nal polarization of the hyperon, then there must be asymmetry relative to at least one of these planes. It must be noted that since the properties of the longitudinal polarization (if there is any) are unknown, it may possibly be different (in magnitude and sign) for different angles of production of the hyperon, and the effect may be cancelled out to some extent in integrating over the angles. In this connection it would be interesting to study this process in a narrow range of angles of production of the hyperons.

At high π-meson energies the most probable processes will be those with three or more particles in the final state. In this case the reaction $\pi^- + p \to \Sigma^- + K^+ + \pi^0$ is of great interest. If parity is not conserved in the production of hyperons and K mesons, there will be an asymmetry in the distribution of the K mesons relative to the plane (in the center-of-mass system) containing the directions of the incident π meson and the Σ particle. It must be pointed out that this reaction is a very convenient one from the point of view of the processing of the experimental data. The advantage of this and analogous reactions ($K^- + d \to \Lambda + p + \pi^-$; $\pi^- + p \to Y^0 + K^+ + \pi^-$) lies in the fact that the asymmetry does not depend on the properties of the longitudinal polarization, so that one can obtain better statistics by totalling the experimental data for all angles of production of the hyperons.

***The writer is grateful to Professor Drell for sending a preprint and an account of his work on the problem of PC conservation.**

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Translated by W. H. Furry.
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ON THE EMISSION MECHANISM OF PROMPT FISSION NEUTRONS

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Submitted to JETP editor October 30, 1958

J. Exptl. Theoret. Phys. (U.S.S.R.) **36**, 629-630 (February, 1959)

RECENTLY the energy and angular distributions of fission neutrons have been determined with respect to a system in which a fission fragment is at rest.[1] They are in disagreement with the mechanism hitherto usually considered for the emission of prompt fission neutrons, namely the analog of the evaporation of molecules from the surface of hot materials. The measurements show that the neutron angular distributions are strongly anisotropic with respect to the direction of motion of the fission fragment in the system of coordinates in which the fission fragment is at rest, and the energy distribution of the neutrons shows a sharp maximum at an energy of the order 0.1 to 0.2 Mev, with a width of the same order. As is well known the evaporation mechanism leads to an isotropic distribution with a Maxwellian energy spectrum. A possibility of an anisotropic neutron angular distribution can be understood from the point of view of Hill and Wheeler.[2] However, the motion of the nuclear surface can modulate the neutron evaporation spectrum only weakly and essentially cannot explain the sharp peak observed in reference 1.

The foregoing characteristics of the spectra of prompt fission neutrons can be explained by assuming that the surface energy, contained in the outgrowths which remain after the "neck" breaks at the instant of fission, is liberated in the form of a shock wave, which then propagates in the direction of motion of the fragment. Such a shock wave can lead to emission of almost monoenergetic neutrons along the direction of motion of the fission fragment.

To estimate the effect one has to know the form of the deformed fragments at the instant at which the "neck" breaks. At present there does not exist any experimental indications concerning this form. We therefore shall utilize the results of Hill,[3] which were derived within the framework of the liquid drop model. These computations show that right after the instant of fission each fragment has an outgrowth with linear dimensions exceeding the nuclear radius by a factor 1.5 to 2. Utilizing the commonly accepted value for the surface energy one can estimate that each outgrowth contains a deformation energy of the order 20 to 30 Mev. Knowing the number of nucleons in the outgrowth one can easily calculate the velocity of contraction of the outgrowths. This turns out to be of the order

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.

The author is deeply grateful to A. I. Leipunskiĭ for his critique of this paper and I. P. Stakhanov and A. A. Rukhadze for valuable suggestions and discussions.

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

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Submitted to JETP editor November 1, 1958

J. Exptl. Theoret. Phys. (U.S.S.R.) **36**, 630-632 (February, 1959)

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

$$S^* = S_0 + \nu_m^2/6, \tag{1}$$

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-