In the presence of boundary conditions close to (2) on samples with b/c >> 1, a strong magnetic field likewise exerts an influence on the current-voltage characteristic, but this influence is not so strong [4, 5]. In this case the behavior of the current-voltage characteristics is connected with the Hall current only near the edges of the sample, at a distance on the order of c, and since b/c >> 1, the influence of the magnetic field on the current-voltage characteristics is not so large as described in the present paper.

Thus, for the case of electron-phonon scattering, we have demonstrated experimentally that when $\vec{E} \perp \vec{H}$ and when boundary conditions close to $E_H = 0$ and $j_H \neq 0$ are realized, a "turning" of the current-voltage characteristic takes place.

The authors are grateful to F.G. Bass for indicating the possibility of observing this phenomenon.

[1] F.G. Bass, Zh. Eksp. Teor. Fiz. 48, 275 (1965) [Sov. Phys.-JETP 21, 181 (1965)].
[2] H.I. Lippman and P. Kut, Z. Naturforsch. 13A, 462 (1958).
[3] R.F. Kazarinov and V.I. Skobov, Zh. Eksp. Teor. Fiz. 42, 1047 (1962) [Sov. Phys.-JETP 15, 726 (1962)].
[4] V.I. Veselago, M.V. Glushkov, Yu.S. Leonov, and A.P. Shotov, Fiz. Tekh. Poluprov. 3, 1580 (1969) [Sov. Phys.-Semicond. 3, 1326 (1970)].
[5] V.I. Veselago, M.V. Glushkov, Yu.S. Leonov, and A.P. Shotova, ibid. 4, 1476 (1970) [4, 1262 (1971)].

PRODUCTION OF TENSOR AND SCALAR MESONS IN ee COLLISIONS

V.M. Budnev and A.K. Slivkov
Novosibirsk State University
Submitted 16 October 1970
ZhETF Pis. Red. 12, No. 11, 523 - 526 (5 December 1970)

1. The use of accelerators with colliding electron beams makes it possible to investigate thoroughly vector resonances (ρ, ω, ϕ) [1]. Production of resonances with other spins (0, 2, ...) occurs in the next higher orders in accordance with the schemes of Figs. 1a [2], 1b [3], or 2.

To extract information on the resonance-production cross section in accord with Fig. 1a is difficult because of the large radiation background connected with the production of the vector resonances ρ, ω, and ϕ. The study of resonances in processes of Fig. 1b depends strongly on the model employed. We shall consider the production of resonances in the process of Fig. 2, and for concreteness we shall consider e^-e^- beams. The colliding electron beams serve as sources of opposing (virtual) photon beams producing the resonance. To study the properties of the resonances, we must measure the energies E_i and the scattering angles θ_i of the final electrons. This makes it possible to study

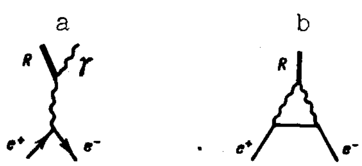

Fig. 1

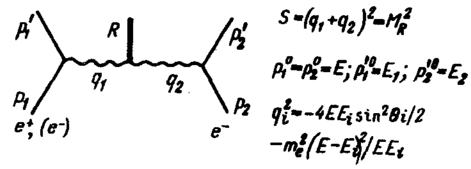

Fig. 2

in the same experiment the cross sections for the production of different resonances at different q_i^2. A study of the angular correlations and of the energy correlations of the scattered electrons makes it possible to determine the widths Γ_{ab} of the decays $R \to 2\gamma$ for different polarizations a and b and of the "masses" q_i^2 of the photons.

2. The differential cross section for a narrow resonance $\Gamma \ll M_R$ is

$$\frac{d\sigma}{dE_1 d\Omega_1 dE_2 d\Omega_2} = \left(\frac{\alpha}{2\pi}\right)^2 \frac{E_1}{E}\frac{E_2}{E} \frac{M_R(2S+1)}{q_1^2\, q_2^2} \times$$
$$\times \sum_{\substack{a-c=b-d \\ a,b,c,d=\pm 1,0}} \rho_1^{ab} \rho_2^{cd} \Gamma_{acbd}\, \delta(s - M_R^2). \tag{1}$$

Here ρ^{ab} are the polarization density matrices of the electrons [4], $\Gamma_{a,b,a,b}(q_1^2, q_2^2) = \Gamma_{a,b}(q_1^2 q_2^2)$ is the width of the decay of the resonance into virtual photons with masses q_1^2 and q_2^2 and helicities a and b. The terms of $\Gamma_{a,c,b,d}$ with $a \neq b$ and $c \neq d$ are connected with the $\gamma\gamma$ scattering amplitudes in which the helicities of the individual particles are not conserved (after averaging over the angle between the electron-scattering planes, they make no contribution to the total cross section).

3. To estimate the total cross section, we take into account only the contributions of the transverse photons. If we measure in the experiment only small θ_i, $q_i^2 \ll m_\rho^2$, and M_R^2, then the contribution from the scalar photons is small

$$\sum_{a,b=\pm 1} \Gamma_{ab}(-q_1^2, -q_2^2 \ll m_\rho^2, M_R^2) = \Gamma^{2\gamma} . \tag{2}$$

Here $\Gamma^{2\gamma}$ is the total width of the two-photon decay $R \to 2\gamma$.

$$\sigma_{ee\to eeR} = 16\alpha^2(2S+1)(\Gamma^{2\gamma}/M_R^3) I \left(\tilde{\gamma} = \frac{E\theta}{m_e};\ k = \frac{4E^2}{M_R^2}\right), \tag{3}$$

$$I = \frac{1}{4k^2}\int_1^k \frac{dx}{x}\left[(2x^2 - 2x + 1)\ln \tilde{\gamma}(x-1) - x(x-1)\right] \times$$
$$\times \left[\left(\frac{2(k-x)k}{x^2} + 1\right)\ln \tilde{\gamma}\frac{k-x}{x} - \frac{k(k-x)}{x^2}\right] \tag{4}$$

θ is the maximum electron-registration angle.

Particle	η_{0+}	$\eta(x^0)$	π_N	η_{0+}	f	A_2	E	f'
$M(S)$	700(0)	958 (0?)	1016(0)	1060(0)	1260(2)	11300(2)	420(0?)	1515(2)
$\Gamma^{2\gamma}$	$\alpha^2\Gamma$	[6]	$\alpha^2\Gamma$	$\alpha^2\Gamma$	[5]	[5]	[7]	[5]
$\Gamma^{2\gamma}$ keV	5	220	1.25	5	28	31	240	2.8
$\sigma\cdot 10^{33}$cm^2	1	13.5	0.06	0.19	2.8	2.5	2.7	0.12

For E = 3.5 GeV and θ = 10°, the cross sections for the production of the concrete resonances are listed in the table.

Unlike Low [8], we took into account only the contributions of $|q_i^2| < m_e^2\tilde{\gamma}^2$. Allowance for large q_i^2 requires knowledge of the form factors and does not make an appreciable contribution to the cross section. In addition, we do not assume that $\ln k \ll \ln \tilde{\gamma}$, and this increases the estimate at high energies.

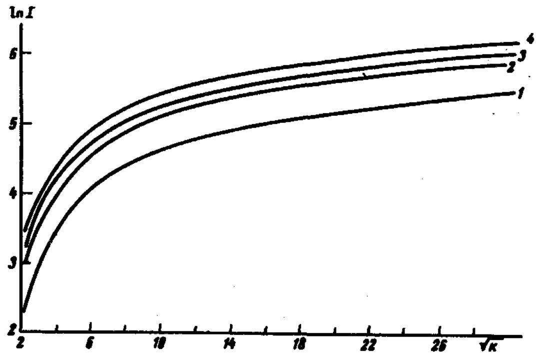

Fig. 3. 1 - $\tilde{\gamma}$ = 100, 2 - $\tilde{\gamma}$ = 500, 3 - $\tilde{\gamma}$ = 1000, 4 - $\tilde{\gamma}$ - 2000.

The authors are grateful to N.N. Achaseov, V.E. Balakin, A.I. Vainshtein, I.F. Ginzburg, V.G. Serbo, V.L. Chernyak, and I.B. Khriplovich for useful discussions.

[1] V.L. Auslender et al., Proc. Stanford Internal. Symp. on Electron and Photon Interactions, at High Energies, Stanford, 1967.
[2] M.J. Crentz and M.B. Einhorn, Phys. Rev. 1D, 2537 (1970).
[3] A.I. Vainshtein and I.B. Khriplovich, Paper at 15th Conf. on High-energy Physics, Kiev, 1970.
[4] V.M. Budnev and I.F. Ginzburg, Yad. Fiz. 13, 353 (1971) [Sov. J. Nuc. Phys. 13, No. 2 (1971)].
[5] G.M. Radutskii, ibid. 8, 115 (1968) [8, 65 (1969)].
[6] A.H. Rosenfeld, Review of Particle Properties, Phys. Lett. August 1970.
[7] W. Tybor and A-N. Zaslavsky, Preprint JINR E-2-4976 (1970).
[8] F.E. Low, Phys. Rev. 120, 1860 (1960).

INTERSTITIAL (CROWDION) MECHANISM OF PLASTIC DEFORMATION AND FAILURE

V.L. Indenbom
Crystallography Institute, USSR Academy of Sciences
Submitted 16 October 1970
ZhETF Pis. Red. 12, No. 11, 526 - 528 (5 December 1970)

Crowdions, interstitial atoms that move along close-packed directions like other possible configurations of interstitial atoms well known in radiation physics, are traditionally disregarded in the physics of plasticity. It is assumed that since the energy of formation of these defects is large, their concentration is negligibly small compared with the concentration of other point defects in the lattice. In diffusion, in particular, the decisive role is usually ascribed to vacancies and not to interstitial atoms. The latest data make it necessary, however, to reestimate the role of interstitial atoms in processes of plasticity and failure, and make it possible to refine the hypothesis previously advanced by us [1] concerning the possible conditions for the realization and macroscopic manifestation of the interstitial mass-transport mechanism.

We note that any vacancy sink should be converted into a source of interstitial atoms if the temperature is lowered sufficiently and the stress is sufficiently increased (the direction of mass transport remains the same as before). Let the chemical potential of the vacancies near the sink be lowered (and the chemical potential of the interstitial atoms raised) by an amount $\Delta\mu = \gamma\sigma$, where σ is the stress and γ the activation volume (the increment of