From Eq. (12) we obtain the relation for U assuming that the deviation of the distribution function from f_0 is small, i.e.

$$f(\mathbf{q}, \mathbf{p}) = f_0(\mathbf{p}) + f''(\mathbf{q}, \mathbf{p}); \; f''(\mathbf{q}, \mathbf{p}) \ll f_0(\mathbf{p}). \quad (13)$$

Substituting Eq. (13) into Eq. (12) and retaining only the first order terms, we obtain for $\partial t / \partial t = 0$ the following equation for the potential

$$\Delta U = -4\pi e^2 \int F(\mathbf{k}) e^{i\mathbf{k}(\mathbf{q}-\mathbf{q}')} U(\mathbf{q}') d\mathbf{k} d\mathbf{q}'. \quad (14)$$

In Eq. (14) the function $F(\mathbf{k})$ is given by Eq. (4). For $\hbar = 0$ Eq. (14) turns into the expression derived by the Debye theory. For $\hbar k \ll p_0$ we obtain for the potential of a quantum system the equation

$$\Delta U = r_d^{-2} U, \quad (15)$$

which agrees with the relation obtained in the Debye theory, except that it is for a different correlation radius. For a completely degenerate Fermi gas, the correlation radius is determined by Eq. (11). This result agrees with the results of Landau and Lifshitz.[3]

The expressions obtained for the correlation function are therefore correct in the case of weak interactions both for classical and quantum systems of particles with central interactions at arbitrary temperatures.

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Interaction of π^--Mesons with Protons at 4.5 BEV

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THE experimental data on the n-p interaction at 1.7 bev and the π^--p interaction at 1.37 bev do not contradict the statistical theory which takes into account the isobaric states of nuclei[1,2]. We have carried the calculation for the π^--p interaction, the energy of the incident meson being equal to 4.5 bev in the laboratory system.

In the calculation of the final state density, we have taken into account the conservation of momentum and the indistinguishability of mesons, as well as the exact nucleonic mass (or the isobaric state). We have, however, neglected the mass of the meson. The last approximation is justified by the fact that, as we shall see, in the most important processes there are no more than four particles in the final (or the intermediate isobaric) state. Even in the worst case (process $3N'$) the kinetic energy per particle amounts to 0.365 bev (total energy in the center-of-mass stystem 3.1 bev). If every one of the four mesons, created in the process of annihilation of a nucleon and an antinucleon, possessed such an energy, the correction factor to the meson mass would amount to 0.7 (according to I. L. Rozental' and V. M. Maksimenko). We take exactly into account only one (the heaviest) mass and the correction, therefore, will be even smaller. Only the processes $4N'$ and $5N$ may substantially depend on it, but their role is small at such high energies.

We shall use the following notation[1,2]: N--nucleon, N'--isobaric state; nN--state with n pions and one nucleon, nN'--state with n pions and one isobar. The statistical weights of the processes under consideration are given in Table I.

As usual, we take $R = 1.4 \times 10^{-13}$ (R is the parameter determining the nonshortened interaction volume $V_0 = 4/3\,\pi R^3$).

Table II gives the division of the charge states for all processes.

Some of the implications of our calculations can be already compared with preliminary experimental results on the π^--p interaction at 4.5 bev[3]. In Ref. 3 the relative proabilities are given of elastic nondiffractive collisions and of inelastic collisions producing two-, four- and six-prong stars.

TABLE I

Number of Pions	Type of process	Statistical weight
1	1 N	1.17
2	2 N	13.0
	1 N'	2.10
3	3 N	21.67
	2 N'	19.2
4	4 N	9.72
	3 N'	23.4
5	5 N	1.75
	4 N	7.96

TABLE II

Number of pions n	Products of the Reaction	Distribution of nN	Distribution of $(n-1)\ N'$
1	$p-$	0.555	
	$n\ 0$	0.445	
2	$p-0$	0.378	0.274
	$n\ 0\ 0$	0.155	0.163
	$n+-$	0.467	0.563
3	$p+--$	0.276	0.248
	$p-\ 0\ 0$	0.200	0.174
	$n+-0$	0.462	0.508
	$n\ 0\ 0\ 0$	0.062	0.070
4	$p+--0$	0.358	0.326
	$n++--$	0.209	0.229
	$p-\ 0\ 0\ 0$	0.096	0.086
	$n+-\ 0\ 0$	0.316	0.338
	$n\ 0\ 0\ 0\ 0$	0.021	0.021
5	$p++---$	0.129	0.121
	$p+--\ 0\ 0$	0.302	0.282
	$n++--0$	0.337	0.357
	$n+-\ 0\ 0\ 0$	0.182	0.192
	$p-\ 0\ 0\ 0\ 0$	0.042	0.039
	$n\ 0\ 0\ 0\ 0\ 0$	0.008	0.009

The experimental and the theoretical values of the relative probability of the processes are compared in Table III. As it can be seen, the agreement is satisfactory.

I wish to express my gratitude to Prof. S. Z. Belenkii for interesting discussions and his constant attention to the present work.

TABLE III

	Experimental data	Statistical Calculation	
		isobaric states accounted for	isobaric states neglected
Elastic nondiffractive scattering	2	1	2
2-prong stars	44	49	56
4-prong stars	28	24.5	17
6-prong stars	1	0.5	0.1

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