hand side of (12) for making the necessary adjustment of the field with reference to physical conditions. Q_0 would naturally affect the coefficients in (11) as well.

What is significant is that near the origin, the density $\rho \propto t^{-2}$ and that v^1 is suggestive of the velocity-distance law.

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N.M.R. STUDY OF HEXAMETHYLENETETRAMINE AT ROOM TEMPERATURE

THE present study of proton magnetic resonance of hexamethylenetetramine ($C_6H_{12}N_4$) at room temperature reveals the check of molecular structure and also the discrepancy of second moments calculated by various workers.[9,10] The authors have also calculated the second moments taking different C–H distances.

The structure of hexamethylenetetramine has been investigated by X-ray method by R. G. Dickson and A. L. Raymond.[1] They found that it is a body-centered cubic lattice with $a = 7{\cdot}02$ Å and $Z = 2$, lying in the space group $T^{\beta 3}$ ($I\bar{4}3m$). This structure is in one of the unique cases where the molecules of point groups $\bar{4}3m$ completely retain their symmetries in the crystal. Within the experimental error the valence angles are tetrahedral (110° 6′) with C–N = $1{\cdot}44_8 \pm 0{\cdot}01_5$ and C–H = 1·09.

Different workers have referred different values of C–H distance; thus Schomaker and Shaffer[2] have taken C–H = 1·09, Anderson[3] has taken it as (1·13) and R. Brill and co-workers[4] as (1·175) according to their different techniques of measurement.

The present work deals with the measurement of second moment (Van Vleck)[5] at room temperature (16° C.) and was corrected for modulation amplitude (Andrew).[6] The second moment (S_0) is calculated from the sum of intramolecular (S_1) and intermolecular (S_2) contributions. Moreover the intermolecular contribution can be broken into truncated contributions at radius M (where $r_{jk} \gg$ M) and terminal contributions (Ibers and Stevenson).[7] It is often found necessary to treat only neighbours up to about 5 Å distant and to change the sum for remaining ones into an integral assuming the more distant neighbours to be uniformly distributed with known density (Andrew).[6] In the present case the second moment at room temperature is approximately the same as at rigid lattice temperature. Hence the value of (S_1) is calculated in Table I taking the different values of C–H at room temperature using the formula for protons:

$$S_1 = 358{\cdot}1\ N_0^{-1} \sum n_i \sum r_{ij}^{-6}\ \text{gauss}^2.$$

The intermolecular contributions can be calculated by the formula:

$$S_2 = 358{\cdot}1\ N_0^{-1} \sum_j n_j^i \sum_i N_i \sum r_{jk}^{-6} \cdot$$

$$+ 358{\cdot}1 \times 4\pi N_p\ (3M^3\ V)^{-1}$$

where r_{jk} is the radius between protons j and k, N_0 is the per molecule proton number n_i is the equivalent protons of type i, M is the cut-off radius, V is the volume of unit cell in A^3 and N_i is the number of molecules on the i-th nearest neighbour sites.

TABLE I

Intramolecular contribution at room temperature

C-H in Å	Intramolecular contribution (S_1)
1·17	12·30 (gauss²)
1·13	14·23 ,,
1·09	16·61 ,,

Yagi[9] has worked on the same problem and calculated the second moment at room temperature assuming C–H = 1·09 Å and tetrahedral angle. He found second moment to be $16{\cdot}8 \pm 0{\cdot}5$ gauss² which is in disagreement with theoretical value. Later G. W. Smith[10] also calculated and found second moment 20·2 gauss² taking C–H = $1{\cdot}13 \pm 0{\cdot}02$ Å. He emphasised that the discrepancy in result arises from the fact that Yagi has neglected the intermolecular contribution assuming that it is less than 0·1 gauss². Thus the second moment is practically all-intramolecular contribution. According to Smith (S_2) must be taken into account. He calculated (S_2) of hexamethylenetetramine and found to be 5·80 gauss² for M = 4·80 Å. Here authors have calculated the theoretical value of second moment taking C–H = 1·09 and also the contribution of nitrogen nuclei as follows:

$S_0 = S_1 + S_{2\,\text{trunc}} + S_{2\,\text{term}}$ + nitrogen contribution

$= 16{\cdot}61 + 4{\cdot}86 + 0{\cdot}94 + {\cdot}05$

$= 22{\cdot}46$ gauss.²

The N.M.R. broadline spectrometer has been described elsewhere[12] and the record of hexamethylenetetramine (Fig. 1) was taken at

FIG. 1. Showing proton resonance of Hexamethylene tetramine at room temperature at 25 Me/sec,

25 Mc/Sec. by one of us at the University College of North Wales, Bangor, U.K. The practical value of second moment is found to be 22·43 gauss^2 which agrees well with theoretical value (22·46 gauss^2) when C–H distance is taken 1·09 Å.

The rotational second moment has also been calculated which is totally intermolecular and found to be ·9 gauss^2. Therefore intermolecular contribution must be included by Yagi. Also the C–H distance (1·09 Å) taken by Yagi is well in agreement than the distance taken by Smith (1·13 Å). The C–H distance concluded by the authors is also confirmed by *Tables of Interatomic Distances*[11] published by Chemical Society, London.

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COMPTON SCATTERING OF GAMMA-RAYS FROM BOUND ELECTRONS

THE available data on Compton scattering of gamma-rays from bound electrons are too scanty to derive any useful information regarding the incoherent scattering function $S(q, z)$ which describes the effect of binding and motion of the scattering electrons. Our earlier experiments[1] on the small angle scattering of low energy gamma-rays showed that for small values of momentum transfer involved in the scattering process, the Compton scattering cross-section from bound and moving electrons is less than that from free and stationary electrons, *i.e.*, the value of scattering function is less than unity and its value decreases as momentum transfer decreases. The experiments[2-4] on large angle scattering of high energy gamma-rays, however, show that the situation is reversed at large values of momentum transfer. The scattering function attains values greater than unity and the Compton scattering from bound electrons becomes more intense than that from free electrons. No information is yet available about the integrated Compton cross-section from bound electrons where the momentum transfer may vary from zero to some maximum value depending upon the energy of gamma-rays. From the data so far available it may be guessed that the integrated Compton scattering cross-section from bound electrons may be either less than, or equal to, or greater than that from free electrons depending upon the maximum value of the momentum transfer which in turn depends upon the energy of gamma-rays. Unfortunately at low gamma-ray energies the interference from the photoelectric interaction becomes too great to make the measurement of integrated Compton cross-section from bound electrons possible. It is, therefore, hard to draw any worth-while conclusions regarding the integrated Compton cross-section of low energy gamma-rays from bound electrons. However for gamma-rays of energy higher than 1 MeV the contributions of Compton and photoelectric interactions are comparable and this makes the determination of the integrated Compton scattering cross-section from bound electrons possible.

We have measured the integrated Compton scattering cross-section of Co-60 gamma-rays (1·17 MeV and 1·33 MeV) from K-electrons in tungsten and report the result in this letter. The experimental details are omitted and will be reported elsewhere.

1·17 MeV and 1·33 MeV gamma-rays from about 500 mc. Co-60 source were collimated on