Nuclear Magnetic Resonance of Ni^{61} in Metallic Nickel

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The nuclear magnetic resonance of Ni^{61} in unenriched metallic nickel has been observed. The results provide the first experimental measure of the internal field at the nucleus in nickel. The resonance occurs at a frequency of 26.02 Mc/sec at room temperature, yielding an estimate of 170 kilogauss for the internal field.

WE wish to report the observation of the nuclear magnetic resonance (nmr) of Ni^{61} in unenriched nickel powder. These observations are similar to those previously reported by Portis and Gossard[1] on Co^{59} in cobalt metal and by Gossard, Portis, and Sandle[2] on Fe^{57} in 80% enriched iron. The nmr of Fe^{57} in unenriched iron has also been observed by Robert and Winter[3] as well as in our laboratory.[4]

The Ni^{61} resonance is observed at a frequency of 26.02 megacycles at a temperature of 298°K in high-purity (99.999%) Johnson-Matthey powder with the natural abundance (1.25%) of Ni^{61}. A typical recorder trace, exhibiting the approximate second derivative of the resonance absorption curve, is shown in Fig. 1. The linewidth at room temperature is about 50 kc/sec.

The resonant frequency has been measured at three fixed temperatures; the results are tabulated in Table I. The results contained in Table I cannot be fitted by an expression of the form

$$\nu(T)=\nu_0[1-(T/T_c)^2]^{\frac{1}{2}}, \quad (1)$$

which has proved adequate for the cobalt observation[1] in this temperature range. In Eq. (1), T_c is the Curie temperature which for nickel is 631°K.

TABLE I. Ni^{61} resonant frequencies at three different temperatures.

Temperature	Frequency (Mc/sec)
78°K	28.21
193°	27.54
298°	26.02

The nuclear spin of Ni^{61} is known to be $\frac{3}{2}$.[5] Using this, together with the Ni^{61} moment of 0.30 nm as measured by Orton, Auzins, and Wertz,[6] we find the internal field at the nickel nucleus to be 170 kilogauss at room temperature. Further studies of the temperature dependence of the internal field are in progress.

ACKNOWLEDGMENT

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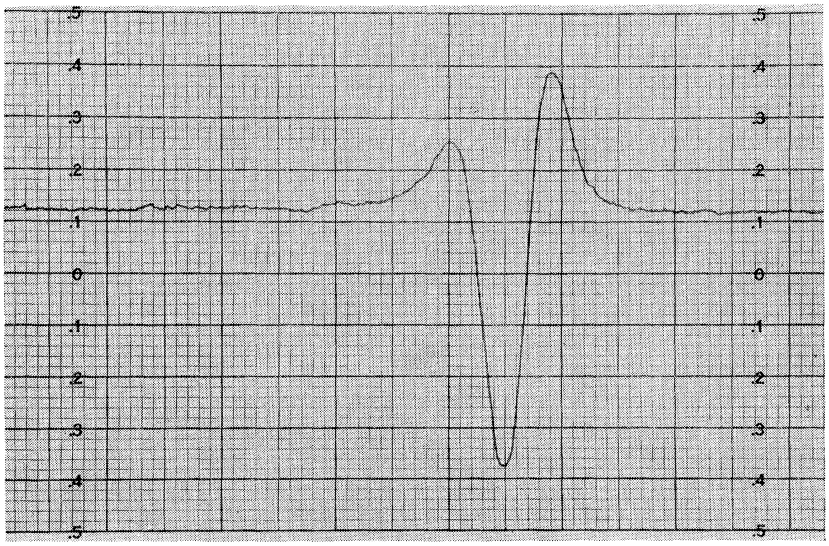

FIG. 1. The approximate second derivative of the absorption curve for the Ni^{61} resonance.

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[2] A. M. Portis (private communication).
[3] C. Robert and J. -M. Winter, Compt. rend. **250**, 3831 (1960).
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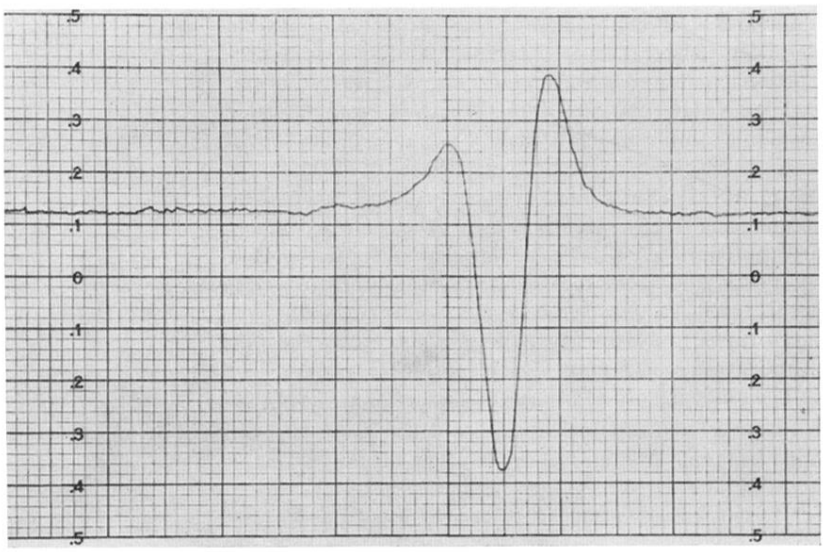
[5] H. H. Woodbury and G. W. Ludwig, Phys. Rev. Letters **1**, 16 (1958).
[6] J. W. Orton, P. Auzins, and J. E. Wertz, Phys. Rev. **119**, 1691 (1960).



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