is 20 - 25 kW (corresponding to ~0.005 J radiated in the pulse). Calculation has shown that under the conditions of our experiment the compression of the discharge occurs 0.2 - 0.3 μsec after the start of the discharge. The appearance of the generation pulse thus coincides in time approximately with the instant of discharge compression.

The realization of negative-temperature states in a pinch discharge uncovers new possibilities for the production of pulsed gas lasers. Indeed, the plasma energy pumping in a powerful compressed pinch discharge can in principle reach or even exceed the corresponding value for a solid. Therefore the elucidation of the mechanism and of the conditions under which negative-temperature states are produced in such discharges is of great interest both for plasma physics and for quantum electronics, and calls for additional experimental research.

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REAL PART OF THE pn SCATTERING AMPLITUDE IN THE ENERGY INTERVAL 2 - 10 GeV

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We investigated elastic pd scattering in the energy interval 1 - 10 GeV. On the basis of these experimental data, as well as information on the pp scattering amplitude in the same energy range, we found the value of the real part of the pn scattering amplitude. The experiment was performed by a method involving registration of slow recoil deuterons from a film-target of deuterated polyethylene 0.5 - 0.6 μ thick [1,2]. The investigated range of squared momentum transfer was $0.003 < |t| < 0.2$ $(GeV/c)^2$.

The differential cross sections of elastic pd scattering at energies 1, 2, 4, 6, 8, and 10 GeV are shown in Fig. 1. The statistical error is ≈3% and the accuracy of the absolute monitoring is 7%.

In the range of angles where the influence of Coulomb scattering can be neglected, the differential cross section of elastic pd scattering is approximated by the formula $d\sigma/d|t| = \exp(a + bt + ct^2)$. The values of the parameters a, b, and c are indicated in Fig. 1. The total cross sections for elastic pd scattering are listed in Table 1.

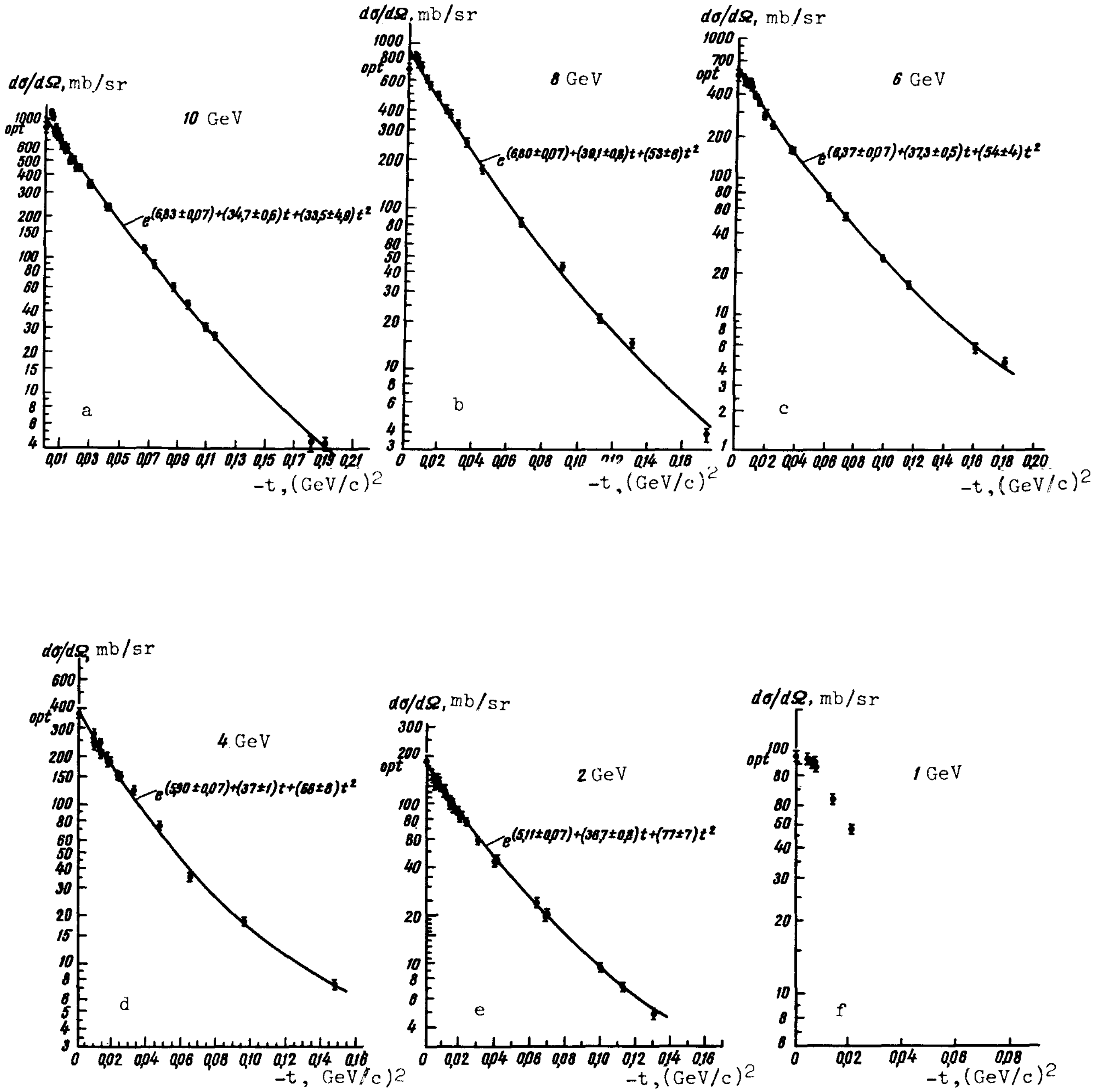

Fig. 1. Differential cross sections of elastic pd scattering vs. the square of the momentum transfer at different proton energies.

Table 1

E_{kin}, GeV	σ_{el}, mb	R, F
2	9.5 ± 0.7	2.08 ± 0.04
4	9.9 ± 0.8	2.11 ± 0.04
6	9.5 ± 0.7	2.20 ± 0.04
8	9.5 ± 0.7	2.26 ± 0.04
10	9.3 ± 0.7	2.20 ± 0.04

The value we obtained for the total cross section of elastic pd scattering at 6 GeV is several times smaller than that measured in [3], where $\sigma_{el} = 12.6 \pm 1.4$ mb. The last column of this table gives the interaction radii corresponding to the parameter of the slope of the differential cross section at $|t| = 0.06$ $(GeV/c)^2$.

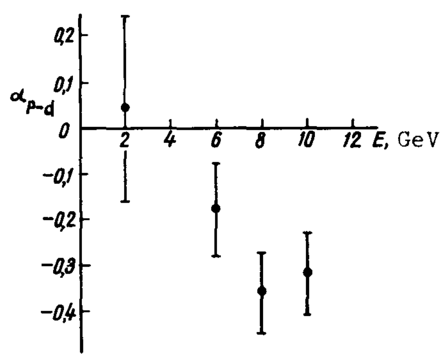

Fig. 2. Plot of α_{pd} = [ReA(p - d)]/ImA(p - d)] vs. the energy of the primary proton.

In the small-angle region of pd scattering, constructive interference is observed between the Coulomb and nuclear scatterings. The results were analyzed with the aid of the Bethe formula [4]. The function α_{pd} = [ReA(p - d)]/[ImA(p - d)] for the pd scattering amplitude is shown in Fig. 2. Comparison of the obtained data with our measurements of the pp scattering amplitude at the same energies [5] allows us to estimate the real part of the pn scattering amplitude. Using a simple model of the deuteron, after Glauber [6], we can express the forward pd scattering amplitude in terms of the scattering amplitudes of the nucleons contained in it:

$$f_{pd} = f_{pp} + f_{pn} + \frac{i}{k}\,\overline{(r^{-2})}_d\, f_{pp}\, f_{pn}. \tag{1}$$

Separating the real and imaginary parts of the amplitude and using the optical theorem, we can obtain the following expressions:

$$\alpha_{pn} = \frac{1}{\sigma_{pn}} \left[(\alpha_{pd}\,\sigma_{pd} - \alpha_{pp}\,\sigma_{pp})\left(1 + \frac{\overline{(r^{-2})}_d}{4\pi}\,\sigma_{pp}\right)\right] + \frac{\overline{(r^{-2})}_d}{4\pi}\,\alpha_{pp}\,\sigma_{pp}, \tag{2}$$

$$\sigma_{pd} = \sigma_{pp} + \sigma_{pn} + \frac{\overline{(r^{-2})}_d}{4\pi}\,\sigma_{pp}\,\sigma_{pn}\,(\alpha_{pp}\,\alpha_{pn} - 1). \tag{3}$$

Here σ_{pp}, σ_{pn}, and σ_{pd} are the total cross sections of the pp, pn, and pd interaction; α_{pp}, α_{pn}, and α_{pd} are the ratios of the real and imaginary parts of the pp, pn, and pd scattering amplitudes, respectively. The parameter $\overline{(r^{-2})}_d$ is taken from the paper of Galbraith et al. [7] on the total interaction cross sections, $\overline{(r^{-2})}_d = (0.042 \pm 0.003)$ mb^{-1}. The quantities entering in expression (3) were measured experimentally, and σ_{np} was measured in a neutron beam in [8,9]. This allows us to check on the correctness of the approximation used in the derivation of formulas (1 - 3). This check shows that expression (3) is satisfied with an accuracy not worse than 7%. The quantity α_{pn} = ReA(pn)/ImA(pn) was calculated from formula (2).

Table 2 lists the obtained values of α_{pn} and, for comparison, the values of α_{pp} at the same energies.

Table 2

E_{kin}, GeV	2	4	6	8	10
α_{pp}	-0.12 ± 0.07	-0.38 ± 0.1	-0.30 ± 0.07	-0.33 ± 0.08	-0.26 ± 0.05
α_{pn}	+0.2 ± 0.4	-	-0.06 ± 0.19	-0.45 ± 0.20	-0.40 ± 0.17

The latest experiments carried out at CERN [10] also speak in favor of a nonzero real part of the pn scattering amplitude at a momentum 19.3 GeV/c: $\alpha_{pn} \approx \alpha_{pp} = -0.33$.

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BROKEN UNITARY SYMMETRY AND POSSIBLE $\Omega^-(1875)$ RESONANCE

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It is reported in [1] that resonance with mass 1710 MeV has been observed in the $p\pi^+\pi^0$ system. Although its width is small ($\leq$50 MeV), it can be assumed that its presence is the very cause of the irregularity on the total π^+p scattering cross section curve in the ~1650 MeV region [2]. The resonance has in this case an isospin T = 3/2, and will be therefore henceforth denoted $\Delta(1710)$.

The three resonances $\Delta(1710)$, $\Sigma(1765)$ [3], and $\Xi(1820)$ [4-7] are equidistant. This suggests that, like the known isobars with quantum numbers $3/2^+$, they are members of a unitary decuplet. Their spin and parity are then most likely $5/2^-$. This is connected with the fact that both in π^-p and in K^-p scattering in the region of the resonances N(1688) and $\Lambda(1815)$ there are present waves both with $J^P = 5/2^+$ and $J^P = 5/2^-$. The presence of the latter can be attributed to the near-lying $\Delta(1710)$ and $\Sigma(1765)$. The same decuplet should contain also a resonance with strangeness -3, namely $\Omega^-(1875)$. It can be observed as a resonance in reactions of the type

$$K^- + p \to \Xi^- + \bar{K}^0 + K^0 + K^+$$
$$\Xi^0 + K^- + K^0 + K^+$$

The mass of $\Omega(1875)$ is determined by the equidistance condition. The error in its determination is apparently the same as in the other terms of the decuplet, and is of the order of ±10 MeV. We now present an estimate of the width of this resonance.

It is noted in [8] that the unitary relations for the partial widths of the members of the possible decuplet with $J^P = 5/2^-$ do not agree with the experimental data. We shall therefore use henceforth relations that are valid when account is taken (in first order) of the interaction that breaks unitary symmetry (the latter is assumed to be the eighth component of an octet) [9]. If we separate the kinematic factors, and set the width of the $I \to B + \pi$ decay equal to

$$\Gamma(I \to B + \pi) = \frac{m_B}{m_I} K^5[I \to B\pi]^2, \quad (1)$$

where k is the momentum of relative motion of B and π, and assume that the parameters [ ] depend little on the masses of the hadrons that participate in the reaction, then

$$[\Omega^-(1875) \to \Xi^0 K^-] = [\Delta^{++}(1710) \to p\pi^+] - \sqrt{3}[\Sigma^+(1765) \to p\bar{K}^0] + \sqrt{6}[\Xi^-(1820) \to \Xi^-\pi^0]. \quad (2)$$

By virtue of T-invariance, all the constants [ ] which enter in (2) are real, but their