**U3. Integral and Rational Numbers in the Nuclear Domain.** [illegible] E. WITMER, *University of Pennsylvania.*—Some years [illegible] the writer proposed the idea that $hc/e^2$ is exactly 861, [illegible] which is $41\times42/2$. From the best and most recent value[1] of $hc/e^2$ is slightly less than 861.023, which supports this [illegible] quite well. The nuclear magnetic moments $\mu$ appear to [illegible] given by the equation $\mu=Ck$, where $C$ is a constant and $k$ [illegible] an integer or rational number with a small denominator. [illegible] is 1/10 for the proton. There is much accurate data to support this statement. The extremely accurate ratios of the nuclear magnetic moments of certain isotopes make possible a very drastic test of this idea. Furthermore, it frequently happens that the $k$ differences of isotopes are integers even when the $k$ values are not integral but only rational. Also the moments of nuclei not subject to beta decay or $K$-capture appear to be an integral number of prouts. The prout is defined to be one-eleventh of the rest mass of the negative electron. Many of the nuclei subject to beta-decay or $K$-capture follow the integral rule. There are considerable data to support this.

[1] M. Kroll and F. Pollock, Phys. Rev. **84**, 594 (1951).

**U4. Nuclear Magnetic Moment of Indium$^{115}$.** YU TING, J. K. BIARD, AND DUDLEY WILLIAMS, *The Ohio State University.*—A nuclear magnetic resonance absorption line attributed to $In^{115}$ has been observed in a saturated solution of indium nitrate in 30 percent nitric acid. Comparison of this line with the $Sc^{45}$ line observed in $ScCl_3$ in the same magnetic field leads to the frequency ratio $\nu_{In}/\nu_{Sc}=0.902292\pm0.000010$, where the indicated uncertainty is a measure of the internal consistency of the data, and the possibility of systematic errors as large as $\pm0.000050$ cannot be completely excluded. The observed ratio $\nu_{In}/\nu_{Sc}$ used in conjunction with Lindstrom's value $\mu_{Sc}/\mu_{proton}=0.242939\pm0.000003$ and the recent value $\mu_{proton}=2.79268\pm0.00006$ nm leads to a value $\mu_{In}=5.50945\pm0.00011$ nm when nuclear spin $I=9/2$ is assumed. This preliminary value for the $In^{115}$ magnetic moment has not been corrected for diamagnetic effects of the extra-nuclear electrons nor for the slight paramagnetic effects of a magnetic catalyst ($Mn(NO_3)_2$) used in the sample. Further work is being done on samples not containing a catalyst. The value obtained in the preliminary work is higher than the value obtained in molecular beam experiments.

**U5. The Nuclear Gyromagnetic Ratio of Vanadium 50.** H. E. WALCHLI, W. E. LEYSHON, AND F. M. SCHEITLIN, *Oak Ridge National Laboratory.**—The nuclear gyromagnetic ratio of vanadium 50 has been determined in a nuclear induction spectrometer. An electronically regulated electromagnet maintained a field homogeneous to 0.1 gauss over the sample volume. Frequency measurements were made using a BC-221 frequency meter calibrated with an external 100 kc crystal controlled oscillator and checked against WWV. The sample consisted of 271 mg of vanadium as $VOCl_3$ of which 10 percent was $V^{50}$. Measurements at three values of magnetic field gave the following preliminary ratio:

$$\nu(V^{50})/\nu(D^2)=+0.649530\pm0.00007.$$

The sign of the moment was determined to be positive by direct comparison with $Rb^{85}$ and $Cl^{35}$. Using a value of 2.7926 nm for the proton moment and Levinthal's deuteron-to-proton ratio,[2] the nuclear gyromagnetic ratio for vanadium 50 becomes +0.55707. New frequency ratios, $V^{50}/Rb^{85}$; $V^{50}/Cl^{35}$; $Rb^{85}/Cl^{35}$; $Rb^{85}/H^1$; and $Cl^{35}/H^1$ will be reported.

* This paper is based on work performed for the AEC by Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation, Oak Ridge, Tennessee.
[1] Sommer, Thomas, and Hipple, Phys. Rev. **80**, 487 (1950).
[2] E. C. Levinthal, Phys. Rev. **78**, 204 (1950).

**U6. High Frequency Lines in the hfs Spectrum of Cesium.** J. E. SHERWOOD, HAROLD LYONS, R. H. MCCRACKEN, AND P. KUSCH, *National Bureau of Standards.*—A brief account is given of the atomic beam magnetic resonance apparatus which is being developed at the National Bureau of Standards as a possible time standard in the microwave region.[1] The beam gear is essentially a Rabi[2] type apparatus, except for details. Permanent magnets are used for deflection together with a weak $C$ field of the order of a few oersteds. A quartz oscillator-multiplier system is used as a stable exciting source and for precise frequency measurement. At present, a short path length of approximately one cm is used giving the expected $Q$ of the order of 300,000 at 9192 Mc. Results are confined to experiments with cesium, for which the variation with magnetic field of some of the high frequency lines in the ground state hfs will be given. A new value is obtained for $\nu_0$, the line frequency at zero magnetic field. This directly measured value lies between previously announced[3,4] values and outside their limits of error.

[1] P. Kusch, Phys. Rev. **76**, 161 (1949).
[2] J. M. B. Kellogg and S. Millman, Revs. Modern Phys. **18**, 323 (1946).
[3] P. Kusch and H. Taub, Phys. Rev. **75**, 1477 (1949).
[4] Roberts, Beers, and Hill, Technical Report No. 120, June 6, 1949. Research Lab. of Electronics, M.I.T.; Phys. Rev. **70**, 112 (1946).

**U7. Magnetic Moment of Helium in the Metastable $^3S_1$ State by Atomic Beam Method.*** G. L. TUCKER, V. W. HUGHES, E. H. RHODERICK, AND G. WEINREICH,† *Columbia University.*—A comparison has been made of the gyromagnetic ratio of the two-electron system in helium in the metastable $^3S_1$ state with that of the one-electron system in the ground state of hydrogen. The atomic beam magnetic resonance method was used and the atoms were made to traverse almost identical paths in the magnetic field.[1] With fields between 400 and 500 gauss the lines $m_J=\pm1\rightarrow0$ of helium and $F$, $m_F=1$, $0\leftrightarrow1$, $-1$ of hydrogen were measured alternately. Using the Breit-Rabi formula for hydrogen and recent values[2] of $g_I$ and $\Delta\nu$ we find $g_J(\mathrm{He},{}^3S_1)/g_J(\mathrm{H},{}^2S_{\frac{1}{2}})=1.000001\pm0.000025$. Using $g_J(\mathrm{H},{}^2S_{\frac{1}{2}})^3=2(1.0011275\pm0.000013)$ gives

$$g_J(\mathrm{He},{}^3S_1)=2(1.001129\pm0.000028).$$

Precision was limited principally by field inhomogeneities and by field drift during approximately 15-minute periods between gases. Further measurements are in progress.

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† AEC predoctoral fellow.
[1] For production and detection of a beam of metastable helium atoms see V. Hughes and G. Tucker, Phys. Rev. **82**, 322 (1951).
[2] H. Taub and P. Kusch, Phys. Rev. **75**, 1481 (1949); A. G. Prodell and P. Kusch, Phys. Rev. **79**, 1009 (1950). Uncertainties in these numbers do not limit our precision.
[3] Koenig, Prodell, and Kusch, Phys. Rev. **83**, 687 (1951).

**U8. Measurement of Short β-Decay Lifetimes.** R. N. THORN, R. W. WANIEK AND R. B. HOLT, *Harvard University.*—A method for measuring the lifetimes of isotopes extremely unstable to $\beta$-decay is described. These isotopes are produced in the bombardment of light elements by the internal proton beam of the Harvard fm cyclotron. The decay particles are detected by a crystal, Lucite probe, and photomultiplier arrangement. The target is located about four inches directly below the detecting crystal. Because of the focusing action of the magnetic field, most of the decay particles enter a cylindrical shaped anthracene crystal lodged in a slotted hole at the end of the Lucite rod. The Lucite pipe is enclosed in a vacuum-tight tube and transmits the light signal to a photomultiplier outside the cyclotron tank. The signal is fed from the photomultiplier to a cathode follower and from there to a linear amplifier in the control room. The pulses from the discriminator output go into an integrating circuit; the resulting current is registered on linear roll paper by a fast recorder. All circuits are left on continuously. The target is irradiated, the cyclotron is turned off, and the excitation is observed. By this method, lifetimes shorter than one-tenth of a second are measured.