sure, did not exceed 1 x 10^{-9} dyne and therefore could not affect the measurement results. The charge of the pellet was measured with the aid of low-intensity x-rays. Preliminary measurements have shown that it is possible to produce a charge on the order of a hundred electrons on such a pellet. The fluctuations of the charge apparently determine the possibility of employing the described procedure in the search for quarks.

In conclusion, the author takes this opportunity to thank Ya. B. Zel'dovich and V. V. Migulin for valuable discussions.

[1] Ya. B. Zel'dovich, L. B. Okun', and S. B. Pikel'ner, UFN 87, 122 (1965), Soviet Phys. Uspekhi 8, in press.
[2] R. A. Millikan, Electrons, Protons, Photons, Neutrons, Mesotrons, and Cosmic Rays, Univ. of Chicago Press, 1947.
[3] J. W. Beams, J. Appl. Phys. 17, 886 (1946); Rev. Sci. Instr. 21, 182 (1950).
[4] W. Braunbek, Z. Physik 112, 764 (1939).
[5] N. N. Vasil'ev, Optika i spektroskopiya 18, 1065 (1965).
[6] C. Becchi, G. Gallinaro, and G. Morpurgo, Nuovo Cimento 39, 409 (1965).

CONCERNING INDUCED MANDEL'SHTAM-BRILLOUIN SCATTERING

A. A. Chaban
Acoustics Institute, Moscow

Submitted 22 November 1965
ZhETF Pis'ma 3, No. 2, 73-76, 15 January 1966

Several recent papers (cf., e.g., [1-4]) have dealt with theoretical and experimental aspects of induced Mandel'shtam-Brillouin scattering (IMBS). We shall show below that the elastic oscillations generated in IMBS are not ordinary sound waves, but anomalous waves of reduced propagation velocity and with beam velocity making a certain angle with the front. This phenomenon is similar in nature to that considered in [5]. It has apparently already been experimentally observed in the form of a shift of the Stokes line [4].

Let a plane light wave with constant energy flux density I_0 be incident along the z axis on a lens of focal distance ℓ. The energy flux dI which travels towards the focus from a solid angle element $d\Omega$ is equal to

$$dI(p) = I_0 \ell^2 p^3 \, d\Omega, \qquad (1)$$

where $p = \cos^{-1}\vartheta$ and ϑ is the angle between the direction of the light ray and the z axis. (The refraction of the light rays on the boundary of the investigated substance is disregarded for simplicity, inasmuch as it leads only to a numerical correction of no fundamental significance.)

The wavelength of the hypersound responsible for the IMBS is smaller by many orders of magnitude than the dimensions of the focal spot. Therefore in the first approximation it is sufficient to consider the propagation of elastic oscillations in an infinite homogeneous medium with amplification coefficient

$$\alpha(p) \simeq D\frac{dI(p)}{d\Omega} = D\, l^2\, I_0\, p^3 \quad \text{for} \quad p \leq p_0. \tag{2}$$

Here D is a constant, $p_0 = \cos^{-1}\vartheta_0$, and ϑ_0 is the maximum angle between the light rays and the z axis. When $p > p_0$ the amplification due to the IMBS decreases rapidly. In the derivation of (2) it has been assumed that the amplification coefficient of the hypersound propagating at an angle ϑ to the z axis is proportional to the value of $dI/d\Omega$ for this angle, with the angular dependence of the latter taken from (1).

We first ascertain what types of oscillations can propagate in a medium having the anisotropic gain properties indicated above. Let an infinite homogeneous plate, placed in the plane $z = 0$, oscillate with cyclic frequency ω. Let us find the resultant radiation from all the elements of the plate in the half-space $z > 0$. According to [5] the displacement at a point with coordinate z is equal to

$$u(z) = 2\pi A\int_1^{p_0} z\,\exp[i(\omega t - kzp) + \alpha(p)zp]dp. \tag{3}$$

Here A is a constant, $k = \omega/s$, and s is the speed of sound. If the amplification is so large that $\alpha(p_0)zp_0 \gg 1$, then

$$u(z) \simeq \frac{2\pi A}{ik}\exp[i(\omega t - \frac{kz}{\cos\vartheta_0}) + \frac{\alpha(\cos\vartheta_0)z}{\cos\vartheta_0}]. \tag{4}$$

Thus, in an active medium there can propagate along the z axis waves having an anomalously low velocity $s\cos\vartheta_0$ and an amplification coeffiecient $\alpha(\cos\vartheta_0)/\cos\vartheta_0$. In our case the problem is somewhat different from that considered above. It is necessary to trace the transformation of an ordinary wave after the amplification is turned on. It is clear from the symmetry properties that the wave number k cannot change. Consequently in our problem there will be amplified in the course of time a plane wave with the initial wave number, but with an altered frequency

$$\omega' = \omega\cos\vartheta_0. \tag{5}$$

The speed of sound will be $s\cos\vartheta_0$, and the amplification is described by the factor $\exp[\alpha(\cos\vartheta_0)st]$.

In the case of IMBS with a scattering angle 180°, the first Stokes component will be characterized by precisely this modified speed of sound. For Stokes components of higher order, the picture becomes extremely complicated. That the speed of sound determined from the induced scattering is lower than the speed obtained from scattering by thermal oscillation had been noted in [4], where this phenomenon was regarded as a consequence of heating under the influence of a powerful light beam. (Unfortunately, the lens aperture for the scattered rays used in [4] was not small compared with the aperture for the initial light beam, as was necessary for a quantitative interpretation of the phenomenon.)

Thus, in calculating the induced scattering it is necessary to take account of the fact that the waves generated are not ordinary elastic waves, but waves with an anomalous propagation velocity and with a ray velocity directed at an angle to the wave front. It is of interest to trace experimentally the variation of the effective velocity obtained from IMBS as a function of the angle given by the experimental geometry.

The author is grateful to Yu. L. Gazaryan, M. A. Isakovich, and I. A. Chaban for an interesting discussion.

[1] R. Y. Chiao, C. H. Townes, and B. P. Stoicheff, Phys. Rev. Lett. 12, 592 (1964).

[2] E. Garmire and C. H. Townes, Appl. Phys. Lett. 5, 84 (1964).

[3] R. G. Brewer and K. E. Rieckhoff, Phys. Rev. Lett. 13, 334 (1964).

[4] D. I. Mash, V. V. Morozov, V. S. Starunov, E. V. Tiganov, and I. L. Fabelinskii, JETP Letters 2, 246 (1965), transl. p. 157.

[5] A. A. Chaban, ibid. 2, 234 (1965), transl. p. 149.

SEARCH FOR PARITY NONCONSERVATION IN NUCLEAR GAMMA TRANSITIONS

V. M. Lobashov, V. A. Nazarenko, L. F. Saenko, and L. M. Smotritskii
A. F. Ioffe Physico-technical Institute, USSR Academy of Sciences
Submitted 25 November 1965
ZhETF Pis'ma 3, No. 2, 76-81, 15 January 1966

Phenomena connected with weak nucleon-nucleon interaction were recently observed in gamma decays of nuclei. These include the asymmetry of photon emission upon capture of polarized neutrons by Cd^{113} (asymmetry 3.7×10^{-4}) [1] and circular polarization of the gamma quanta from Ta^{181} ($P_\gamma = 2 \times 10^{-4}$) [2].

In view of the great difficulty of experiments of this kind, refinement of the existing data and searches for new effects are most desirable.

The greatest difficulty in the measurement of small effects is a decrease in the statistical error within an acceptable duration of the experiment at the pulse-counting rates attainable with modern apparatus ($\sim 10^7$ counts/sec).

One of the authors of this article has proposed a method of measuring the circular polarization of gamma quanta, in which the statistical accuracy of the result is limited only by the γ-quantum source strength [3].

A feature of the method is that the integral detector current is recorded instead of counting individual pulses produced in the γ-quantum detector. A periodic change of the γ-quantum intensity upon reversal of magnetization of the polarimeter, in the case when polarization is present, is measured by a resonant device tuned to the magnetization-reversal frequency and making it possible to accumulate the signal. In this investigation we used this method to measure the circular polarization of the γ quanta emitted from Ta^{181} after the β decay of Hf^{181}.

The circular polarization was measured by the "forward scattering" method. The polarimeter switching frequency was 0.5 cps. The detector was a NaI(Tl) crystal with semiconductor surface-barrier counter (photodiode) which was insensitive to the action of the magnetic field,