TABLE I. Temperature dependence of line widths.

Temperature Kelvin	$\bar{\mu}/\mu$	$P/\Delta\nu$ arbitrary	$(T\Delta\nu\mu)/(\bar{\mu}P)$	$(T^{\frac{1}{2}}\Delta\nu\mu)/\bar{\mu}P$
300	0.54	1±0.02	556±10	32.1±0.6
195	0.516	0.66±0.02	574±15	41.0±1.0

are summarized in Table I. In interpreting the data, it is assumed that the line width is also proportional to the average component of dipole moment $\bar{\mu}$ of the colliding molecules along the angular momentum axis.[2,3] As $\bar{\mu}$ varies slightly with temperature, its ratio to the static dipole moment μ is also tabulated.

The experiment clearly shows that $\Delta\nu$ is inversely proportional to the temperature and hence σ is inversely proportional to the impact velocity, confirming Anderson's theory. These results however should not be extrapolated indiscriminately to all types of microwave collision broadening. They may be expected to hold rigorously only for an inverse cube dependence of interaction energy on molecular separation—exemplified by the above symmetric top dipole-dipole interactions. Experimental and theoretical papers on these and other interactions are now in preparation.

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Recoil Electron Spectrum of the K^{40} Gamma-Ray

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THE observation that the ratio of positron emission to electron capture in the decay of K^{40} is $\lambda^{\beta+}/\lambda^{c}<0.005$, leads to the conclusion that the $A^{40}-K^{40}$ mass difference must be less than 1.6 Mev, if expressions for either third or fourth forbidden beta-transitions and axial vector or tensor interactions are used.[1] As considerations of the K^{40} β^- energy end point[2] seem to indicate that the gamma-ray from K^{40} be placed on the A^{40} side of the decay scheme, it is remarkable that the energy which has been observed[3] for the gamma-ray of 1.55±0.05 Mev should be so close to the maximum possible $A^{40}-K^{40}$ mass difference. It was therefore thought of interest to measure the energy of the gamma-ray more accurately, using the new scintillation spectrometer which we have developed.[4]

The crystal element of activated NaI, $1''\times1''\times1''$, was surrounded by approximately 90 g of KF, and the recoil electron spectrum which was obtained after filtering of the radiation by 4 mm of Al is shown in Fig. 1. The shape of the spectrum was later confirmed using another source of KCl. The pulse height distribution for the background is given and also the recoil electron spectrum of an uncollimated beam of Co^{60} gamma-rays for purposes of comparison and calibration. The Co^{60} scale is greatly reduced and ordinates refer only to the K^{40} and background spectra. In these experiments the spectrometer was enclosed in a three-inch wall lead castle. The photo-cell noise becomes apparent only below 20 kev on the pulse scale and the rise in the recoil electron spectra at low energies is attributed to degenerate radiation entering the crystal, as well as to the loss of recoil electrons from the surfaces and possible low energy gamma-rays in the case of $K^{40}\rightarrow Ca^{40}$. Any differences in the form of the two spectra are due, in addition, to the nature of the extended source in the case of K^{40}, and to the existence of two Co^{60} gamma-rays. It would not be possible from these results to draw any conclusions

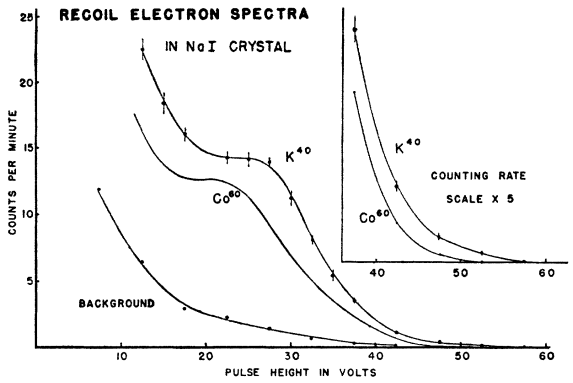

FIG. 1. Differential pulse height distributions obtained with scintillation spectrometer. The curves for K^{40} and Co^{60} have been corrected for background.

regarding a possible complexity of the K^{40} gamma-radiation. Careful consideration has been given to the manner of approach to the axis of the two spectra near the end point (Fig. 1) and, due account being taken of resolving power, the form of the Compton distribution, etc., a value has been estimated for the gamma-ray energy for K^{40} of 1.47±0.03 Mev in terms of the 1.33 Mev Co^{60} gamma-ray. This means that the energy available for electron capture to the excited state of A^{40} is less than 0.13±0.03 Mev. Coincidence experiments are being carried out to elucidate further the decay scheme.

The scintillation spectrometer has been used to measure the possible gamma-activity of certain members of the isobaric pairs of nuclei of neighboring Z. In some cases (notably cerium) activity has been observed but measurements with the spectrometer have indicated these activities to be due in the main to minute traces of thorium. Attempts are being made to have the purest possible materials prepared for this work.

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The Cation Distribution in Ferrites with Spinel Structure

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FROM studies of the cation distribution in spinels it was concluded by Verwey and co-workers[1] that, for the ferrites with this structure, zinc ferrite and cadmium ferrite are normal spinels while nickel-, copper-, magnesium-, ferrous- and manganese-ferrite are inverse spinels.[2] In the normal spinel the divalent ions (zinc or cadmium) occupy the tetrahedral position while the trivalent iron occupies the octahedral position. In the inverse spinel the tetrahedral position is occupied by one-half of the trivalent iron ions while the octahedral positions are occupied by a random distribution of the remainder of the iron ions together with the divalent cations (e.g., Cu^{+2}). In addition, it was indicated that a solid solution of a normal-spinel ferrite with an inverse-spinel ferrite (for instance, zinc ferrite in solid solution with copper ferrite) had a structure in which, in the example taken, the tetrahedral positions were occupied preferentially by Zn^{+2}, the remainder of these positions being filled by Fe^{+3}; the octahedral positions were occupied by the remaining Fe^{+3} and the Cu^{+2}.

Néel,[3] however, from a consideration of the magnetic properties of the ferrites concludes that the cation distribution is not as "ordered" as in the description given. The distribution according to Néel may vary so that, for instance, the distribution in copper ferrite is not simply $Fe\,[FeCu]O_4$ but may be $Fe_{0.82}Cu_{0.18}$