TABLE I.

Nucleus	$_{24}C^{50}$	$_{44}Ru^{100}$	$_{62}Sm^{150}$	$_{80}Hg^{200}$	$_{92}U^{238}$
$2E_s^0/E_c^0$	3.70	2.20	1.66	1.33	1.20

Recently several laboratories[3] have reported experiments showing that the uranium nucleus when activated by the capture of a neutron can explode into two heavy parts (possibly barium and krypton) and possibly a number of light particles (neutrons). The results stated in Table I suggest that the activation energy required to enable the uranium isotope to pass through the potential energy hill which stabilizes the state of spherical symmetry may well be only a few million volts. According to this picture the natural uranium isotopes and other heavy nuclei should explode occasionally when activated by bombardment with energetic gamma-radiation or charged particles.

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Ferromagnetic Anisotropy in Nickel-Iron Crystals. Evidence for Superstructure near Ni_3Fe

Evidence for the existence of superstructure in nickel-iron alloys at about Ni_3Fe has been offered by Kaya.[1] Long distance order has not been found in this range by Haworth.[2] Precise measurements, herein reported, on the ferromagnetic anisotropy of single-crystal spheroids of critical compositions, seem best explained by short distance order.

The method used is that developed in this laboratory,[3] with changes in apparatus and technique which permitted greater precision.

A spheroid with 75 percent by weight of nickel and 25 percent of iron was, as nearly as could be measured, magnetically isotropic when rapidly cooled in vacuum after about half an hour at 750°C, as shown in curve A in Fig. 1. After reheating this spheroid to 600°C, lowering its temperature 20° a day for 5 days and to 450° in the next 15 days, it had, at room temperature, the anisotropy shown in curves B. Five days more at 430°C produced no further change. A second heating to 750°C, again followed by rapid cooling, restored the isotropic state (curve A).

A spheroid with 70 percent by weight of nickel and 30 percent of iron was similarly treated. In the rapidly cooled state the direction of easiest magnetization was [100], followed by [111] and [110] in that order. In the state following 22 days baking between 500°C and 430°C the direction of easiest magnetization was [111], followed by [110] and [100] in that order. It is therefore probable that at some rate of cooling almost complete isotropy could be established in crystals of this composition.

The two specimens just mentioned were from stock kindly furnished by the Bell Telephone Laboratories some years ago. The spheroids of J. D. Kleis were made from this stock. The results he reported[4] are similar to those here reported for quickly cooled specimens. Measurements on other compositions are in progress.

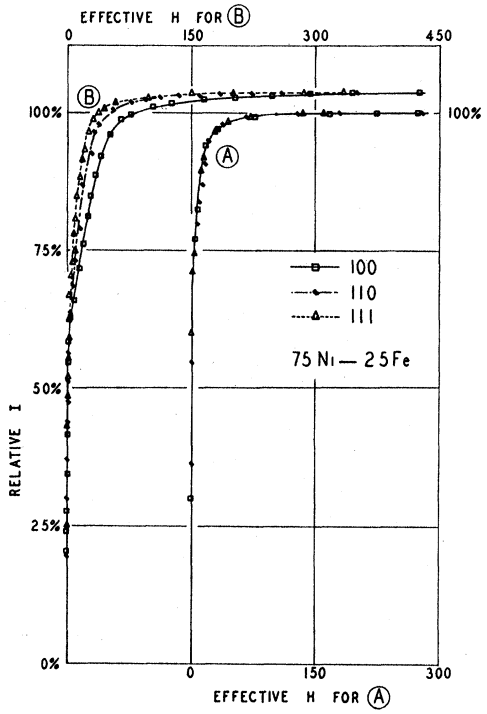

FIG. 1

Besides the changes in directional properties we have to report that the saturation magnetization for all directions is raised in this range of composition by low temperature baking. The change in the 75 percent spheroid was about three percent, in the 70 percent spheroid about two percent. The reversibility of this change has been checked in the 75 percent spheroid.

It is noted that the change in anisotropy is consistent with the effect of ordering calculated by one of us.[5] The occurrence of zero anisotropy in the neighborhood of 75 percent nickel was consistent with dependence of the first anisotropy constant (K_1) almost exclusively upon "quadrupole" magnetic interaction, and this term is decreased (algebraically) in this region, by passing from disorder to order. A change of K_1 from zero to a negative value was therefore to be expected at the transition point for disordered states.

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