corpuscular rays are not deflected, by passing through the iron to such a great extent, as electrons or protons of 10 or 20 milliards e-volt would be, provided the effective magnetic field is identical with the induction field. (In the latter experiment, for example, it was from electrons of 10^{10} e-volt that an effect of 20 per cent was to be expected.)

A fuller description of the experiments, with a more exhaustive discussion of the results obtained, will be published later.

BRUNO ROSSI.

Physical Institute, University of Florence,
    Arcetri, Italy, July 10.

[1] W. Bothe und W. Kolhörster, *Zeit. f. Phys.*, **56**, 751 ; 1929.
[2] B. Rossi, *Rend. Lincei*, **11**, 478 ; 1930.
[3] L. M. Mott-Smith, *Phys. Rev.*, **37**, 1001 ; 1931.
[4] B. Rossi, *Phys. Rev.*, **36**, 606 ; 1930.

Nuclear Moments of the Isotopes of Lead : Relative Values of the $g(I)$ Factors of Pb(207) and Tl.

As a continuation of the programme that was initiated with the analysis of the hyperfine structure of Tl II,[1] the hyperfine structure of Pb III was investigated. The important Pb III lines [2] in the visible region were examined by means of a concave and an echelon grating. The structure and intensities of the patterns were interpreted consistently by attributing $I = 0$ to the two even isotopes Pb(206) and Pb(208), and $I = \frac{1}{2}$ to the odd isotope Pb(207). This interpretation is in agreement with Kopfermann's[3] deductions based on the structure of Pb I and II lines and with Schüler and Keyston's [4] inference based on intensity measurements of the lead line λ4058.

The observed H.F.S. of Pb(207) III is similar in regard to relative separations to that of Tl II. The magnitudes of the separations in Pb(207) III, however, are much smaller than those of Tl II. The separation of the $6s7s$ $^3S_1$ of Pb(207) III is only 2·25 cm.$^{-1}$ as compared with the 4·97 cm.$^{-1}$ separation of the corresponding state of Tl II.

From these separations of the $^3S_1$ states of the two spectra, the values of the interaction constants of the $6s$ electrons of the $6s7s$ configurations of Pb(207) III and Tl II can be evaluated.[5] A comparison of these values shows that the $g(I)$ factor of the Tl nucleus is about four times that of the Pb(207) nucleus.

This result is especially significant. Up to the present the observed I values have been explained consistently on the assumption that only spinning protons contribute to the resultant moment of the nucleus.[6] The simple assumption that each proton contributes $\frac{1}{2}h/2\pi$ to the resultant was sufficient to explain the known facts. On this simple theory, the resultant moments of the nuclei of Tl and Pb(207), for both of which $I = \frac{1}{2}$, would be due to one un-neutralised spinning proton. The $g(I)$ factors of the two nuclei, then, would be expected to be the same, since there is no evidence to indicate why different spinning protons with the same mechanical moments should have widely different magnetic moments. Contrary to this expectation, experiment shows that the $g(I)$ of the Tl nucleus is about four times that of the Pb(207) nucleus. The obvious conclusion is that the moment of at least one of the nuclei is composite and not due simply to a spinning proton. This conclusion invalidates the simple rule that each proton contributes $\pm \frac{1}{2}h/2\pi$ to the resultant, and necessitates endowing some of the protons in at least one of the nuclei with some property in addition to spin.

Our knowledge of extra-nuclear electronic structure suggests orbital motion. This model is not extreme, since the dimensions of a proton relative to a complete nucleus are of the same order as the dimensions of an electron to the atom. Such a model has the possibilities of explaining not only resultant I values, but also the nuclear $g(I)$ factors, even if the latter are negative.

J. C. McLENNAN.
M. F. CRAWFORD.
L. B. LEPPARD.

[1] McLennan and Crawford, in Press.
[2] Smith, *Phys. Rev.*, vol. 34, p. 393 ; 1929.
[3] Kopfermann, *Naturwiss.*, **19**, p. 400 ; 1931.
[4] Schüler and Keyston, *Z. f. Phys.*, **68**, p. 174 ; 1931.
[5] Pauling and Goudsmit, " Structure of Line Spectra ", chap. xi.: McGraw-Hill, New York, 1920.
[6] Bartlett, *Phys. Rev.*, vol. 37, p. 327 ; 1931.
[7] Page and Watson, *Phys. Rev.*, vol. 35, p. 1584 ; 1930.

Diamagnetism of Liquid Mixtures.

WITH regard to the discussion in NATURE by Trew and Spencer[1] and Ranganadham[2] on the diamagnetism of liquid mixtures, I should like to communicate the following data based on measurements carried out by me.

I find that the deviations from the susceptibility for the mixture calculated from the proportions of the components for acetone-chloroform is only 2 per cent. I find no trace of paramagnetism. Trew and Spencer believe that the paramagnetism they find for this mixture is probably attributable to the formation of dimethyltrichloromethyl carbinol (in German, Tri-chlorbutylalkohol tertiär), which their measurements show to be *paramagnetic*. I find this substance to be *diamagnetic* ($\chi = -0·65 \times 10^{-6}$, and with water of crystallisation present $\chi = -0·67 \times 10^{-6}$). Further, for this substance I have obtained values of $\chi = -0·64_5$ and $\chi = -0·66 \times 10^{-6}$ respectively from calculation following Pascal's rule. Again, the density of this substance according to Trew and Spencer is 0·66, whereas I find it to be 1·5, and these authors state that the substance is pale yellow, while all chemical references agree that it is white, a fact which I have observed myself. I find in agreement with previous work that the melting-point is 96·5° C. (97° C. ?) and 76° C. in the case where water of crystallisation is present. Two samples of dimethyltrichloromethyl carbinol where investigated, one from Kahlbaum, the other made by Frl. Karin Meyer ; the two showed identical properties.

The capillary ascension method of Quincke was employed using field strengths of 8200, 3850, 1800, and 1300 gauss ; the last of these gave only qualitative results since the sensibility at this field strength was not sufficiently great. In view of the present results, the possibility of explaining Trew and Spencer's measurements (at 640 gauss) by an anomalous depend-ence on the field strength is thus probably excluded. For the dimethyltrichloromethyl carbinol a Weiss (bifilar) balance method was employed to determine the susceptibility using a field of 8500 gauss.

It should also be noticed that the density curve for acetone and chloroform, given by Trew and Spencer in their original paper, shows that dimethyltrichloro-methyl carbinol could not have been present in this mixture, for if it had been, a large density anomaly would have appeared.

The use of Pascal's theoretical values, by means of which Trew and Spencer have attempted to support their results, appears to me to be misleading. For example, the single exception in agreement between theory and measurements quoted by Trew and Spencer, namely, acetone, is precisely the substance for which the large deviations are found to occur. Further, a closer inspection of Pascal's results shows that the deviations between calculated values and experimental observations of other authors are system