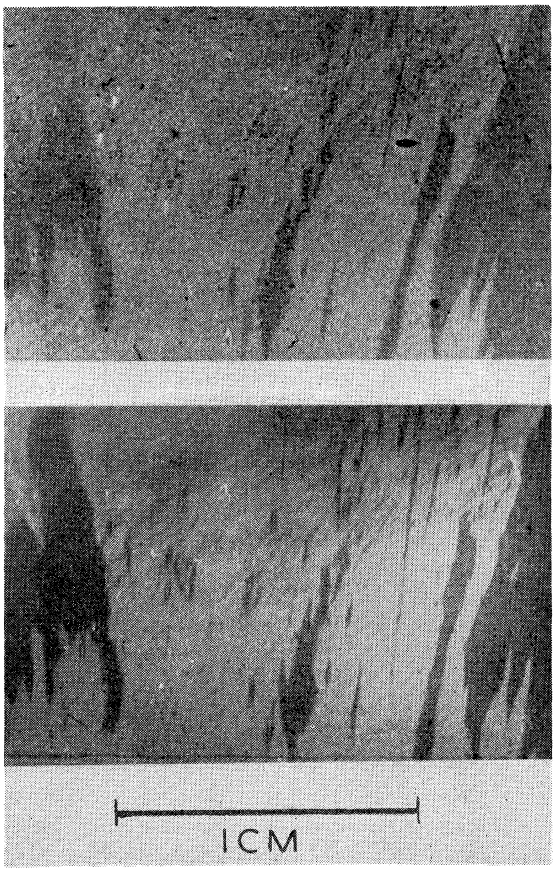

FIG. 1. Photographs of the domain structure of a transparent NiFe film in the same magnetic state, taken (upper) with the Kerr magneto-optic reflection technique and (lower) with the transmission method utilizing the Faraday effect.

contrast, and in decreased surface imperfections is apparent in the transmission case, whose photographic exposure time was only one quarter that required for the reflection picture. We would conclude that the method is a practicable one for observing domains in transparent ferromagnetic films, and are proceeding with an investigation of much thinner specimens.

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Hyperfine Structure of K^{39} in the $4P$ State and of Cs^{133} in the $6P$ State*

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THE atomic-beam resonance method has been used to investigate the hyperfine structure of the $4P$ excited state of K^{39} and the $6P$ excited state of Cs^{133}. For cesium, the apparatus and method of observation were the same as those used in a previous experiment on the $5P$ state of rubidium.[1] For potassium, certain important modifications were necessary.

TABLE I. Results of ten runs on the $6P_{\frac{3}{2}}$ spectrum of Cs^{133}.

Transition	Center frequency of observed resonance in Mc/sec	Average in Mc/sec
$F=3$ to $F=2$	152.2, 151.2, 152.2, 152.5	152.0±0.8
$F=4$ to $F=3$	202.9, 204.0, 201.5, 203.5	203.0±1.1
$F=4$ to $F=5$	252.6, 252.4	252.5±1.0

In Cs^{133}, three resonances were observed in the $6P_{\frac{3}{2}}$ state at near-zero static magnetic field. The results of ten runs are given in Table I.

With this arrangement, we were able to observe a partially resolved resonance at a frequency of 20.1±0.4 Mc/sec. Four runs were taken on this resonance and the results are shown in Table II.

In the $6P_{\frac{3}{2}}$ state of Cs^{133}, the three hyperfine level separations are given by

$$5a+(5/7)b \quad \text{for} \quad F=5 \quad \text{to} \quad F=4,$$
$$4a-(2/7)b \quad \text{for} \quad F=4 \quad \text{to} \quad F=3,$$
$$3a-(5/7)b \quad \text{for} \quad F=3 \quad \text{to} \quad F=2.$$

The assignment of individual resonances to a particular transition can be made uniquely as follows:

$$252.5 \text{ Mc/sec}: \quad F=5 \text{ to } F=4,$$
$$203.0 \text{ Mc/sec}: \quad F=4 \text{ to } F=3,$$
$$152.0 \text{ Mc/sec}: \quad F=3 \text{ to } F=2.$$

The interaction constants a and b are then

$$a=50.67\pm0.11 \text{ Mc/sec}, \quad b=-0.46\pm0.53 \text{ Mc/sec}.$$

The corresponding value of Q is

$$Q=(-0.0033\pm0.0039)\times10^{-24} \text{ cm}^2.$$

For potassium it was impossible to find the $4P_{\frac{3}{2}}$ resonances with the apparatus as previously described,[2] because the ground state rf effect,[2] due to the transition $F=2$, $m_F=-2$ to $F=2$, $m_F=-1$ in the region of interest (20 Mc/sec) gave signals on the recorder twenty to fifty times as large as the expected excited-state rf effect. It was not possible to read the excited-state rf effect on top of this ground-state effect and its associated fluctuations directly. The following scheme sufficed to avoid the problem.

In addition to the high-power square-wave modulated rf current used to study the excited-state rf effect, an unmodulated rf current of 50 ma at a frequency of 1.5 Mc/sec was put into the hairpin. This served to

TABLE II. Center frequency of $F=3$ to $F=2$ transition in $4P_{\frac{3}{2}}$ state of K^{39}.

Run	Observed frequency in Mc/sec	Average in Mc/sec
1, 2, 3, 4	20.2, 20.5, 19.8, 20.0	20.1±0.4

TABLE III. Center frequency of $F=2$ to $F=1$ transition in $4P_{\frac{1}{2}}$ state of K^{39}.

Run	Observed frequency in Mc/sec	Average in Mc/sec
1, 2, 3	57.5, 58.3, 57.4	57.7±0.5

"scramble" the populations in the $F=2$, $m_F=-2$ and $F=2$, $m_F=-1$ ground-state levels (as well as the other ground-state levels) and by slight adjustments of current and frequency of the low-frequency oscillator, 50% of the atoms in the $F=2$, $m_F=-2$ level were transferred to the $F=2$, $m_F=-1$ level and vice versa. Since the effect was already at maximum, the high-power rf could not produce any additional refocused signal. Consequently the ground-state rf effect was zero.

Another resonance was observed at a frequency of 57.7±0.6 Mc/sec and this we assign to the transition $F=2$ to $F=1$ in the $4P_{\frac{1}{2}}$ state. Three runs were taken and the results are shown in Table III. From this, the value of $a_{\frac{1}{2}}$ is 28.85±0.3 Mc/sec. The value of $a_{\frac{3}{2}}$ is then 5.77±0.06 Mc/sec, because the ratio $a_{\frac{1}{2}}/a_{\frac{3}{2}}$ is theoretically 5 to within a few percent.[3,4] This was found to be true experimentally in the case of sodium[2] and rubidium.[1]

In the $4P_{\frac{3}{2}}$ state of K^{39}, the three hyperfine level separations are

$$3a+b \quad \text{for} \quad F=3 \text{ to } F=2,$$
$$2a-b \quad \text{for} \quad F=2 \text{ to } F=1,$$
$$a-b \quad \text{for} \quad F=1 \text{ to } F=0.$$

We assign the 20.1-Mc/sec resonance to the $F=3$ to $F=2$ transition. This gives a value for b of 2.8±0.4 Mc/sec, where the error quoted is taken to be the extreme of the deviation from the average. Because of the difficulty of fitting curves to an incompletely resolved resonance, we feel this error should be increased to ±0.8 Mc/sec.

The value of Q is $(0.07\pm0.02)\times10^{-24}$ cm^2.

Full details of this experiment will be published later.

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$C^{13}(\gamma,p)B^{12}$ Cross Section*

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RECENT work[1] at this laboratory showed the $C^{13}(\gamma,n)C^{12}$ cross section to have a small peak near 13.5 Mev in addition to the "giant resonance" peak

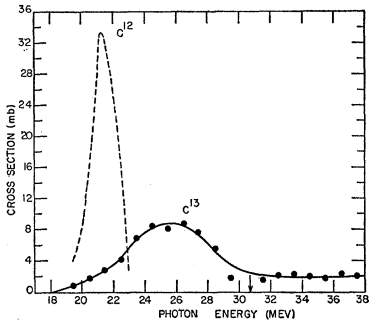

FIG. 1. The $C^{13}(\gamma,p)B^{12}$ cross section. The $C^{12}(\gamma,p)B^{11}$ cross section is that of Halpern and Mann.[4]

near 25 Mev. Although energy considerations seem sufficient to exclude competition with the $C^{13}(\gamma,p)B^{12}$ reaction as the reason for the decrease of the (γ,n) cross section above 13.5 Mev, the (γ,p) cross section has now been measured to confirm this conclusion. These two measurements together yield a total absorption cross section that can be interpreted less ambiguously than the partial cross section for the production of neutrons.

B^{12} was detected by the $\beta^-(E_{\max}=13.43$ Mev) decay, and a yield function obtained up to 45 Mev. The yield at 30 Mev is 1.3×10^7 protons/100 r mole, compared to 3.6×10^7 neutrons/100 r mole at the same energy for total neutron production. The half-life of B^{12} was redetermined to be $(18_{-1.3}^{+1.5})$ msec, compared to the 22 msec or 27 msec previously reported.[2] Over 5×10^6 disintegrations were recorded to obtain the complete yield curve and used for making this half-life determination.

The (γ,p) cross section (Fig. 1) was derived from the yield curve by using the tables of Leiss and Penfold[3] for the inverted bremsstrahlung spectrum; it shows a broad maximum of 8.8 mb near 25.5 Mev. In contrast, the cross section[4] for $C^{12}(\gamma,p)B^{11}$ is much narrower with a peak value of 34 mb at 21.5 Mev. Although the shapes of the two cross sections differ, the integrated cross sections are the same. For C^{13} the cross section integrated over the resonance (to 30 Mev) is 55 mb Mev, while the corresponding quantity (to 25 Mev) for C^{12} is 63 mb Mev.

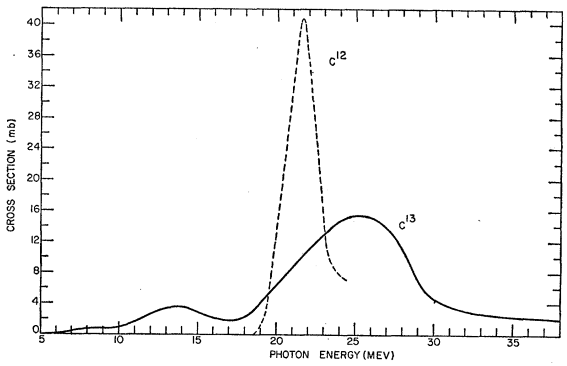

FIG. 2. The total photon absorption cross section of C^{13} and C^{12}. The latter cross section is known only from 18 to 25 Mev. An allowance for neutron multiplicity has been made.