at Johns Hopkins; completed redeterminations of the velocity of light by K. D. Froome, by E. Bergstrand, and others, under way at the U. S. National Bureau of Standards; a remarkably accurate redetermination of γ, the gyromagnetic ratio of the proton, just completed by Bender and Driscoll[7] at the U. S. National Bureau of Standards; redeterminations of the important transfer constant, g, the acceleration due to gravity, which exerts a frequently overlooked effect on the measurement of many other constants.[8] Two efforts by theoretical physicists[9] to derive the complete correction terms for the effect of the finite extension of the nuclear (proton) charge and magnetic dipole distributions in the expression connecting α with the very accurately measured hyperfine structure shift, $\Delta\nu_H$, in hydrogen still leave the question in an unsatisfactory state because of lack of knowledge of the part played by the virtual meson field in perturbing the electric and magnetic interaction between the electron and the proton in hydrogen.

Because of this array of new information which promises to be forthcoming in the next one or two years we feel it would be premature at present to make a complete new least-squares adjustment accompanied with a long table of derived values of constants and conversion factors. It seems unlikely that any of the values as given in our 1955 tables will be modified seriously outside the error measures (standard deviations) tabulated in that adjustment. The changes will chiefly permit giving the values with increased precision. The information in this letter is discussed in much greater detail in a recent paper,[10] which also gives a complete review of the entire present experimental foundation of our knowledge of the constants.

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*Work supported by the U.S. Atomic Energy Commission, the Office of Ordnance Research and the National Science Foundation.

[1] M. Karplus and N. M. Kroll, Phys. Rev. 81, 73 (1951).

[2] So far as we know, N. M. Kroll has not publicly announced his verification. We are gratefully indebted for this information to private correspondence with A. Petermann.

[3] A. Petermann, Helv. Phys. Acta 30, 407 (1957).

[4] C. M. Sommerfield, Phys. Rev. 107, 328 (1957).

[5] Cohen, DuMond, Layton, and Rollett, Revs. Modern Phys. 27, 363 (1955).

[6] We deem it preferable to give independently the effects of changes in various input data rather than showing the combined result of a number of these, at least until a complete new least-squares adjustment is prepared. In the following references the evidence for and the result, of changing another input datum, the directly observed value of λ_g/λ_s (the first equation in Table II of reference 5), has already been discussed. How great this change will be can at present only be roughly estimated. J. W. M. DuMond and E. R. Cohen, Phys. Rev. 103, 1583 (1956); J. W. M. DuMond, Suppl. Nuovo cimento 6, 77 (1957); E. R. Cohen and J. W. M. DuMond, Handbuch der Physik (Springer-Verlag, Berlin, 1957), Vol. 35, p. 86; Cohen, Crowe, and DuMond, The Fundamental Constants of Physics (Interscience Publishers, New York, 1957), p. 178.

[7] P. L. Bender and R. L. Driscoll, Minutes of the August 13, 1958, Boulder, Colorado, Conference on Electronic Standards and Measurements, Paper No. 1.3. (Published versions of all papers read at the Boulder Conference mentioned in this and succeeding references are planned to appear in Transactions of the Institute of Radio Engineers under the Professional Group on Instrumentation.)

[8] The role played by g in determinations of other important constants has been ably discussed by R. D. Huntoon and A. G. McNish of the United States National Bureau of Standards in the following two papers: R. D. Huntoon and A. G. McNish, Nuovo cimento, 6, 146 (1957); R. D. Huntoon, Minutes of the August 13, 1958, Boulder, Colorado, Conference on Electronic Standards and Measurements, Paper No. 1.1.

[9] A. M. Sessler and R. L. Mills, Phys. Rev. 110, 1453 (1958). C. K. Iddings and P. M. Platzman, California Institute of Technology (to be published).

[10] Jesse W. M. DuMond, Minutes of the August 13, 1958 Boulder, Colorado, Conference on Electronic Standards and Measurements, Paper No. 1.2.

NUCLEAR SPIN OF 12.6-HOUR IODINE-130†

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The nuclear spin of 12.6-hr I^{130} has been measured by means of an atomic-beam magnetic-resonance experiment and found to be 5. The apparatus used to make this measurement was designed for the observation of the nuclear spins and hyperfine structure of the radioactive halogen isotopes and has been described elsewhere.[1]

The I^{130} was produced in the Berkeley 60-inch cyclotron by bombarding powdered tellurium metal with 12-Mev protons, by the use of the reaction $Te^{130}(p,n)I^{130}$. The radioactive iodine was evaporated from the target material in an electric furnace and collected upon a cooled platinum disk. The iodine was washed from the disk with sodium hydroxide solution containing sodium iodide carrier, and the mixture of radioactive and natural iodine was precipitated in acid solution by $NaNo_2$ oxidizing agent. After the iodine was extracted into carbon disulfide containing additional iodine carrier, the solution was evaporated to dryness under vacuum and introduced into the apparatus through a heated platinum tube to dissociate the I_2 molecules to iodine atoms. The beam was collected upon buttons previously sprayed with evaporated silver, and then counted in continuous-flow methane proportional counters.

The nuclear spin of the radioactive sample was measured by the method described in reference 1. For normal ordering of the hyperfine levels in atoms such as the halogens, with ${}^2P_{3/2}$ electronic ground state, two "flop-in" resonances are observable at each value of the magnetic field. For spin $I \geq 1$ these may be denoted as

$$\alpha: (F=I+3/2, M_F=-I+1/2) \rightarrow (F=I+3/2, M_F=-I-1/2),$$

and

$$\beta: (F=I+1/2, M_F=-I+3/2) \rightarrow (F=I+1/2, M_F=-I+1/2).$$

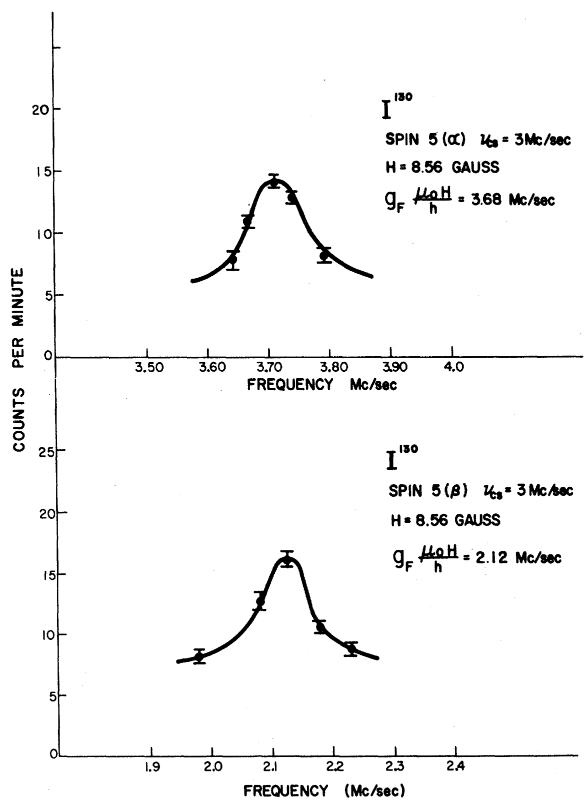

FIG. 1. Spin 5(α) and 5(β) resonances in I^{130}.

Both resonances have been observed in I^{130} at three different magnetic fields of 2.86, 8.56, and 14.24 gauss. Figure 1 exhibits two typical resonances obtained at a field of 8.56 gauss. Positive identification of the isotope was made by means of its decay half-life, and by analysis of its gamma-ray spectrum using a 100-channel pulse-height analyzer.

The value of 5 for the nuclear spin of I^{130} is consistent with the single-particle shell model of the nucleus.[2] The spins of I^{129} and I^{131}, both with an even number of neutrons, are known to be 7/2. If in I^{130} the odd proton is assigned to the $1g_{7/2}$ level and the odd neutron to the $2d_{3/2}$ level, Nordheim's weak rule applies, and the observed spin results from a coupling of j_n and j_p to the maximum permissible value. If on the other hand the odd neutron is assigned to the neighboring $1h_{11/2}$ level, Nordheim's strong rule applies and a spin of 2 can be expected.[3] It is thus likely that the odd neutron in I^{130}, as in ${}_{54}Xe_{77}{}^{131}$, occupies the $2d_{3/2}$ level.

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[1] Garvin, Green, and Lipworth, Phys. Rev. 111, 534 (1958).
[2] M. G. Mayer and J. H. J. Jensen, Elementary Theory of Nuclear Shell Structure (John Wiley and Sons, New York, 1955), pp. 194-196.
[3] L. W. Nordheim, Revs. Modern Phys. 23, 322 (1951).

LEVEL INVERSION IN THE HYPERFINE STRUCTURE OF BROMINE-76. NUCLEAR MOMENTS OF BROMINE-76†

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In the course of an investigation of 17-hr Br^{76} by the method of atomic beams, it has been established that the ratio of the nuclear electric quadrupole and magnetic dipole interaction constants is such that the zero-field hyperfine levels do not occur in normal order.

The nuclear spin of Br^{76} is 1.[1] The electronic