthcoming paper in the *Zeitschrift für Physik*.

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'Hard Seeds' in Leguminosæ.

WHEN offered ideal conditions for germination there commonly occur in seed of most cultivated Leguminosæ, seeds which do not absorb moisture and, in consequence, fail to swell up and germinate: they do not soften, and are therefore known generally as 'hard seeds.' This inability to absorb moisture endures for an indefinite period, extending possibly for many years, though ideal conditions for germination may be continuously or intermittently offered. The cause of 'hardness' has always been attributed to some peculiarity of the seed coat itself, largely because very slight damage, such as abrasion, enables the seed to behave in a normal way.

This summer, working with sweet peas and other legumes, I found good evidence for the belief that 'hardness' does not lie in the seed coat itself, but is the result of a varnish-like deposition on the seed surface, produced within and by the pod. On a nearly ripe but still green pod being opened, a quantity of watery fluid is found bathing the seeds, and, as ripening proceeds, this fluid becomes concentrated, so as to appear quite sticky on the fingers. It is suggested that this fluid, when fully concentrated, deposits the 'varnish' which on drying becomes insoluble in water and forms an impermeable film on the surface of the seed.

The chemical nature of neither the fluid nor the