moment (which he denotes by q) as the average over all protons, and in support of his definition states that the quadrupole field is proportional to Zq. However, the experimental values which he quotes are values of Q, so that these should be divided by Z to conform to his definition.

E. H. RHODERICK

Cavendish Laboratory,
Cambridge.
May 30.

[1] See, for example, Kellogg, Rabi, Ramsey and Zacharias, *Phys. Rev.*, 57, 677 (1940).
[2] Mattauch, "Kernphysikalische Tabellen" (Springer, 1942).
[3] Casimir, "On the Interaction between Atomic Nuclei and Electrons" Prize essay published by Teyler's Tweede Genootschap. Also published in *Archives du Musée Teyler*, iii, 8, 201 (1936).
[4] Feather, "Nuclear Physics" (Cambridge, 1936), 109.

Probabilities of Magnetization

IN an earlier analysis of the B—H curves of polycrystalline iron it was shown that a simple 'trichotomy' of the steep part of the curves could lead to useful estimates of the quantitative distribution of operative lattice orientation along any given direction in polycrystalline sheet material[1]. Subsequent work was directed towards correlating such estimates with directional measurements of Young's modulus[2]; and it has been found that while the general trend of agreement is unmistakable, there is a consistent tendency for the trichotometrical method, when applied along the rolling direction, to yield a modest over-assessment of the operative percentage of [100] orientation.

The most likely causes of a systematic discrepancy of this kind would appear to be: (1) that there is a deficiency in the previously adopted conventional assumption that in the demagnetized state there will exist an equivolumetric distribution of domain magnetization along each of the six possible [100] crystal directions of easy magnetization; and (2) that the original approximation made no provision for the inevitable overlapping between the 'easy' reversals in one crystal-group and the 'hard' reversals in another.

An attempt has therefore been made to arrive at a sounder physical basis for the concept of trichotomy, and at the same time to gain further insight into the actual build-up of the technical magnetization curve, by postulating that the 180° reversal component of the steep part of the curve (for polycrystalline iron) will represent the summation of three probability-integrals, one for each of the idealized [100], [110] and [111] crystal-groups; and that each of these three integrals will satisfy a relationship of the form

$$\mu_d = \mu_{dm} \cdot \exp\left[-b\left\{1 - (H/H_m)\right\}^2\right], \qquad (1)$$

where μ_d is the differential permeability; μ_{dm} is the maximum value of μ_d; and b is a 'variance' factor or a 'distribution index' which will reflect, for any given crystal-group, the manner in which the achievement of 180° reversals is distributed about some characteristic 'mode' H_m of the critical field strength.

This revised treatment will clearly lead to a general relationship of the form

$$B = \mu_n H + \Sigma\mu_{dm}\int_0^{H \leqslant 2H_m} \exp\left[-b\left\{1 - (H/H_m)\right\}^2\right] dH, \qquad (2)$$

where B is the externally measured magnetic induction, and μ_n is of the same order as the initial permeability μ_0. For iron and iron-silicon alloys, the summation term will comprise the areas generated by equation (1) for each of the three idealized crystal-groups. In equation (2), the $\mu_n H$ term will ordinarily be relatively small.

Investigation along these lines has indicated that this method of synthesis can lead to consistently improved and close agreement with observation up to the 'knee' region of the magnetization curve, that is, up to the point at which 180°-reversals are expected to be substantially completed[1]. A detailed discussion of its apparent applicability to a variety of experimentally induced conditions is in course of preparation for later publication, and the present communication is being submitted because the general picture which presents itself seems to provide an explanatory background for the peculiarly 'peaked' K_d curves recently recorded on certain types of ferromagnetic wire[3]. It will readily be seen that the summation term of equation (2) is fully competent to take charge of sharply segregated inhomogeneities of magnetization such as would result from the existence of markedly differing 'phases' in a ferromagnetic specimen; each phase will be expected to behave in accordance with its own 'probabilities', with resultant irregularities in the observed K_d curve. It is also clear that the physical basis of the treatment is in complete harmony with the expressed view that the irregularities observed "represent 180° reversals of demagnetized domain orientation of magnetization at values of H corresponding to the critical value of H_0 for different ferritic combinations."[3]

G. C. RICHER

Lysaght Research Laboratories,
Orb Iron Works,
Newport, Mon.
May 24.

[1] Richer, *J. Iron and Steel Inst.*, 150, 111 (1944).
[2] Richer, *Metallurgia*, 33, 251 (1946).
[3] Hobson, *Nature*, 159, 436 (1947).

Relative Times of Arrival of Bursts of Solar Noise on Different Radio Frequencies

IT is becoming recognized that on metre wavelengths solar noise from the disturbed sun is characterized by the occurrence of sudden large increases in intensity of a duration of several seconds or minutes. Bowen[1], of this Laboratory, has reported that these increases of intensity are not necessarily coincident in time or shape when observed on different radio frequencies. The present communication describes observations, chiefly during July and August 1946, of the relative times of arrival of such bursts on 200, 75 and 60 Mc./s., with a few observations on 30 Mc./s. For each frequency a separate receiving system, actuating its own recording meter, was used. Loud-speakers were also connected giving aural confirmation of the recorded data.

Three main conclusions can be drawn from these observations:

1. *Lack of correlation between most bursts.* First and most important, the majority of the intensity variations, particularly the smaller ones, show no correlation with those on other frequencies. This supports a hypothesis that the noise on different