both quantities decrease like $\sim 1/p$. At $h\nu_1 = 2 \times 10^{-13}$ erg, we have $w_1 \simeq 1$ if $I_1 \simeq 0.2 - 2$ W/cm^2. If $\sigma_2 = 10^{-19}$ cm^2 and $h\nu_2 = 4 \times 10^{-12}$ erg, then $w_2 \simeq 1$ and $I_2 \simeq 4 \times 10^3$ W/cm^2. At the presently available radiation intensities, two-step dissociation can be realized, in particular, and is faster than the time of vibrational relaxation.

From the point of view of two-step dissociation, interest attaches to excitation of the molecules CF_3I ($\nu_1 = 1073$ cm^{-1}) by a CO_2 laser. The continuous absorption spectrum of these molecules from the lower vibrational level begins with 35,500 cm^{-1}, and it is possible that excitation of about ten vibrational levels will suffice for dissociation of this molecule by radiation of the second harmonic of a neodymium laser ($\sim$20,000 cm^{-1}).

We note in conclusion that resonant photoexcitation of molecule vibrations can greatly increase the rate of photodissociation from broad band sources of visible light by increasing the number of photodissociation channels.

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SCATTERING OF γ QUANTA BY NUCLEONS IN THE QUARK MODEL

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Submitted 21 June 1971
ZhETF Pis. Red. 14, No. 3, 181 - 184 (5 August 1971)

In connection with the appearance of experimental data on the total cross sections of γN interactions at high energies [1], it is of interest to extend the quark model to the processes $\gamma + N \to \gamma + N$.

The amplitudes of γN scattering (above the threshold of V-meson photoproduction) can be connected in the quark model with the amplitudes of elastic scattering of mesons by nucleons:

$$\frac{8}{a}\frac{\gamma_\rho^2}{4\pi}F(\gamma N \to \gamma N) = \left(1 + \frac{\gamma_\rho^2}{\gamma^2} - \frac{\gamma_\rho}{\gamma_\phi^2}\right)[(\pi^- p) + (\pi^+ p)] +$$

$$+ \frac{\gamma_\rho^2}{\gamma_\phi^2}[(K^+ p) + (K^- p) + (K^\circ p) + (\bar K^\circ p)] \pm 2\frac{\gamma_\rho}{\gamma_\omega}[(K^+ p) + (K^- p) - (K^\circ p) - (\bar K^\circ p)], \quad (1)$$

where (πp) and (Kp) are the amplitudes of elastic πp and Kp scattering, γ_V are standard constants of the γV interaction; the signs (±) correspond to scattering of γ quanta by protons and neutrons.

Using the optical theorem, we can readily rewrite (1) in terms of the corresponding total cross sections.

Relations (1) allow us to draw the following conclusions:

1. The total cross sections of γN interaction should satisfy the inequality

$$\sigma_t(\gamma p) > \sigma_t(\gamma n), \tag{2}$$

which agrees with the experimental data in a wide energy interval [1]. Condition (2) is based on the inequality

$$\sigma_t(K^+p) + \sigma_t(K^-p) - \sigma_t(K^\circ p) - \sigma_t(\bar{K}^\circ p) > 0,$$

which is satisfied at large momenta of the incident particles (p > 4 GeV, for example).

2. Describing the energy dependence of the quantities $\sigma_t(\pi N)$ and $\sigma_t(KN)$, measured in [2], by the formula $\sigma_t = \sigma_\infty + c/\sqrt{p}$ (p - momentum, in GeV, of the incident meson in the laboratory system), we obtain with the aid of (1)

$$\sigma_t(\gamma p) = \left(88 \pm 11 + \frac{90 \pm 11}{\sqrt{k}}\right)\ \mu b\ , \quad \sigma_t(\gamma n) = \left(87 \pm 11 + \frac{86 \pm 11}{\sqrt{k}}\right)\ \mu b\ , \tag{3}$$

where k is the energy of the γ quantum in GeV. For the constants $\gamma_V^2/4\pi$ we used the values obtained in experiments with colliding e^+e^- beams [3].

In [4], the energy dependence of the quantities $\sigma_t(\pi N)$ and $\sigma_t(KN)$ was described by the formula $\sigma_t = \sigma_\infty + c/p$. The values of σ_∞ and c from [4] make it possible to obtain with the aid of (1)

$$\sigma_t(\gamma p) = \left(107 + \frac{115}{k}\right)\ \mu b\ , \quad \sigma_t(\gamma n) = \left(106 + \frac{66}{k}\right)\ \mu b \tag{4}$$

Both obtained parametrizations (3) and (4) do not contradict the available experimental data on $\sigma_t(\pi N)$.

3. If we use at t = 0 the parametrization based on Regge poles [5] for the amplitudes (πp) and (Kp), then we can calculate with the aid of (1) the real parts of the amplitudes of γN scattering at zero angle. The values predicted in the quark model for σ_N = Re $F(\gamma N \to \gamma N)$/Im $F(\gamma N \to \gamma N)$ are listed in Table 1.

Table 1

k, GeV	6	8	10	12	14	16	18	20
$-\alpha_p$	0.41	0.37	0.34	0.31	0.30	0.28	0.27	0.26
$-\alpha_n$	0.23	0.21	0.19	0.185	0.175	0.17	0.16	0.155

We see that $|\alpha_p| > |\alpha_n|$, and the predicted values of α_p exceed in absolute magnitude the customarily employed $\alpha_p = -0.2$.

4. The differential cross sections of γN scattering at t = 0 are determined by the formula

$$\frac{d\sigma}{dt}(\gamma N \to \gamma N)_{t=0} = \frac{\sigma_t^2(\gamma N)}{16\pi}(1 + \alpha_k^2) \quad (5)$$

Table 2 gives the values of the γN scattering cross sections calculated in accordance with (5) using α_n from Table 1.

Table 2 (sections in 10^{-32} cm^2/Gev^2)

k, GeV	6	8	10	12	14	16	18	20
$\frac{d\sigma}{dt}(\gamma p \to \gamma p)_{t=0}$	89,0	82,5	76,0	72,5	69,7	67,3	66,5	66,0
$\frac{d\sigma}{dt}(\gamma n \to \gamma n)_{t=0}$	73,3	70,0	66,0	63,3	62,0	59,5	59,5	59,5

The predicted values for $d\sigma/dt(\gamma p \to \gamma p)_{t=0}$ agree with the available experimental data [6]:

$$\frac{d\sigma}{dt}(\gamma p \to \gamma p)_{t=0} = (85 \pm 15)\cdot 10^{-32}\frac{\text{cm}^2}{\text{GeV}^2}(k = 5{,}5\ \text{GeV}),$$

$$(63 \pm 6)\cdot 10^{-32}\ \text{cm}^2/\text{GeV}^2 (k = 11{,}5\ \text{GeV}).$$

We see from Table 2 that the difference between the differential cross sections of γp and γn scattering at t = 0 reaches 10%.

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