triangular $AB'B''$, when $y < |\gamma_2|$, or $x > 0.41$. The spontaneous magnetization at $T = 0$ is

$$M_0 = I(1+x), \qquad y > |\gamma_2|$$
$$= I(2-x)(1/|\gamma_2| - 1), \quad y < |\gamma_2|, \qquad (7)$$

I being here the saturation magnetization of YIG. The resulting curve (in which there is no adjustable parameter) agrees rather well with experiment (Fig. 2). These considerations can be extended to higher temperatures. The upper Curie point corresponds to ferrimagnetic order when $y > \gamma_2^2/(2 - \alpha_2\gamma_2)$, $(x < 1.45)$, and to antiferromagnetic order at higher x.

More information on these materials could be obtained from neutron diffraction, and from high-field susceptibilities (as in the manganite series).[5]

It is a pleasure to thank Professor C. Kittel for discussions on these and related matters.

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ANTIPHASE ANTIFERROMAGNETIC STRUCTURE OF CHROMIUM*

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In the course of a neutron diffraction study of single crystals of chromium grown by the strain-anneal method[1] it was observed that the antiferromagnetic superstructure reflections exhibited characteristic splittings. An analysis of these splittings has led to an interpretation in terms of an antiphase antiferromagnetic domain structure in analogy with antiphase domains in ordered alloys.[2]

The region around the (100) and (111) reciprocal lattice points was systematically explored by the traverses shown in Fig. 1. From the experimental observations, the intensity distribution in reciprocal space shown in Fig. 2 was deduced. This distribution can be characterized in the following manner: (a) The size of the individual

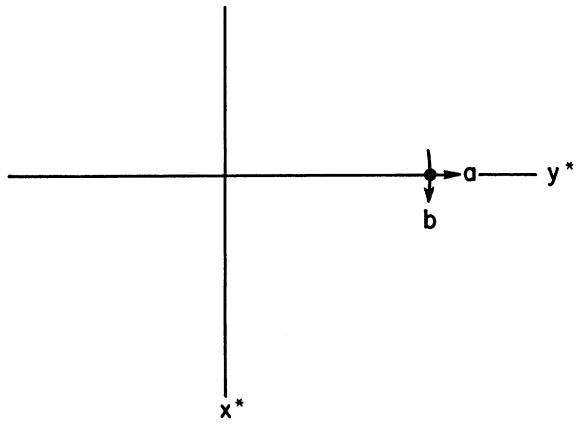

FIG. 1. Traverses of reciprocal lattice point. (a) Crystal and counter rotation in $\theta, 2\theta$ relationship, (b) Crystal rotated and counter fixed at $2\theta_{\text{Bragg}}$.

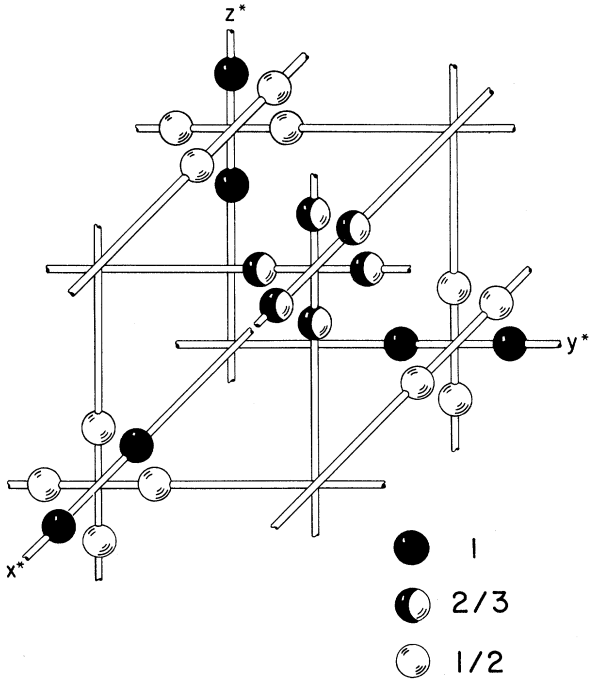

FIG. 2. Intensity distribution about the (100) and (111) reciprocal lattice points. The relative intensities are shown in the diagram.

spots is comparable to that observed for an ordinary nuclear reflection. (b) The spots in the neighborhood of each reciprocal lattice point exhibit octahedral spatial symmetry with relative intensities as shown in the figure. (c) The separation of the spots along the axes of each octahedron is $1/39\ A^{-1}$.

The following model accounts for the above observations. The antiferromagnetic structure of chromium (bcc) is one in which the body-centered spin is antiparallel to the corner spin. The splitting of the superstructure peaks is produced by platelike antiphase domains in which 180° spin reversals in the antiferromagnetic spin arrangement occur every 14 unit cells normal to the antiphase boundaries as follows:

$$+-+-+-+-+-+-\Big\}-+-+-+-+-+-+\Big\}+-+-\ \text{etc.}$$

These antiphase domain boundaries are parallel to the crystallographic cube faces, but the crystal as a whole consists of a random arrangement of regions in any one of which the domain boundary is parallel to a particular cube face. Within a domain the spins are parallel to the domain boundary. It is this restriction on spin direction which accounts for the observed relative intensities of the spots in the reciprocal lattice given in Fig. 2 since the magnetic intensity depends on the relative orientations of the spin and scattering vectors.

From the integrated intensities of the magnetic superstructure peaks (100), (111), and (210), the Bohr magneton number is found to be 0.4 ± 0.05 in agreement with Shull and Wilkinson.[3] It was also found that the magnetic form factor is in agreement with that of Mn^{+2}.[4] The magnetic intensity of the (100) peak as a function of temperature agreed with that derived from the Brillouin function for spin $\frac{1}{2}$ and gave a Néel temperature of $35°C \pm 2°$ which coincides with other physical anomalies such as resistivity, Young's modulus, and lattice expansion. This temperature, however, is not in agreement with powder neutron diffraction data previously reported by Shull and Wilkinson[3] ($T_N \cong 175°C$) and recently confirmed by us.

The origin of the antiphase domains is not known but a recent proposal of Kaplan[5] points out the possibility of lowering the energy by virtue of a nearest and next-nearest neighbor interaction, both of which are antiferromagnetic. In his proposed model the spins do not make an abrupt 180° reversal but rather spiral with a fixed period.

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HYPERFINE COUPLING IN CoFe AND CoNi ALLOYS AS DETERMINED BY HEAT CAPACITY MEASUREMENTS*

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Each nucleus in a ferromagnet experiences an effective magnetic field (H_{eff}) caused by the hyperfine interaction with unpaired electrons. Marshall[1] has calculated the various contributions to this effective field and has shown how these contributions may be expected to depend on the electronic configuration surrounding the nucleus. The hyperfine interaction gives rise to a nuclear polarization at low temperatures and to a nuclear contribution to the specific heat given by

$$\frac{C_n}{Nk} = \tfrac{1}{3}\frac{I+1}{I}\left(\frac{\mu H_{\text{eff}}}{kT}\right)^2 + O\left(\frac{\mu H_{\text{eff}}}{kT}\right)^4,$$

where N is the number of nuclei, μ and I are the nuclear moment and spin, respectively, and k is Boltzmann's constant. Similar contributions to the specific heat in a ferromagnetic metal have previously been measured in cobalt[2-4] and