between the light and the beam up to several milliseconds. The efficiency can also be increased by means of multiple reflections and by reverse reflections of the light back into the trap.

In connection with these problems it is of great theoretical and experimental interest to investigate the ionization and dissociation of molecules and molecular ions in intense optical fields. It is possible that in molecular systems there are various effects that can affect atomic interactions because of perturbations of electron states. For example, polarization can cause repulsion of the atoms or the excitation of vibrational oscillations.[5] A strong optical field can favor exchange transitions and exchange interactions between atoms.

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DOUBLE CHARGE EXCHANGE OF π^+-MESONS

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A large number of stars with secondary π^+ mesons was recorded in a study of the production of mesons by mesons in a nuclear emulsion bombarded by 250—300 MeV π^- mesons[1]. One of the causes of these events is the formation of an additional meson on individual nucleons in complex nuclei, in accordance with the reaction

$$\pi^- + p \rightarrow \pi^+ + \pi^- + n, \qquad (1)$$

in which a secondary negative meson is absorbed in the same nucleus, or else charge exchange in the same nucleus of one of the π^0 mesons from the reaction

$$\pi^- + p \rightarrow \pi^0 + \pi^0 + n. \qquad (2)$$

However, other processes are also possible, and they can result in the formation of a π^0 meson following a collision between a π^- meson and a nucleus. These are double charge exchange processes in accordance with the scheme

$$\begin{array}{l} \pi^- + p \rightarrow \pi^0 + n \\ \qquad\qquad \downarrow \\ \qquad\qquad \pi^0 + p \rightarrow \pi^+ + n \end{array} \qquad (3)$$

or

$$\pi^- + (2p) \rightarrow \pi^+ + (2n). \qquad (4)$$

The difficulties in separating the effects from reactions (3) and (4) are apparently the main reason why they have not been investigated. However, an investigation of double charge exchange of mesons is of interest, since this can yield additional information on the interaction between charged and neutral mesons with nucleons in complex nuclei. In addition, great interest is attached at the present time to the possibility of using double charge exchange for the production of new light nuclei[2].

Using the experimental material accumulated in the study of the production of mesons by mesons, it is possible to attempt to separate the hitherto unobserved processes (3) and (4). However, it is necessary to verify first that the secondary π^+ mesons occur also at energies that are considerably lower than the meson production threshold. In this case the π^+ mesons can be produced only in a double charge exchange process, and consequently reactions (3) and (4) can be observed in such an experiment in pure form.

Such an experiment was performed with the synchrotron of the Nuclear Problems Laboratory of the Joint Institute for Nuclear Research. A charge-symmetrical process was investigated. A pellicle stack measuring $10 \times 10 \times 2$ cm was irradiated in an 80-MeV π^+-meson beam. The π^+ mesons were stopped in the emulsion after traveling through 7.5 cm. The irradiation density was 1.2×10^9 mesons per square meter.

The stopped π^- mesons were identified in the developed emulsions by the characteristic σ stars. Prongless stopped mesons were not registered. The tracks of the registered π^- mesons were continued in the stack to the stars produced in the emulsion. A total of 31 stars with primary tracks were found by scanning 15 pellicles. None of the primary tracks in these stars differed in ionization density (within 10 per cent) and in direction (within $\pm 3°$) from the tracks of the beam π^+ mesons. These events cannot be attributed to an admixture of π^- mesons in the beam.

All the registered events were in the energy interval 30—80 MeV. Not a single event was obtained in the 0—30 MeV primary π^+-meson energy interval.

We have thus registered in this work the process of double charge exchange on emulsion nuclei ($\bar{Z} = 21$).

The cross section for double charge exchange of π^+ mesons (with allowance for the geometrical correction for the probability of registration of π^- mesons in the stack and the correction for pronged less stopping) is $(4 \pm 1) \times 10^{-28}$ cm^2 in the energy interval 30—80 MeV.

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NEUTRINOSCATTERING BY A POLARIZED ELECTRON

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IN view of tne importance of the experimental discovery of the $(e\nu)(e\bar{\nu})$ interaction, the existence of which is predicted by the Feynman–Gell-Mann scheme [1], it seems useful to note the strong spin dependence of the cross sections for $\nu + e$ and $\bar{\nu} + e$ scattering. The cross sections for the scattering of neutrinos and antineutrinos by a polarized electron are respectively:

$$\sigma_{\nu e} = 2\sigma_0\omega^2(1+\lambda)/(1+2\omega) \approx \sigma_0\omega(1+\lambda), \quad \omega \gg 1,$$

$$\sigma_{\bar{\nu} e} = \frac{1}{3}\sigma_0\omega\left\{\left(1-\frac{1}{(1+2\omega)^3}\right)+\lambda\left[\left(1+\frac{1}{\omega}\right)\left(1-\frac{1}{(1+2\omega)^3}\right)\right.\right.$$
$$\left.\left.-\frac{3}{2}\frac{1}{\omega}\left(1-\frac{1}{(1+2\omega)^2}\right)\right]\right\} \approx \frac{1}{3}\sigma_0\omega(1+\lambda), \quad \omega \gg 1,$$

where $\sigma_0 = 2G^2m^2/\pi = 8.4 \times 10^{-45}$ cm^2, $\omega = E/m$, E is the neutrino (antineutrino) energy in the laboratory system, m is the electron mass, and λ is the polarization of the electron in the direction of the neutrino (antineutrino) beam. It is possible that the indicated fact could be used in neutrino scattering on polarized iron in order to separate the effects of $\nu(\bar{\nu}) + e$ scattering from the background.

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