the ion concentration n_i, and the quantity $<\sigma_i v_e>$ (σ_i - cross section for the ionization of the atom by the electrons) is assumed to be constant. 2) A pure hydrogen plasma is considered. 3) The cross section $\sigma(v_r)$ for the charge exchange of the atom with the proton is a function of the relative velocity v_r in the form $\sigma = A + B \log v_r$, in accord with the experimental and theoretical data given in [1]. 4) An isotropic monenergetic flux of neutral hydrogen atoms of energy 1 eV is incident on the plasma surface.

The purpose of the investigation was to calculate the distribution of the neutral atoms $n_0(\rho)$, the albedo of the plasma, and the energy spectrum of the escaping particles within the framework of this simple model, to ascertain whether this model is suitable for the description of the distribution $n_0(\rho)$ in the T-3 apparatus, and to analyze various approximations that facilitate the solutions of more complicated problems (in which account is taken of the dependence of the plasma parameters on the spatial coordinate ρ). The chosen plasma parameters were close to those realized in certain regimes of the T-3 setup, viz., T_i = 200 eV, $<\sigma_i v_e> = 1.7 \times 10^{-8}$ cm³/sec, radius of plasma pinch a_0 = 15 cm. The density n_i had three values: (1, 2, and 4) × 10^{13} cm^{-3}. The calculations were made with the M-220 computer.

We estimated the effect of the anisotropy of the charge-exchange cross section (in the laboratory frame) [2], and found it to be negligible.

An approximate analytic formula was derived for the distribution of the atoms in a cylindrical plasma pinch under conditions when the plasma is "black" to the incoming particles and sufficiently transparent to atoms of energy on the order of T_i. The results of the Monte-Carlo calculation are in good agreement with the formula.

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INFLUENCE OF ρ^0-ω MIXING ON THE SPIN DENSITY MATRIX OF THE ω MESON IN THE REACTIONS $\pi N \to \omega N$ AND $\pi N \to \omega\Delta$

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Destructive and constructive interferences between the ρ^0 and ω mesons in the mass spectrum of decay pions were recently observed in the reactions $\pi^+ p \to \pi^+\pi^-\Delta^{++}$ and $\pi^- p \to \pi^+\pi^-(n,\Delta^0)$ respectively [1 - 3]. It was also established experimentally that the $\pi N \to \rho(N,\Delta)$ differential cross sections are much larger than the $\pi N \to \omega(N,\Delta)$ differential cross sections in the region of relatively small momentum transfers ($|t| \lesssim 0.2$ $(GeV/c)^2$). In this paper we wish to call attention to the fact that these two circumstances allow us to expect a strong influence of electromagnetic ρ^0-ω mixing on the spin density matrix of the ω meson in the reactions $\pi N \to \omega(N,\Delta)$. Namely, the ρ^0-ω mixing can help explain the relatively large value $\rho^{\omega}_{00} \simeq 0.5 - 0.2$ at $0.02 \lesssim |t| \lesssim 0.2$, as well as the dip in ρ^{ω}_{00} at $|t| \simeq 0.25$ in the reactions $\pi^+ n \to \omega p$ and $\pi^+ p \to \omega\Delta^{++}$. (Here and throughout, ρ^{ω}_{ij} are elements of the ω-meson spin density matrix in the Gottfried-Jackson system [4], and $|t|$ is in $(GeV/c)^2$ units.) In addition, in the indicated interval of $|t|$ the values of ρ^{ω}_{00} and $\rho^{\omega}_{00}(d\sigma/dt)^{\omega}$ are expected to be smaller by a factor 2 - 3 for the reactions $\pi^- N \to \omega(N,\Delta)$ than for the reactions $\pi^+ N \to \omega(N,\Delta)$, in spite of the isotropic equations; the absence of a dip in ρ^{ω}_{00} at $|t| \simeq 0.25$ is also to be expected.

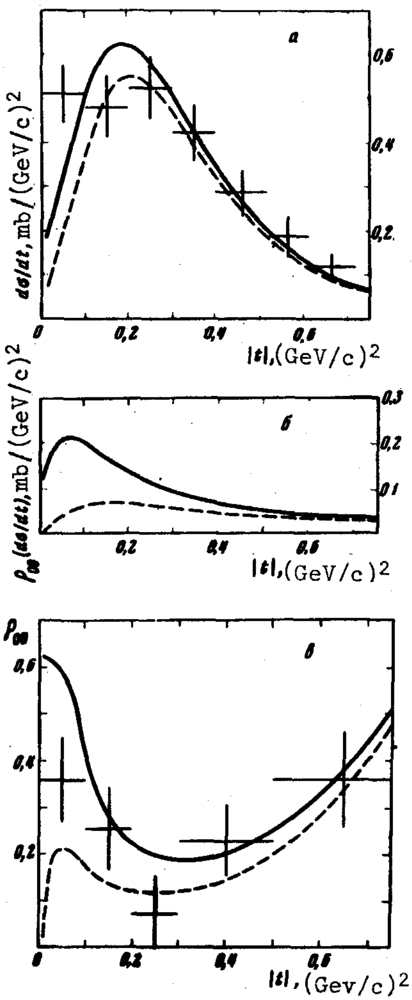
2. The $\pi^+\pi^-$ and $\pi^+\pi^-\pi^0$ production amplitudes, with allowance for ρ^0-ω mixing in the resonance regions, is written in the form

$$T(\pi^+\pi^-) = \frac{g_{\rho\pi\pi}}{m_\rho^2 - s - i\Gamma_\rho m_\rho}(f_\rho - \epsilon f_\omega) + \frac{f_\omega g_{\rho\pi\pi}}{m_\omega^2 - s - i\Gamma_\omega m_\omega}\left(\epsilon + \frac{g_{\omega\pi\pi}}{g_{\rho\pi\pi}}\right), \tag{1}$$

$$T(\pi^+\pi^-\pi^0) = \frac{g_{\omega 3\pi}}{m_\omega^2 - s - i\Gamma_\omega m_\omega}(f_\omega + \epsilon f_\rho) - \frac{f_\rho}{m_\rho^2 - s - i\Gamma_\rho m_\rho}(\epsilon g_{\omega 3\pi} - g_{\rho 3\pi}). \tag{2}$$

Here f_ρ and f_ω are the amplitudes for the production of the ρ^0 and ω meson in strong interactions; the parameter of the electromagnetic mixing is $\varepsilon = M_{\omega\rho}/(m_\rho^2 - m_\omega^2 - i\Gamma_\rho m_\rho - i\Gamma_\omega m_\omega)$; $M_{\omega\rho}$ is the constant of the ρ^0-ω transition; s is the invariant mass of the $\pi^+\pi^-$ and $\pi^+\pi^-\pi^0$ systems in formulas (1) and (2), respectively.

The electromagnetic ρ^0-ω mixing leads to effects of two kinds. First, it changes the mass spectrum of the decay pions, and second, it changes the amplitudes of production of the vector mesons (the terms proportional to ε in the first parentheses of formulas (1) and (2)). For reactions of type (1), the most important is the change of the mass spectrum owing to the narrowness of the ω resonance. For reactions of type (2), to the contrary, the change of the mass spectrum is immaterial, since it is difficult to distinguish the low and broad ρ^0 resonance against the background of the narrow and tall ω peak. An appreciable change of the ω-production amplitude is possible for these reactions. The point is that, starting with $|t| \simeq 0.03$, the cross sections for ρ^0 and ω production in the reactions considered by us diverge sharply in the region of small $|t|$. The differential ω-production cross sections are approximately constant when $0.02 \lesssim |t| \lesssim 0.3$, and the differential ρ^0-production cross sections increase sharply with decreasing $|t|$, being 10 and 25 times larger at the peak than the ω-production cross sections in $\pi N \to \omega N$ and $\pi N \to \omega\Delta$, respectively. Such a picture is obtained for medium energy in the 4 - 10 GeV range, cf., e.g., [8 - 10]. In addition, it is known from experiment that in the interval $0.02 \lesssim |t| \lesssim 0.2$ the amplitude with the quantum numbers of the π meson in the t channel accounts for 90% - 60% of the differential cross section of $\pi N \to \rho(N,\Delta)$, cf., e.g., [12]. It is therefore natural to expect that the strongest change in the reactions $\pi N \to \omega(N,\Delta)$ should be experienced by the ω-production amplitude with the quantum numbers of the B meson in the t channel, for it is precisely such amplitudes, which have identical spin structure, which



Solid lines - theoretical curves for the reaction $\omega^+n \to \omega p$, dashed lines - for the reaction $\pi^-p \to \omega n$.

become intermixed when isotopic invariance is violated. This should become manifest experimentally in $\rho^{\omega}_{00}(d\sigma/dt)^{\omega}$ and ρ^{ω}_{00}. Inasmuch as $\rho^{\omega}_{11}(d\sigma^{\omega}/dt) \simeq \rho^{\rho}_{11}(d\sigma/dt)^{\rho}$ in the region of $|t|$ under consideration, the other ω-production amplitudes will not be noticeably altered by the ρ^0-ω mixing.

Let us rewrite (1) and (2), taking into account in (1) only the change of the mass spectrum and leaving out the direct $\omega \to 2\pi$ transition, in view of the large value of $|\varepsilon|$ [5 - 6], and taking into account in (2) only the change of the ω-production amplitude:

$$T(\pi^+\pi^-) = \frac{g_{\rho\pi\pi} f_\rho}{m_\rho^2 - s - i\Gamma_\rho m_\rho} + \epsilon \frac{g_{\rho\pi\pi} f_\omega}{m_\omega^2 - s - i\Gamma_\omega m_\omega}, \qquad (3)$$

$$T(\pi^+\pi^-\pi^0) = g_{\omega 3\pi} \frac{f_\omega + \epsilon f_\rho}{m_\omega^2 - s - i\Gamma_\omega m_\omega}. \qquad (4)$$

From theoretical [6] and experimental [1, 13] considerations we have $|\varepsilon| = 0.05 - 0.06$ at $\Gamma_\rho \simeq 110$ MeV. It follows from all the foregoing that if the relative phase shift in (4) is $\phi = \phi_\varepsilon + \phi_\rho - \phi_\omega = 0$, then ρ^{ω}_{00} and $\rho^{\omega}_{00}(d\sigma/dt)^{\omega}$ should increase 40 - 60% in the considered interval of $|t|$ as a result of the ρ^0-ω mixing; on the other hand if $\phi = \pi$, then these quantities should decrease by 40 - 60% at the same values of $|t|$.

3. Important information on the phase shifts can be obtained from experiments on the interference patterns in the two-pion mass spectra [1 - 3], since the largest interference at $|t| \lesssim 0.3$ is observed in amplitudes with the quantum numbers of π and B mesons in the t channel [1, 5]. Destructive interference between the ρ^0 and ω mesons was observed in the reaction $\pi^+p \to \pi^+\pi^-\Delta$ [1]. This means that $\phi_\varepsilon + \phi_\omega - \phi_\rho \simeq \pi$ in expression (3) for this reaction. This value of the relative phase shift was confirmed also in $\pi^-p \to \pi^+\pi^-\Delta^0$ [3], where constructive interference was observed, in accord with isotopic invariance for strong interactions. Constructive ρ^0 and ω interference was observed in the reaction $\pi^-p \to \pi^+\pi^-n$ [2]. It follows therefore that in this reaction $\phi_\varepsilon + \phi_\omega - \phi_\rho \simeq 0$, and in the reaction $\pi^+n \to \pi^+\pi^-p$, by virtue of isotopic symmetry, $\phi_\varepsilon + \phi_\omega - \phi_\rho \simeq \pi$. Consequently for the $\pi^+N \to \omega(N,\Delta)$ reactions we have $\phi \simeq 2\phi_\varepsilon - \pi$, and for $\pi^-N \to \omega(N,\Delta)$ we have $\phi \simeq 2\phi_\varepsilon$.

From theoretical considerations [5 - 7], $\phi_\varepsilon \simeq \pi/2$. In addition, this is necessary [5] in order to explain the experiments of [1 - 3]. But if $\phi_\varepsilon \simeq \pi/2$, then it follows that $\phi \simeq 0$ for the $\pi^-N \to \omega(N,\Delta)$ reactions and $\phi \simeq \pi$ for the $\pi^-N \to \omega(N,\Delta)$ reactions. Thus, the results listed at the beginning of the article become understandable. The presence of a dip [1, 8] in ρ_{00}^{ω} for the reactions $\pi^+p \to \omega\Delta^{++}$ and $\pi^+n \to \omega p$ at $|t| \simeq 0.25$ is due to the fact that the influence of the ρ^0-ω mixing becomes stronger in the region of small $|t| \lesssim 0.2$, and is an indirect confirmation of the described picture. It would be of interest to measure $\rho_{00}^{\omega}(d\sigma/dt)^{\omega}$ and ρ_{00}^{ω} in the reactions $\pi^-N \to \omega(N,\Delta)$ at $|t| \lesssim 0.3$, since their predicted values are smaller by a factor 2 - 3 than in $\pi^+N \to \omega(N,\Delta)$. It must be noted that in spite of the strong difference in $\rho_{00}^{\omega}(d\sigma/dt)^{\omega}$, the expected difference in $(d\sigma/dt)^{\omega}$ is larger by not more than 20%. At the present time there are no data on ρ_{00}^{ω} and $\rho_{00}^{\omega}(d\sigma/dt)^{\omega}$ for $\pi^-N \to \omega(N,\Delta)$. Their study, together with experiments on the ρ^0-ω interference in the two-pion mass spectrum, would make it possible to establish the value of ϕ_ε, since all the results are connected with the closeness of ϕ_ε to $\pi/2$. The figure illustrates the described situation for the reactions $\pi^+n \to \omega p$ and $\pi^-p \to \omega n$ within the framework of the Regge-pole model with cuts at 4.19 GeV. The comparison for $\pi^+n \to \omega p$ with experiment is made in [8]. The ρ and B Regge poles and the ρP cut were taken for f_ω, and the π Regge pole from [12] was taken for f_ρ, with $|\varepsilon| = 0.06$ and $\phi_\varepsilon = \pi/2$. It should be noted that even at $|\varepsilon| = 0.03$ all the results remain in force, although the influence of the ρ^0-ω mixing, naturally, decreases. A detailed analysis of ρ_{ij}^{ω} for $\pi N \to \omega N$ and $\pi N \to \omega\Delta$ with allowance for ρ^0-ω mixing will be reported separately.

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ESTIMATE OF ΛN INTERACTION IN THE p STATE

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At the present time, the experimental data on Λp scattering and on the binding energies of hypernuclei are such that the information extracted from them is in the way of estimates. This applies specially to the question of the strength of the ΛN interaction in the p state. All that can be regarded as established is the fact that if the ΛN potentials are chosen in accord with the Λp scattering, then they must overestimate the experimental values of the Λ-particle detachment energies, B_Λ, in the hypernuclei of the p shell and in nuclear matter [1, 2]. The situation is not remedied by additional fitting of the potential to B_Λ of the hypernuclei H_Λ^3 and He_Λ^4. The potentials chosen in this manner overestimate B_Λ even for He_Λ^5, the heaviest hypernucleus of the