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Translated by J. G. Adashko
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Orientation of Planes in Double V° Decay Events

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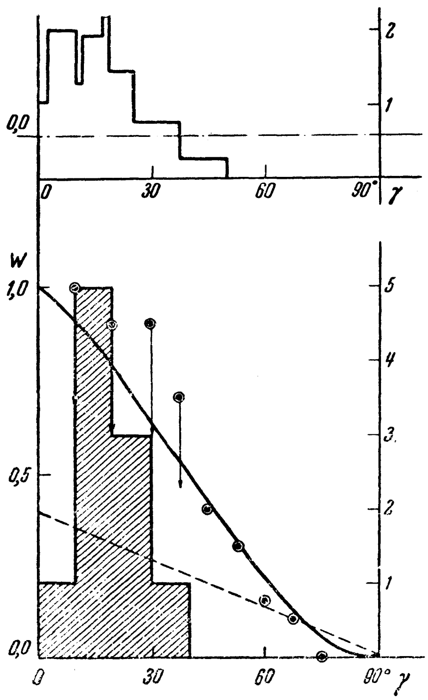
(Submitted to JETP editor August 31, 1955)
J. Exper, Theoret.. Phys. USSR 29, 868-869 (December, 1955)

IN a letter under the same title, Bellam[1] et al considered ten so-called double V° events obtained with a Wilson cloud chamber, two V° decays appearing on the same photograph. The authors assume that both V° particles originated from the same disintegration, and they consider the angles between the plane of their lines of flight and the planes of their decay products. Denoting η_a as the lesser and η_b as the greater of the two angles for a double V° event, the authors plot all ten events as points on an $\eta_b - \eta_a$ plane. Under these circumstances, it turns out that the majority of the points lie in the lower right corner of the graph, i.e., η_a is comparatively small ($< 40^\circ$) as a rule, and η_b is large ($> 40^\circ$ in most cases). On the basis, despite the poor statistics, the authors assume that there is a possibility of some correlation between the directions of the decay planes of the secondary particles and the plane of the V° particles. From this the authors conclude that at least one V° particle has a spin greater than 1/2[2].

Actually, on the basis of the available statistics and the positions of the points on the graph of reference 1, no conclusions can be made concerning a correlation. From elementary considerations it is apparent that if one does not distinguish the angles for some physical reason, the lesser angles will always be concentrated about a small value, and the larger angles about a large value. For η_a in the interval η_a to $\eta_a + d\eta_a$, and η_b in the interval $\eta_b + d\eta_b$, and for the conditions $\eta_a \leq \eta_b$ and isotropic decay, the probability is

$$\frac{6}{5}\cdot\frac{64}{\pi^4}\left(\frac{\pi}{2}-\eta_a\right)\eta_b\, d\eta_a\, d\eta_b.$$

The figure shows the integral curve of the probabilities W for a number of events lying in the lower right corner of the $\eta_b - \eta_a$ plane, to the right of a line cutting off the axes η_b and η_a with segments γ and $\pi/2 - \gamma$, depending on the magnitude of γ, and plotted with experimental points from reference 1. The arrows show the errors as defined by $\sqrt{N}$. The majority of the experimental points lie satisfactorily close to the calculated curve.



Nevertheless, one can draw certain conclusions concerning the orientations of decay planes if one considers the distribution for angle η_a only. The differential curve of the distribution will appear as a straight line (dotted line in the figure.) Experimental data from reference 1 are shown in the figure in the form of a crosshatched histogram. One may note a grouping of experimental points in the neighborhood of the angle $\sim 20^\circ$. These values are analogous to those obtained earlier in reference 3 where particles of a definite type $\Lambda_0 \Lambda^-$

were selected (see the upper histogram and the dashed line in the diagram; experimental data are plotted using exact calculations of angle). Analogous grouping is not obtained for angle η_b.

I wish to thank G. S. Saakian for reviewing this communication.

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Translated by B. G. Saunders
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Electroacoustic Waves in a Gas Discharge Plasma with Consideration of Volume Recombination

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(Submitted to JETP editor, June 12, 1955)
J. Exper. Theoret. Phys. USSR **29**, 874-876
(December, 1955)

IN a previous paper[1] electroacoustic waves were studied, taking into account the production of ionized particles but not considering volume recombination. This occurs along with recombination at walls[2] and plays an important role in some cases (e. g. in molecular gases). The present work deals with the effect of volume recombination on the behavior of electroacoustic waves.

Three possible cases are considered 1. all particles ultimately diffuse to the walls where recombination takes place; 2. recombination takes place only in volume, and 3. both volume recombination and recombination of the walls take place at the same time.

The behavior of the electrons and ions is described by the system of hydrodynamic equations derived earlier[1]. On the assumption that the neutral atoms do not move and that the electrons and ions are separately thermalized, the system of equations becomes (in the notation used earlier)

$$\frac{\partial\sigma^-}{\partial t} + \frac{\partial}{\partial x_\alpha}(\sigma^- v_\alpha^-) = Z^-\sigma^- - R^-\sigma^+\sigma^-, \tag{1}$$

$$\frac{\partial\sigma^+}{\partial t} + \frac{\partial}{\partial x_\alpha}(\sigma^+ v_\alpha^+) = Z^+\sigma^+ - R^+\sigma^-\sigma^+,$$

$$\frac{\partial}{\partial t}(\sigma^- v_\alpha^-) + \frac{\partial}{\partial x_\rho}(\sigma^- v_\alpha^- v_\rho^-)$$

$$= -\frac{\theta^-}{m^-}\frac{\partial\sigma^-}{\partial x_\alpha} + \frac{e\sigma^-}{m^-}E_\alpha - \alpha_-\sigma^- v_\alpha^-,$$

$$\frac{\partial}{\partial t}(\sigma^+ v_\alpha^+) + \frac{\partial}{\partial x_\rho}(\sigma^+ v_\alpha^+ v_\rho^+)$$

$$= -\frac{\theta^+}{m^+}\frac{\partial\sigma^+}{\partial x_\alpha} - \frac{e\sigma^+}{m^+}E_\alpha - \alpha_+\sigma^+ v_\alpha^+,$$

$$\partial E_\alpha/\partial x_\alpha = 4\pi e(\sigma^-/m^- - \sigma^+/m^+),$$

where $R^-\sigma^+\sigma^-$ and $R^+\sigma^-\sigma^+$ are the mass recombination rates of electrons and ions respectively.

Assuming cylindrical symmetry and neglecting, as before, terms quadratic in the particle velocities, we obtain a set of equations for the relative deviations n^- and n^+ from stationary solutions* $\sigma_0^-(r)$ and $\sigma_0^+(r)$, i.e., setting

$$\sigma^- = \sigma_0^-(1 + n^-), \quad \sigma^+ = \sigma_0^+(1 + n^+), \tag{2}$$

On replacing $\sigma_0^-(r)$ and $\sigma_0^+(r)$ by their average values over r, the equations become

$$\frac{\partial^2 n^-}{\partial t^2} - \frac{\theta^-}{m^-}\frac{\partial^2 n^-}{\partial z^2} + (\alpha_- - Z^- + R^-\overline{\sigma_0^+})\frac{\partial n^-}{\partial t} + \omega_e^2 n^- = (\omega_e^2 - \alpha_- R^-\overline{\sigma_0^+})n^+ - R^-\overline{\sigma_0^+}\frac{\partial n^+}{\partial t}, \tag{3}$$

$$\frac{\partial^2 n^+}{\partial t^2} - \frac{\theta^+}{m^+}\frac{\partial^2 n^+}{\partial z^2} + (\alpha_+ - Z^+ + R^+\overline{\sigma_0^-})\frac{\partial n^+}{\partial t} + \omega_i^2 n^+ = (\omega_i^2 - \alpha_+ R^+\overline{\sigma_0^-})n^- - R^+\overline{\sigma_0^-}\frac{\partial n^-}{\partial t},$$