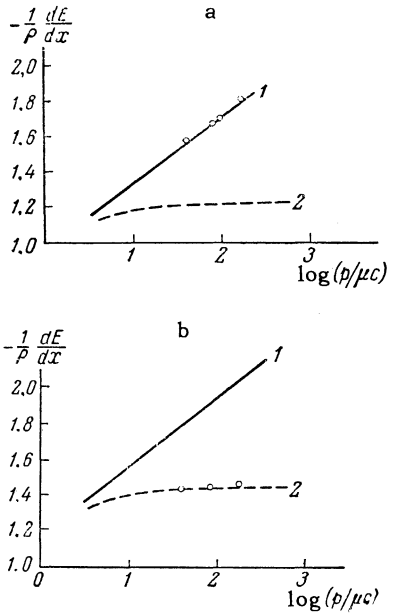

FIG. 2. Theoretical curves and experimental values of energy losses in polystyrene films of thicknesses 10^{-6} cm (a) and 2×10^{-3} cm (b). 1) Theoretical curve without allowance for the density effect; 2) theoretical curve with allowance for the density effect. The circles denote the results of measurements. The ordinate axis gives the specific luminescence in relative units.

$p/\mu c$	10	40	100	200
$10^6 a_0$, cm	31.7	37,5	39.5	45.0

In the present work the film thickness was $\approx 10^{-6}$ cm, in accordance with the condition (1). In a control experiment measurements were also made on thick films (2×10^{-3} cm).

As a measure of the electron energy loss in the film we took its specific luminescence, i.e., the luminescence of the film per one transmitted electron. The luminescence was recorded with an FÉU-29 photomultiplier and a calibration was initially obtained which showed that the luminescence was proportional to the beam intensity. Moreover, it was found that the specific luminescence decreased somewhat at the beginning of the irradiation but remained constant afterwards. Because of this the samples in each series of measurements were subjected to a preliminary irradiation until a specific luminescence, constant in time, was reached for a given electron energy (in practice for a current of 0.01 μA this took about 30 min).

Figure 2 shows the results of measurements and the theoretical curves[3] for films of 10^{-6} cm and 2×10^{-3} cm thicknesses. The experimental data are made to fit the theoretical curves at points corresponding to an electron energy of 40 MeV. The standard error in the measurements was 1%.

As shown by Fig. 2a, the experimental data for thin films agree satisfactorily with a curve which is based on the assumption that there is no density effect. From Fig. 2b we see that the experimental results for thick samples fit the curve which allows for the polarization effect.

Thus we have shown that the ionization losses in thin films rise logarithmically with increase of the electron energy.

Concluding, the authors thank A. A. Krasnikov, V. M. Kharitonov, and V. I. Startsev for their help in this work.

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Translated by A. Tybulewicz
181

ELASTIC ππ SCATTERING AT HIGH ENERGIES

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Submitted to JETP editor January 7, 1963

J. Exptl. Theoret. Phys. (U.S.S.R.) **44**, 1124-1125 (March, 1963)

AN investigation of the analytic properties of the scattering amplitude as a function of the angular momentum has made it possible to establish a connection between the cross sections of particle interaction at high energies[1,2,3]. In particular, a relation exists between the differential cross sections of elastic ππ, πN, and NN scattering:

$$(d\sigma / d\Omega)^2_{\pi N} = (d\sigma / d\Omega)_{\pi\pi} (d\sigma / d\Omega)_{NN}. \quad (1)$$

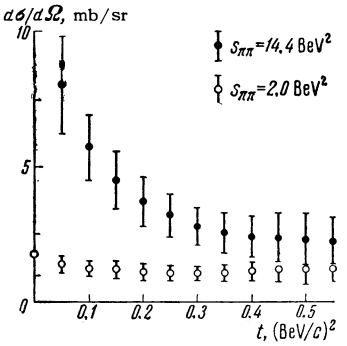
This relation enables us to find the differential cross section of ππ scattering, provided we know $(d\sigma/d\Omega)_{\pi N}$ and $(d\sigma/d\Omega)_{NN}$, measured at identical total energies in the corresponding center-of-mass systems.

An obvious modification of relation (1) for the case when the cross sections for πN and NN scattering are measured at the different energies, leads to the formula

$$(s_{\pi\pi}\, s_{NN} / s_{\pi N}^2)^{2\alpha(t)-1} \left(\frac{d\sigma}{d\Omega}\right)_{\pi N}^2 = \left(\frac{d\sigma}{d\Omega}\right)_{\pi\pi} \left(\frac{d\sigma}{d\Omega}\right)_{NN}, \qquad (2)$$

where s is the square of the total energy of the corresponding process in the c.m.s., and $\alpha(t)$ is the trajectory of the Pomeranchuk pole.

The figure shows the differential cross sections of elastic $\pi\pi$ scattering calculated from formula (2) for values of $s_{\pi\pi}$ = 2.0 and 14.4 BeV^2. For the calculation we used the function $\alpha(t)$ obtained by Domokos in the two-meson approximation[4]. The experimental data on elastic πp scattering at 7.2 BeV[5] and pp scattering at 15.5 BeV[6] were approximated by series in powers of the variable $\eta = -t\,(2\mu + \sqrt{4\mu^2 - t}\,)^{-2}$ (t is the square of the transferred 4-momentum and μ is the pion mass) and reduced by the least-squares method. When using these experimental data, it was assumed that at the indicated πp and pp scattering energies the contributions to the differential cross sections from poles other than the Pomeranchuk pole can be neglected.



It is seen from the figure that when $s_{\pi\pi}$ = 2.0 BeV^2 the $\pi\pi$ scattering has an almost isotropic character.

Employing the optical theorem, we obtain for the total $\pi\pi$-interaction cross section $\sigma_{tot} \cong 15$ mb, in accordance with the estimate of Gribov and Pomeranchuk[1].

The author is grateful to B. A. Arbuzov, G. Domokos, L. I. Lapidus, and R. N. Faustov for discussions connected with the present work.

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Translated by J. G. Adashko
182

ON THE ARTICLE "ANTIFERROMAGNETISM OF FREE RADICALS"[1]

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Submitted to JETP editor December 24, 1962

J. Exptl. Theoret. Phys. (U.S.S.R.) **44**, 1125-1126 (March, 1963)

In conformance with the experimental data contained in [1-3] on the Curie temperature $\Theta = zJ/2k$ (J is the exchange integral; the spin is $S = \frac{1}{2}$) and on the electron paramagnetic resonance absorption line width ΔH for the free radical $\alpha\alpha$-diphenyl-β-picrylhydrazyl (DPPH), the following relations hold:

$$\Theta_{77°K}/\Theta_{1.0°K} = J_{77°K}/J_{1.0°K}$$

$$= \exp(-\lambda d_{77°K}/\exp(-\lambda d_{1.0K}) \cong 30, \qquad (1)$$

$$\Delta H_{1.0°K}/\Delta H_{77°K} = (J_{77°K}(J_{1.0°K})\,(d_{77°K}/d_{1.0°K})^6 \cong 4.5. \qquad (2)$$

It is assumed that each unpaired electron has two nearest neighbors (z = 2) the spacing between which is d. In order to satisfy both relations, it must be assumed that $d_{1.0°K}/d_{77°K} = 1.37$. Let us note that $z \neq 6$, since in this case an increase in the volume of the crystalline cell during cooling in the range T ~ 77—1°K would have to be assumed. Substituting this ratio into (1) we find $d_{77°K} \sim 4.6 \times 10^{-8}$ cm for $\lambda \sim 2 \times 10^8$ cm^{-1} [3]. This value is in good agreement with the rough model of the crystal lattice (see sketch) constructed by a "close packing" of the molecules (the lengths of the characteristic chemical bonds are taken from [4,5]). It is seen from the lattice model that the ratio $a/d \approx b/d \gtrsim 2$, where d is the cell dimension along the N-N bond. Taking account of the mean dimension of the cell (obtained by dividing the crystal volume by the number of unpaired electrons), which equals 8×10^{-8} cm[3], we find $a \cong b \approx 10^{-7}$ cm; $d_{77°K} \sim 5 \times 10^{-8}$ cm. The magnitude of the ratio $a/d \approx b/d \gtrsim 2$ also confirms the validity of the assumption z = 2.