then to be expected that, since solvation effects increase with increasing dilution, the local magnetic field at the phosphorus nucleus would also decrease. Possible effects of chemical association among the P molecules will be discussed, as well as possible effects of the bulk susceptibility of the solutions.

* Supported in part by the U. S. Office of Naval Research.
† Now at Saint Mary's College, California.

A6. Experiment for Measurement of the Magnetic Moment of the Neutron.* VICTOR W. COHEN AND NOEL R. CORNGOLD, *Brookhaven National Laboratory*, AND NORMAN F. RAMSEY, *Harvard University*.—An experiment is being performed to make a determination of the ratio of magnetic moments of the neutron to proton, to a greater precision than has heretofore been attained. The method is somewhat similar to that used by Bloch and co-workers[1] and the atomic beam resonance method with separated oscillatory fields.[2] The slow neutrons are highly polarized by reflection at small glancing angles from a magnetized colbalt mirror. These will be reflected from a second analyzing mirror. Between the mirrors, the neutrons pass a region of uniform permanent magnetic field where they may become depolarized by a resonant rf magnetic field. This will result in a decrease in neutron beam intensity reflected from the second mirror. The ratio of the neutron resonance frequency to that of a proton field probe gives the ratio of the magnetic moments. In order to achieve high precision, the path in the magnetic field is about 150 cm. The separated oscillatory field method[2] is used to average the magnetic field along the path of the neutron and thereby to obviate the need for great uniformity. The path length between loops is long enough to give a natural line width for the neutron resonance of about 1 part in 25 000. The magnetic field is explored point-by-point with a small proton resonance probe. Rough preliminary results are in agreement with previous investigators.[1]

* Work carried out under contract with the U. S. Atomic Energy Commission.
[1] Bloch, Nicodemus, and Staub, Phys. Rev. **74**, 1025 (1948).
[2] N. F. Ramsey, Phys. Rev. **78**, 695 (1950).

A7. Free Nuclear Induction in the Earth's Magnetic Field. MARTIN PACKARD AND RUSSELL VARIAN, *Varian Associates*.—Free nuclear induction signals have been observed in the earth's magnetic field. The very simple experimental apparatus does not use a rotating magnetic field but relies on a polarizing field to preorient the magnetic moments at right angles to the earth's field. The polarizing field of about 100 gauss is left on for a time longer than T_1 after which it is reduced to zero rapidly enough to satisfy the nonadiabatic conditions, leaving the moments perpendicular to the earth's field. The precession of the magnetic moments about the homogeneous earth's field at a frequency of 2185 cycles is observed as a voltage induced in a receiver coil oriented perpendicularly to both the earth's field and the polarizing field. The free induction signal from 500 cc of water is observed to persist for a time greater than one second. This free decay time is probably determined by an instrumental T_2 rather than by the real T_2 of the water. A sample of HF shows a beat pattern which occurs at a frequency of about 120 cycles which is compatible with the difference in γ for hydrogen and fluorine. The absolute value of the earth's field can be easily measured by measuring the precessional frequency. The present signal-to-noise of 20 is adequate to permit a measurement of the earth's field to about one part in 15 000.

A8. Measurement of Nuclear Induction Relaxation Times in Weak Magnetic Fields. ARNOLD BLOOM AND DOLAN MANSIR, *Varian Associates*.—The spin-lattice and spin-spin relaxation times of nuclear magnetic moments in weak magnetic fields (of the order of the earth's magnetic field) have been measured through the use of the free precession apparatus described in the previous abstract. To measure T_1 in very weak fields the polarizing field is reduced at $t=0$ from its initial value of about 100 gauss to a residual value of about 2 gauss. The residual field is then removed at $t=\tau$ and the resulting free precession signal has an initial amplitude proportional to $\exp(-\tau/T_1)$. By varying τ, T_1 can be measured. T_2 can be determined directly from the time decay of the signal if the earth's field is homogeneous. If the earth's field is not homogeneous, a form of spin-echo technique can be employed for measuring T_2. In this technique a short pulse of inhomogeneous polarizing field is applied at $t=\tau$, following the initial removal at $t=0$. At $t=2\tau$ a spin echo occurs whose amplitude, under certain conditions, is proportional to $\exp(-2\tau/T_2)$ and is independent of the amplitude and duration of the polarizing field pulse. Experimental results will be discussed.

A9. Isotopic Spin and Odd-Odd $N=Z$ Nuclei.* S. A. MOSZKOWSKI† AND D. C. PEASLEE, *Columbia University*.—The recent discovery of a $T=1$, $J=0$ ground state[1] in Cl^{34} provides the first known exception to the usual expectation that a nuclear ground state has the minimum isotopic spin possible; e.g., $T=0$ for an odd-odd $N=Z$ nucleus. The position of the lowest $T=1$ state of an odd-odd $N=Z$ nucleus relative to the $T=1$ ground state of the neighboring even-even $N=Z+2$ isobar can be estimated theoretically and is in fair agreement with experimental data. For the lightest odd-odd $N=Z$ nuclei, H^2 to Na^{22}, the ground state has $T=0$. However, the energy difference between the lowest $T=0$ and lowest $T=1$ state decreases with increasing A. The known positron emitting states of Al^{26}, P^{30}, and K^{38} appear to have $T=1$, 0, and 0, respectively. Tentative predictions regarding the decay of the lowest $T=1$ state in Na^{22} and K^{38} and the decay of the lowest $T=0$ state in Al^{26} will be presented.

* Work supported by the U. S. Atomic Energy Commission.
† Now at University of California, Los Angeles, California.
[1] W. Arber and P. Stähelin, Helv. Phys. Acta **26**, 433 (1953).

MONDAY MORNING AT 10:00

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(PAUL KIRKPATRICK, presiding)

Contributed Papers

B1. Uniformity of Pulse Heights from a Large-Area Photomultiplier.* A. M. HUDSON AND F. X. ROSER,† *Department of Physics and W. W. Hansen Laboratories of Physics, Stanford University*.—Following a suggestion of R. Hofstadter, a specially designed light baffle has been constructed for use with a large-area photomultiplier (RCA type C7157). This baffle improves the uniformity of pulse heights for scintillation events originating at various regions near the photocathode.