tween the asymmetry and scanning efficiency can in principle be tested by repeating the scanning of observers E, F, G by the observers who obtained a "good" result. In the present case even such a test cannot lead to reliable results in view of the insufficient statistics.

It is not without interest to note that the forward-backward asymmetry of slow pions from τ decay in the experiment of Garwin et al [4] is, contrary to the assertion of VKM, fully significant according to the usual statistical criteria: $\chi^2 = 9.3$ with one degree of freedom, i.e., $P(\chi^2) \approx 2 \times 10^{-3}$.

We are preparing for publication a thorough analysis of the entire problem of π-μ asymmetry, including other experimental data and other considerations not touched upon here.

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LOW-LYING NEGATIVE-PARITY LEVELS IN NONSPHERICAL NUCLEI

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LOW-LYING 1^- levels with energy 0.3—1.3 MeV have recently been observed in deformed even-even nuclei. [1] These levels correspond to internal excitations with K = 0 and negative parity. States of this type are treated in the hydrodynamic model as octupole oscillations of the nucleus relative to the equilibrium form, with energy ~ 3 MeV for the actinides. [2] The hydrodynamic model can thus explain neither the absolute positions of these levels nor their connection with the shell structure.

We propose an interpretation of the 1^- levels on the basis of the superfluid model. The Hamiltonian of the system includes, in addition to the pair interaction, an octupole-octupole interaction which has the same nature as the quadrupole-quadrupole used to describe collective oscillations of the quadrupole type in spherical [3] and nonspherical [4] nuclei. Using the method of approximate second quantization we can obtain, in the same manner as in [4], an equation for the excitation energy ($\hbar = 1$)

$$1 = \varkappa \sum_{\lambda\lambda'} {}_{n,\,p} \left| (q_{30})_{\lambda\lambda'} \right|^2 \frac{E_\lambda E_{\lambda'} - \varepsilon_\lambda \varepsilon_{\lambda'} + \Delta^2}{2E_\lambda E_{\lambda'}} \frac{E_\lambda + E_{\lambda'}}{(E_\lambda + E_{\lambda'})^2 - \omega^2}. \quad (1)$$

Here $q_{30} = r^3 Y_{30}(\theta)$ —single-particle octupole moment operator; the summation is over both the neutron (λ) and proton (λ') states; the single-particle state energies ϵ_λ are reckoned from the Fermi surface; $E = \sqrt{\epsilon_\lambda^2 + \Delta^2}$. In the summations over the neutron (proton) states in (1) we use the values $\Delta = \Delta_n(\Delta_p)$ and $\epsilon_0^n = \epsilon_0^n(\epsilon_0^p)$, where $\Delta_n(\Delta_p)$ is a constant characterizing the neutron (proton) pair correlation energy; $\epsilon_0^n(\epsilon_0^p)$ is the Fermi energy boundary for the neutrons (protons); κ —octupole-octupole interaction constant ($\kappa \sim \epsilon_0/AR^6$). This constant is assumed to be the same for nn, pp, and np interactions.

From the microscopic point of view, the foregoing excitations are bound states of quasi-particles with energy ω, projection of the total momentum on the nuclear symmetry axis K = 0, and negative parity. Equation (1) has, generally speaking, two solutions, which correspond at $\kappa \to 0$ to the breakup of a neutron or proton pair. As can be seen from (1), the excitation energies can be found if the scheme of the single-particle levels (say, the Nilsson scheme [5]) $\Delta_{n,p}$, and κ are specified. For a given group of nuclei, κ can be regarded constant. Therefore, by determining κ from the position of the 1^- level for one nucleus, we can determine from (1) the value of ω for the other nuclei of the given group.

It is of interest to find the probabilities of the electric dipole transition from the 1^- state to the ground state. In the model considered here the reduced probability of this transition is

$$B(E1;\, 1^- \to 0^+) = \frac{1}{6\omega} \left\{ \sum_{\lambda\lambda'} {}_{n,\,p}\, e_{n,\,p} (q_{10})_{\lambda\lambda'} (q_{30})_{\lambda\lambda'} \frac{E_\lambda E_{\lambda'} - \varepsilon_\lambda \varepsilon_{\lambda'} + \Delta^2}{2E_\lambda E_{\lambda'}} \right.$$
$$\times \left. \frac{E_\lambda + E_{\lambda'}}{(E_\lambda + E_{\lambda'})^2 - \omega^2} \right\}^2 \left\{ \sum_{\lambda,\lambda'} {}_{n,\,p} \left| (q_{30})_{\lambda\lambda'} \right|^2 \frac{E_\lambda E_{\lambda'} - \varepsilon_\lambda \varepsilon_{\lambda'} + \Delta^2}{2E_\lambda E_{\lambda'}} \right.$$
$$\times \left. \frac{E_\lambda + E_{\lambda'}}{[(E_\lambda + E_{\lambda'})^2 - \omega^2]^2} \right\}^{-1}, \quad (2)$$

where $e_n = -Ze/A$, $e_p = Ne/A$, e—proton charge, and $Z(N)$ —number of protons (neutrons).

Let us estimate B(E1) in the quasi-classical approximation for the low-lying 1^- levels ($\omega \ll 2\Delta_{n,p}$). In this case we can obtain, for example (see [4]),

$$\sum_{\lambda,\lambda'} |(q_{30})_{\lambda\lambda'}|^2 \frac{E_\lambda E_{\lambda'} - \varepsilon_\lambda \varepsilon_{\lambda'} + \Delta^2}{2E_\lambda E_{\lambda'}(E_\lambda + E_{\lambda'})^3}$$

$$\approx \frac{1}{4\Delta^2} \sum_{\lambda\lambda'} |(q_{30})_{\lambda\lambda'}|^2 \varphi\left(\frac{\varepsilon_\lambda - \varepsilon_{\lambda'}}{2\Delta}\right) \delta(\varepsilon_\lambda) \sim \rho_0 R^6 \Delta^{-2}, \quad (3)$$

where $\varphi(x) = x^{-2} - \ln(x + \sqrt{1+x^2}) \cdot [x^3\sqrt{1+x^2}]^{-1}$, ρ_0 —energy level density near the Fermi surface. The estimate in (3) is valid if the energy differences $\epsilon_\lambda - \epsilon_{\lambda'} \lesssim 2\Delta$. By examining the Nilsson scheme we see that at the observed values of quadrupole nuclear deformation β_0 there exist levels λ and λ' for which this condition is satisfied. Estimating in similar fashion the numerator of (2), we obtain

$$B(E1, 1^- \to 0^+) \sim \left(\frac{N-Z}{A}\right)^2 (eR)^2 \beta_0^2 \rho_0 \Delta \frac{2\Delta}{\omega}. \quad (4)$$

Formula (2) and the estimate (4) are derived without introducing the static octupole deformation (see [6] in this connection).

The reduced probability for the excitation of the 3^- level (rotational satellite of the 1^- level) is in this model

$$B(E3, 0^+ \to 3^-) = \frac{1}{2\omega} \left\{ \sum_{\lambda\lambda', p} |(q_{30})_{\lambda\lambda'}|^2 \frac{E_\lambda E_{\lambda'} - \varepsilon_\lambda \varepsilon_{\lambda'} + \Delta^2}{2E_\lambda E_{\lambda'}} \times \frac{E_\lambda + E_{\lambda'}}{(E_\lambda + E_{\lambda'})^2 - \omega^2} \right\}^2 \left\{ \sum_{\lambda\lambda', n, p} |(q_{30})_{\lambda\lambda'}|^2 \frac{E_\lambda E_{\lambda'} - \varepsilon_\lambda \varepsilon_{\lambda'} + \Delta^2}{2E_\lambda E_{\lambda'}} \times \frac{E_\lambda + E_{\lambda'}}{[(E_\lambda + E_{\lambda'})^2 - \omega^2]^2} \right\}^{-1}. \quad (5)$$

We note that (5) is derived without introducing the effective nucleon charge for the E3 transitions. Estimating $B(E3, 0^+ \to 3^-)$ in analogy with (3), we obtain

$$B(E3, 0^+ \to 3^-) \sim B_{\mathrm{s.p.}}(E3) \rho_0 \Delta \frac{2\Delta}{\omega}, \quad (6)$$

where $B_{\mathrm{s.p.}}(EL) \sim e^2 R^{2L}$ is the reduced probability for the single-particle transition. Comparing (6) with the estimated $B_{\mathrm{hydr}}(E3)$ in the hydrodynamic model, $B_{\mathrm{hydr}} \sim B_{\mathrm{s.p.}}(E3) \cdot A^{2/3}$ [2] we obtain the inequality

$$B_{\mathrm{hydr}}(E3) > B(E3) > B_{\mathrm{s.p.}}(E3). \quad (7)$$

It is seen from (5)—(7) that measurement of the cross section for the Coulomb excitation of the 3^- level is an essential check on the proposed model.

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PHONON SCATTERING ON IMPURITY IONS IN SODIUM CHLORIDE CRYSTALS

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LOCAL distortions in the sodium chloride crystal lattice in the environment of different impurity ions were recently successfully investigated with the aid of nuclear magnetic resonance. In particular, the radii of the distorted zones around Ag^+, Br^-, and K^+ ions were shown to be related as 1:1.4:1.9.[1] The distorted zone apparently plays an important role in the scattering of phonons. The phonon scattering cross section of an impurity ion can therefore be expected to be proportional to the square of the radius of the distorted zone and, consequently, the cross section for scattering on Ag^+, Br^-, and K^+ ions could be expected to be related as 1:2.0:3.5. The purpose of the present project was to verify this assumption.

At a low concentration of impurity ions, when the elastic constants and the heat capacity of a crystal with an impurity practically do not differ from the corresponding properties of a pure crystal, it can be asserted that $\Delta R/R_0 = f(l_0/l_{\mathrm{imp}})$, where R_0 is the thermal resistance of the pure