the competition between the two terms in formula (2)), then an appreciable broadening of the spectrum, due to motion of this focal region, may be observed on either side of the frequency ω_0.

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REGENERATION OF K^0 MESONS ON A DEUTERON AT HIGH ENERGIES

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In this paper, postulating dispersion relations for forward scattering of K mesons by deuterons and using isotopic invariance of strong interaction, we calculate the differential cross section and the phase of the amplitude of the coherent regeneration process $K_2d \rightarrow K_1d$. The calculations were made either under the assumption that the Pomeranchuk theorem is violated [1] or in the Regge-pole model [2].

Figure 1 shows plots corresponding to two parametrizations of the total-cross-section difference $\Delta\sigma = \sigma_t(K^-d) - \sigma_t(K^+d)$ above 3 GeV (or equivalently to two parametrizations of the imaginary part of the coherent-regeneration amplitude):

$$\Delta\sigma(w) = \begin{cases} 5.5 + 20/w & \text{I} \\ 6.0 + 11.4 \cdot \exp(-0.2w) & \text{II} \end{cases}, \quad (1)$$

where the constants have the dimensions of cross section and w is the meson laboratory energy. These parametrizations imply the assumption that the Pomeranchuk theorem is violated.

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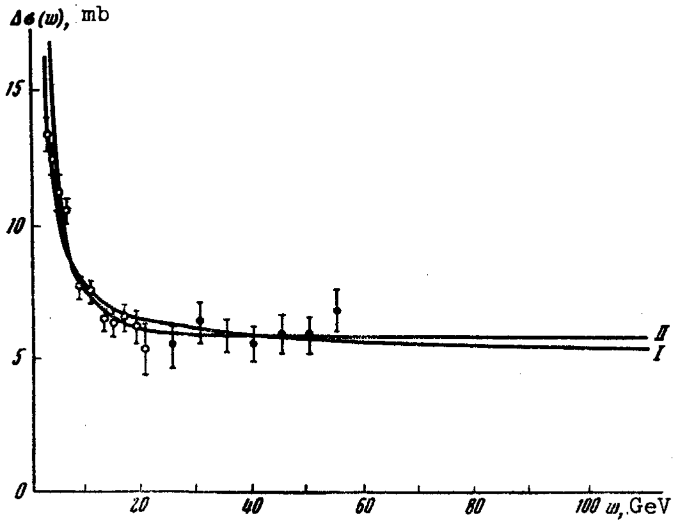

Fig. 1. $\Delta\sigma$ vs. energy under the assumption of a constant $\sigma_t(K^+d) = 336 \pm 0.3$ mb above 3 GeV. The experimental data are from [9]. The curves correspond to parametrizations I and II.

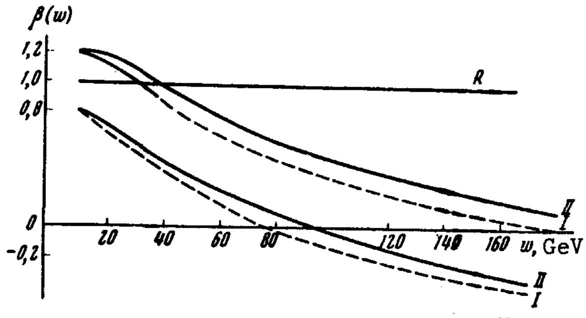

Fig. 2. Energy dependence of the ratio $\beta(w = 10)$ of the real and imaginary parts of the regeneration amplitude for different parametrizations.

Following [3], we reconstruct the real part of the amplitude of coherent regeneration on deuterons by using (1) and the dispersion representation

$$f^{reg}(w) = w\left\{C - \frac{a}{w^2} + \frac{K^2}{\pi}\int_{3\,\mathrm{GeV}}^{\infty} \frac{\Delta\sigma(w')\,dK'}{w'[w'^2 - (w + i\epsilon)^2]}\right\}. \qquad (2)$$

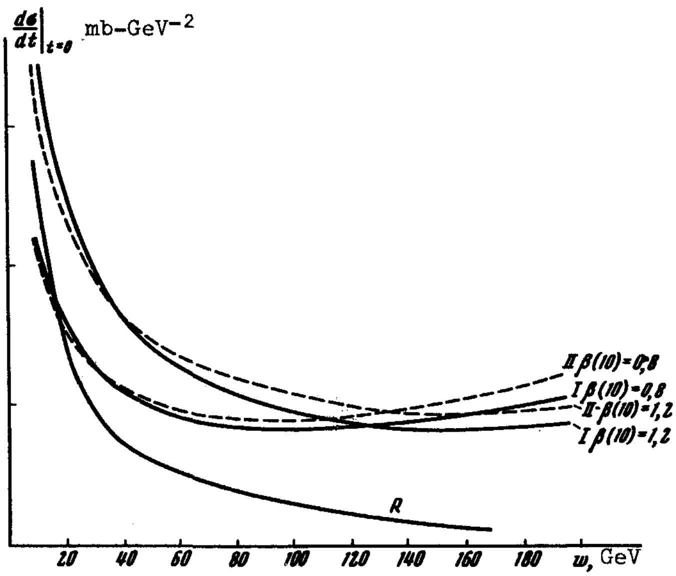

Fig. 3. Differential cross section of forward regeneration on deuterons at different values of $\beta(w - 10) = 0.8$ and 1.2 and at parametrizations I and II. The curve R corresponds to the Regge-pole model.

The quantity a includes the low-energy contribution to the dispersion relations, and is calculated by a power-law fitting of $\Delta\sigma$ at low energies. Errors in the calculation of a have little effect on (2) at high energies. We determine the constant C for fixed values of the ratio β of the real part of the regeneration amplitude to its imaginary part at $w = 10$ GeV. The scatter in the values of between 0.8 and 1.2 should cover the possible changes of β compared with the low-energy experimental data, which yield practically the same value, close to unity, for different nuclei [4].

The differential coherent-regeneration cross section is determined from the formula

$$\left.\frac{d\sigma}{dt}\right|_{t=0} = \frac{1}{\pi\, 64}\,(1 + \beta^2)(\Delta\sigma)^2 \qquad (3)$$

The results of the calculations of the ratio of the real part of the regeneration amplitude to its imaginary part and of the differential forward regeneration cross section are shown in Figs. 2 and 3. The Regge curves shown in the same figures were obtained in Glauber's approximation [5].

It is seen from the figures that even at the Serpukhov energies, regeneration experiments performed with good accuracy can determine the validity of certain models and verify the Pomeranchuk theorem, violation of which does not contradict the general principles of field theory [6].

The fact that β tends to $-(2/\pi)\ln w$ as $w \to \infty$ is the consequence of the dispersion relations and of the constancy of $\Delta\sigma$ at high energies, and does not depend on the kind of regenerator. Therefore measurements on heavy nuclei can verify whether the dispersion relations for the amplitudes of forward scattering by nuclei are valid [7] and whether the difference between the total cross sections of particles and antiparticles is constant at high energies.

If the measurements are made not in the asymptotic region, then the results of experiments on nuclei and nucleons, generally speaking, may differ because of the different manner in which $\Delta\sigma(w)$ approaches $\Delta\sigma(\infty)$ for nuclei and for nucleons. Such a difference can be approximately determined for β by means of the relation

$$\rho_N(w) \approx \beta_A(w) \frac{\Delta\sigma_A(w)}{\Delta\sigma_N(w)} \frac{\Delta\sigma_N(\infty)}{\Delta\sigma_A(\infty)} . \qquad (4)$$

We note that experiments on K mesons also can yield information on the behavior of the difference of the total cross sections of $\pi^{\pm}$ mesons on nucleons within the framework of the quark model [8], whose relation

$$\Delta\sigma_{kp} - \Delta\sigma_{kn} = \Delta\sigma_{\pi p} ,$$

agrees well with the Serpukhov data and with the assumption that the total cross sections are constant at high energies.

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