reverse the fluorine spin,

$$h\nu = g_N\beta_N H - \bar{M}\Sigma A^N = g_N\beta_N H - (\chi H/Ng\beta)\sum A^N = g_N\beta_N H(1-\alpha), \tag{2}$$

where

$$\alpha = (\chi/Ng\beta g_N\beta_N)\Sigma A^N = 669\chi\Sigma A^N, \tag{3}$$

if A is in units of cm^{-1}.

Each A is an anisotropic tensor quantity, whose value for a direction (l,m,n) with respect to its principal axes is given by

$$A^2 = l^2A_x^2 + m^2A_y^2 + n^2A_z^2.$$

Thus in an arbitrary plane the shift, if small, should vary with $\cos^2\theta$, where θ is the angle between the external magnetic field and one of the directions of maximum shift in this plane, as shown in Fig. 2 of reference 1. Each fluorine is bonded to three nearest Mn^{2+} ions, and if bonding to other ions is neglected, it can be shown that the extreme values of ΣA^N in the ab-plane are $(2A_y^{I}+A_x^{II})$ and $(2A_x^{I}+A_y^{II})$ respectively (the nomenclature is that of reference 2). In Tinkham's experiments A_x could not be determined owing to lack of resolution, but the values for the other directions are

$$\left.\begin{array}{ll} A_y^{I}=16.5\pm0.7, & A_y^{II}=14.6\pm1.2 \\ A_z^{I}=18.2\pm0.2, & A_z^{II}=12.5\pm0.2 \end{array}\right\}\times10^{-4}\ \mathrm{cm}^{-1},$$

and he estimates that A_x^{I} is nearly equal to A_y^{I}, while A_x^{II} is nearly 30% larger than A_y^{II}. This gives a mean value in the ab-plane of $\Sigma A^N = A_x^{I}+A_y^{I}+\frac{1}{2}A_x^{II}+\frac{1}{2}A_y^{II} = (49.5\pm4)\times10^{-4}$ cm^{-1}. With the susceptibility data of de Haas, Schultz, and Koolhaas,[3] this gives at 77°K the value $\alpha=0.077\pm0.006$, in close agreement with the observed value 0.0776 (with demagnetizing correction). The exact agreement is fortuitous, since Tinkham's estimates give too small an anisotropy for the shift in the ab-plane. A more delicate test would be obtained from a measurement along the c-axis (z-axis) where Tinkham's results are more precise $[2A_z^{I}+A_z^{II} = (48.9\pm0.6)\times10^{-4}$ cm^{-1}; giving $\alpha=0.0759\pm0.001$ at 77°K].

Shulman and Jaccarino report that the fluorine resonance disappears in the antiferromagnetic state. If the manganese ions are then in their states $M_z=\pm5/2$, there will be a large field at the fluorine nucleus parallel to the c-axis even in the absence of an external field. Since the two type I manganese ions to which the fluorine is bonded belong to one sublattice, while the type II manganese belongs to the other sublattice, the resonance should occur at $h\nu=(5/2)(2A_z^{I}-A_z^{II})$, or at a frequency of 179±2 Mc/sec. With an oscillatory field normal to the c-axis, it may be possible to detect this resonance at low temperatures, but A^N is sensitive to small changes in the bond distances and the frequency may be slightly different from that computed above by using Tinkham's data on Mn^{2+} ions in ZnF_2.

* At present: Visiting Professor, Department of Physics, Columbia University, New York, New York.

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Thiourea, a New Ferroelectric

Allen L. Solomon*
RCA Laboratories, Princeton, New Jersey
(Received September 19, 1956)

THIOUREA is orthorhombic at room temperature.[1] When evaporated silver electrodes are applied to (010) faces of thin, clear plates, hysteresis loops are observed below −104.8°C and a pronounced dielectric constant anomaly is found in this neighborhood. Immediately above this temperature, double loops similar to those described for $BaTiO_3$[2] are observed. The spontaneous polarization is approximately 3.1 microcoulombs/cm² and the coercive field is less than 1000 volts/cm at 60 cycles and −110°C.

Clear crystals have been obtained by the slow evaporation of a saturated solution of thiourea (Distillation Products Industries) in methanol. By slow growth with stirring in a bath held around 30°C, thin tablets were grown with (010) faces which were electroded following an alcohol wash. Some solutions yielded small, clear hexagonal-based prisms which could be cleaved perpendicular to the ferroelectric direction into thin plates.

The author wishes to acknowledge the help of Dr. George J. Goldsmith who carried out the electrical measurements and Dr. John G. White whose x-ray data established the ferroelectric direction.

* Present address: Chemistry Laboratory, Sylvania Electric Products, Inc., Flushing, New York.

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Simulation of Solar Prominence in the Laboratory*

Winston H. Bostick
University of California Radiation Laboratory, Livermore, California
(Received September 19, 1956)

IT is possible to locate a source[1] of plasma in the pole piece of a horseshoe (permanent) magnet, as shown in Fig. 1, and project the plasma outward along the lines of magnetic force. If only one plasma source is employed and the magnet and the vacuum tank "float"