0.1 c, where c is the velocity of light. The sound velocity in nuclear matter can be calculated from the estimates of the nuclear compressibility.[4] It also turns out to be of order 0.1 c. The mean free path of the nucleons is evidently shorter within the outgrowth than within usual undeformed nuclei, which is $\sim 5 \times 10^{-13}$ cm if one takes the imaginary part of the optical potential to be approximately 0.2 of the real part.

These considerations evidently show that the conditions for the appearance and the propagation of shock waves in the fission fragments are fulfilled. Concerning the damping of the shock wave, one would have first to determine its emergence from the outgrowth. However, the damping is clearly rather large and the energy contained in the shock wave will suffice on the average just for the emission of one neutron of very low energy. Part of the energy contained originally in the deformation of the outgrowth will be used up in achieving the equilibrium shape of the fragment, and in its heating. The latter will lead to a background in the observed neutron spectrum, which is not in disagreement with the evaporation mechanism.

If the proposed fission neutron emission mechanism actually occurs, then a more accurate measurement of the fission neutron spectrum and angular distribution will be able to provide information on the deformation of the fragments at a time just prior to the fission. It further could improve our knowledge on the compressibility of nuclear matter, which plays an important part in the mechanism of nuclear fission.

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111

LINE WIDTH OF THE CHLORINE QUADRUPOLE RESONANCE IN CHLORATES OF BARIUM, SODIUM, AND POTASSIUM

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THE large number of factors that tend to broaden the nuclear quadrupole resonance line make difficult the interpretation of absorption line shapes in crystals. However, in a number of cases it is possible to obtain information because mechanical stresses do not play an important role in powders if there are no temperature gradients. In the present work we have studied the width of the quadrupole resonance line in chlorates of barium, sodium, and potassium. The quadrupole resonances in sodium chlorate and potassium chlorate have been reported earlier;[1,2] however, in this work no precise measurements or interpretations of the line width were made.

These observations have been carried out using frequency or Zeeman modulation[3] a superregenerative circuit, a narrow-band, low-frequency amplifier, and a phase-sensitive detector. The reference voltage at the phase-sensitive detector was applied through a reference voltage amplifier which was provided with a phase shifter. The frequency modulation was obtained by means of a vibrating condenser and the Zeeman modulation was produced by means of a coil which was driven by rectangular pulses. All the measurements were carried out at room temperature. In the frequency-modulation measurements the second derivative of the absorption line was recorded since by this means it is possible to suppress spurious amplitude modulation. The correction to the second moment for the second derivative was obtained by the method proposed by Andrew

$$S^* = S_0 + \nu_m^2/6, \qquad (1)$$

where S* is the second moment of the absorption line observed in the experiment, S_0 is the true second moment, and ν_m is the amplitude of the frequency modulation. Equation (1) applies in the case in which the amplitude of the frequency modu-

lation is much smaller than the line width. Starting from the Duhamel formula it can be shown that distortions due to rapid passage through the resonance region and the time constant of the phase detector are given by the following when frequency or Zeeman modulation are used:

$$S^* = S_0 + 2(v\tau)^2, \qquad (2)$$

where v is the rate of passage through the resonance region and τ is the time constant of the detector. The final measurements were made with Zeeman modulation. The use of a superregenerative system makes it possible to use a convenient frequency scale since the signals follow the quenching frequency. The quadrupole resonance signals of Cl^{35} and Cl^{37} were observed in $Ba(ClO_3)_2$, $NaClO_3$, and $KClO_3$ powders. At the present time we have also observed the quadrupole resonance in calcium chlorate. The observed signal amplitudes are in good agreement with the natural abundances of the chlorine isotopes. The amplitude of the rf field was rather small in order to avoid the additional broadening, which exceeds the nuclear magnetic resonance broadening by a factor of 4. In spite of the low level of the rf field the signal-to-noise ratio in potassium chlorate was of the order of 60 for Cl^{35}. The total width of the lines were measured at half heights.

The results of the experiment are shown in the table; it is apparent that in these chlorates the line width is determined basically by nuclear dipole-dipole interactions since the ratio of magnetic moments of the chlorine isotopes is 1.2. An estimate of relaxation-time broadening shows that this quantity is less than 0.03 kcs.[4] Because $NaClO_3$ is a cubic crystal, a simple expression can be used for the second moment[5]

$$h^2\langle\Delta\nu^2\rangle_{av} = 60q^4\beta^4d^{-6}, \qquad (3)$$

where h is Planck's constant, g is the gyromagnetic ratio, β is the nuclear magneton and d is the size of an elementary cell.

It should be noted that Eq. (2) applies in the case in which the center of the line is not shifted. When making corrections, however, one must take account of the displacement of the center. With the introductions of corrections for broadening due to the magnetic field of the earth, the rate of passage through the resonance region, and effects due to sodium atoms, the second moment for Cl^{35} in $NaClO_3$ is found to be

$$\langle\Delta\nu^2\rangle_{av} = 0.42\cdot10^5 \text{ cs}^2.$$

Whence we find that d = 6.9 A. This result is in good agreement with the x-ray data,[6] according to

Material	Isotope	Frequency, Mcs.	$\Delta\nu$, kcs	$\frac{\Delta\nu(Cl^{35})}{\Delta\nu(Cl^{37})}$
$Ba(ClO_3)_2$	Cl^{35}	29.6	2.8	1.07
	Cl^{37}	23.2	2.6	
$KClO_3$	Cl^{35}	28.1	1.1	1.2
	Cl^{37}	22.2	0.9	
$NaClO_3$	Cl^{35}	29.9	1.3	1.13
	Cl^{37}	23.6	1.15	

which d = 6.5 A in $NaClO_3$. The calculation which has been carried out on the basis of well-known crystal structures shows that the line shapes in chlorates are amenable to straight-forward interpretation.

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112

CROSS SECTION OF Te^{125m} PRODUCTION VIA THE (n, γ) REACTION

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WHEN an isomer pair is produced via the (n, γ) reaction, the more probable of the two isomers is the one whose spin is closest to that of the initial nucleus.[1] It has been established that for isotopes of tin, tellurium, and zenon the production cross section of an isomer state with spin $^{11}/_2$ amounts to several dozens of millibarns. Exceptions are the isotopes of tellurium 122 and 124, for which