Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 381.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Forbidden Lines of Fe VII in the Spectrum of Nova RR Pictoris (1925)

THE bright line spectrum of Nova RR Pictoris (1925) is characterized in the later stages by a group of lines in the visible region, of which the most prominent, λ 5723 and λ 6087, form with Hα and λ 4686 of He II the dominating lines of the spectrum[1]. These lines have not been found in any other spectrum and no adequate explanation of them has been given so far.

Some coincidences between lines in Nova Pictoris and forbidden transitions in Fe VI[2] suggested a search for analogous lines of Fe VII. Extrapolating the position of the multiplet $3d^2\ {}^3F - 3d^2\ {}^3P$ in Fe VII, one finds a striking coincidence with a group of lines in Nova Pictoris. The significance hereof is strengthened by the exact reappearance of the separation ${}^3F_2 - {}^3F_3$ between λ 5723 and λ 6087, indicating the identification ${}^3F_2 - {}^1D_2$ and ${}^3F_3 - {}^1D_2$. However, due to the uncertainty in the preceding iso-electronic spectra, the location of ${}^1D$ could not be predicted by extrapolation, and a previous analysis of FeVII[3] is inconsistent with the suggested identifications. Thus a new attempt at locating the $3d^2$ terms of FeVII became highly desirable. This has now been accomplished, and the result confirms and extends the suggested explanation of the Nova Pictoris spectrum, as will be shown below.

The vacuum spark spectrum of iron photographed with a previously described spectrograph[4] at 0·5 A. per mm., reveals several line groups involving $3d^2$ terms. The group $3d^2 - 3d\ 4f$ at λ 150 A. to 159 A., which is well separated from other transitions and shows strong intercombinations, was chosen as the most suitable for the purpose. It was possible to classify *all* (42) observed lines of the group with a tolerance of about 0·001 A. and establish in good agreement with the theoretical formulæ[5] *all* terms of each configuration, which are able to appear in the group. The details of the analysis will be published elsewhere. The $3d^2$ levels thus located are collected in the following table.

$3d^2$	${}^3F_2$	0	$3d^2$	${}^3P_0$	20037
	${}^3F_3$	1047		${}^3P_1$	20428
	${}^3F_4$	2327		${}^3P_2$	21275
	${}^1D_2$	17475		${}^1G_4$	28916

The calculated wave-lengths (±2A.) of the forbidden transitions between these terms are as follows:

${}^3F - {}^1G$	3457·3, 3587·2, 3759·9;
${}^3F - {}^3P$	4699·0, 4893·9, 4942·3, 4989·4, 5158·3, 5276·1;
${}^3F - {}^1D$	5720·9, 6085·5, 6599·7.

The corresponding lines in Nova Pictoris in 1933, some of which are blends, are 3760·0, 4701·2, 4894·8, 4944·7, 4986·1, 5155·3, 5275·6, 5723·4, 6087·5.

From the comparison it is evident that the *complete* array of [Fe VII] transitions falling in the investigated region recurs in Nova Pictoris. At the same time, *all* the lines of hitherto unknown origin in the visible spectrum of the late stages of Nova Pictoris are explained.

The following remarks may be added. The strong 'out of focus' line λ 3760, which was previously ascribed to O++, is no doubt mainly due to [Fe VII], although O++ may contribute, especially in the earlier stages of the nova. The nebular pair of [Ca V] is certainly present, one component being λ 5308 and the other coinciding with λ 6087. The blend of [Ca V] and [Fe VII] in λ 6087 would explain the observed variation in the intensity ratio between λ 5723 and λ 6087, which has been considered as indicating that these lines cannot have a common origin[6].

I. S. BOWEN.

California Institute of Technology,
Pasadena, California.

B. EDLÉN.

Physics Laboratory,
University, Uppsala.

[1] Jones, H. S., *Mon. Not. Roy. Astro. Soc.*, **94**, 35, 816 (1933–34).
[2] Bowen, I. S., *Phys. Rev.*, **47**, 924 (1935).
[3] Cady, W. M., *Phys. Rev.*, **43**, 322 (1933).
[4] Edlén, B., *Z. Phys.*, **100**, 621 (1936).
[5] Condon, E. U., and Shortley, G. H., "The Theory of Atomic Spectra" (Cambridge Univ. Press, 1935), p. 202 and 206.
[6] See ref. 1, p. 36.

Origin of the Earth's Magnetic Field

THERE is considerable physical evidence that the earth possesses a metallic core[1]. Jeffreys[2] has estimated the viscosity of the core and finds it as low as 10^{10} c.g.s. units. If this value is correct, an intense thermal convection must be maintained in the core by the heat development of radioactive impurities, even if the amount of the latter is exceedingly small compared to their concentration in the earth's crust.

I have developed a tentative theory of the magnetic field based on the assumption that this field is caused by *thermo-electric* currents in the core which owe their existence to the conditions created by the turbulent convection. The thermo-electric current density is

$$I = \sigma \operatorname{grad} \omega - B \operatorname{grad} T, \qquad (1)$$

where σ is the conductivity, ω the potential of the space and surface charges, B the thermo-electric constant of the material and T the temperature. σ, B, T are functions of the co-ordinates. If they are given, ω follows as solution of the differential equation $\operatorname{div} I = 0$ together with proper boundary conditions.

© 1939 Nature Publishing Group