Letters to the Editor.

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Magnetic Hysteresis on Weber's Theory.

IN his recent valuable review of the development of the subject of magnetism in discontinuous media¹ Prof. McKeehan makes the statement that the theory, as given in the papers to which he is there referring, "makes no provision for that magnetic hysteresis which is the distinguishing feature of ferromagnetism". This statement is literally quite correct in so

FIG. 1.

far as there was no attempt made in these papers to deal with the subject of hysteresis. But it would be misleading if it were taken to imply that Weber's theory cannot give an account of the phenomena of hysteresis. The existence of directions of equilibrium for magnetisation, alternately stable and unstable, under the Weberian internal field, compel phenomena of that type.

A complete discussion, even for the most important case of cubic crystals only, though of great interest, would be unsuited to the columns of NATURE, yet sufficient evidence as to the general validity of the

FIG. 2.

theory may be afforded by the accompanying diagrams, which refer to magnetisation parallel to a face plane of a cubic crystal.

Fig. 1 shows a simple geometrical construction which is applicable to this case. The two circles have radii 1 and h respectively, where h is the magnitude of the external field expressed in terms of the maximum value, taken as the unit of field strength, of that

component of the internal field which is transverse to the direction of magnetisation. The lines PQR , ABC , and Oh are all drawn in the direction of magnetisation, and OS is in the direction of a crystalline axis of stable magnetisation. If $hOS = \theta$, and $OBA = 4\theta$, while OC is in the direction of the external field, with $COS = \theta_0$, the construction gives $OCA = \theta_0 - \theta$, and corresponds to stable magnetisation. DB' represents the internal field, the component MB' of which is

FIG. 3.

balanced by the component MB of the external field. OM gives the fractional magnetisation, σ , in the direction of the external field. If h be increased so that OC becomes OR , we have $\theta = \pi/8$, and instability is just reached.

In Fig. 2 the curve of magnetisation, $BAOCD$ is shown for the cases $\theta_0 = 0$ and $\theta_0 = \pi/4$, the equation being

$$h = 4\sigma(1 - 2\sigma^2).$$

The curve for the reverse field is also shown. Unstable stretches are dotted, and the hysteresis loop is $ABCD$. So long as h remains less than 1.1, hysteresis does not appear.

In Fig. 3 similar data are exhibited under the condition $\theta_0 = \pi/8$, the equation being

$$h = \frac{1 - 8\sigma^2(1 - \sigma^2)}{\sqrt{1 - \sigma^2}}.$$

So long as $h < 1$, no hysteresis appears. If $h > 1 < 1.466$, approximately, the hysteresis loop is $badc$, and the magnetisation oscillates in direction between the two mutually perpendicular axes $\theta = 0$, $\theta = \pi/2$. If h exceeds the preceding upper limit, the hysteresis loop $BADC$ is described, and the direction of magnetisation oscillates between $\theta = 0$ and $\theta = \pi$.

These results apply under the presumptions that there are no thermal motions, and that the atomic magnets can be regarded as ideal.

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¹ "Review of Modern Physics", 1930, p. 492.

Absorption Spectra of Saturated Chlorides of Multivalent Elements.

FRANCK and his co-workers have shown that the vapours of alkali halides show a continuous absorption spectrum beginning from a long wave-length limit and extending towards the ultra-violet. He interpreted the absorption spectrum as follows: if we take a substance like sodium chloride the valency electron of Na in the normal state may be supposed to pass over completely to Cl and the combination consists of Na^+Cl^- . Such a combination is called ionic. When light falls on sodium chloride vapour, the electron passes over from Cl^- to Na^+ , the molecule thus splitting