where dn(z, s) is the Jacobi elliptic function, s is its modulus, and the quantities A and B (A = max a, B = min a) are slowly varying functions of ξ and τ (compared with the modulation lengths). (When A and B are constant, expressions (8) are, like (7), exact solutions of the equations in (2).) When $\xi \to 0$, B vanishes and (8) goes over into (7). The region of applicability of expressions (8) terminates near the boundaries of the "deeply modulated" region PQ (see the figure). Outside this region, the oscillations of the amplitude are diverging waves similar to those produced during the linear stage of the process when $\xi \gg \kappa_0\tau$. With increasing distance from the points P and Q, the group velocities of the diverging waves take on the asymptotic form ξ/τ. It can also be shown that the width of the region PQ increases more rapidly than τ (as $\tau \to \infty$); the number of solitons formed in the central region PQ is then accordingly increased.

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* The function f(z) can always be chosen such that (6) holds for sufficiently large τ and ξ.

RADIOACTIVE NUCLEI IN SOLAR COSMIC RAYS

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We wish to call attention in this note to the possible existence of an interesting phenomenon in solar cosmic rays.

According to existing notions (see [1,2]), the cosmic rays are generated on the sun during the time of chromospheric flares, and prior to emerging to the interplanetary medium a particle traverses in the solar atmosphere a path $l = 10^9$ cm with an average hydrogen concentration $n_H = 3 \times 10^{13}$ cm^{-3}. The flux of radioactive nuclei of any type i in the energy interval (E_1', E_2'), produced as a result of collision between the accelerated particles and the hydrogen of the solar atmosphere, can be readily calculated from the formula

$$F_i(E_1', E_2') = n_H l \int_{E_1}^{E_2} F_j(E)\sigma(E)dE = n_H l \overline{\sigma(E)} F_j(E_1, E_2), \quad (1)$$

where $\sigma(E)$ is the cross section of this reaction, and $F_j(E_1, E_2)$ is the flux of nuclei of type j in the energy interval (E_1, E_2). We have used here the fact that the path traversed by the particle in the solar atmosphere is equal to the thickness of the region of the flare, regardless of the particle energy [2].

We shall not consider here the production of all possible radioactive nuclei, and indicate only two cases, when the flux of certain nuclei will be represented essentially by their radioactive isotopes.

According to [3], the cross section for the production of the isotope Be^7 from carbon in the reaction $C^{12}(p, x)Be^7$ reaches a maximum of 20 mb at a proton energy 40 MeV, and decreases very slowly with increasing energy, so that even for a proton energy 377 MeV the cross section is ~11 mb. It is clear from kinematic considerations that the energy per nucleon of the produced Be^7 nuclei will be in the same interval as that for the C^{12} nuclei. Therefore, taking a mean value $\overline{\sigma(E)} = 10$ mb, we obtain from (1) for carbon nuclei with energies from 30 to 400 MeV/nucleon

$$\frac{F_{Be7}}{F_{Be9}} = \frac{F_{Be7}}{F_{C12}} \frac{F_{C12}}{F_{Be9}} = 3 \cdot 10^{-4} \frac{F_{C12}}{F_{Be9}}. \quad (2)$$

An analysis of the composition of solar cosmic rays [4] in the interval 120 - 204 MeV/nucleon leads to the conclusion that it agrees well with the chemical composition of the solar atmosphere. If this conclusion can be extended to cover the entire energy interval of the carbon nuclei, then (2) can be written in the form

$$\frac{F_{Be7}}{F_{Be9}} = 3 \cdot 10^{-4} \frac{n_{C12}}{n_{Be9}} = 7 \cdot 10^{2},$$

where n_{C12} and n_{Be9} are the concentrations of these nuclei on the sun [5].

Thus, the flux of Be^7 nuclei in the energy interval 40 - 140 MeV/nucleon should be many times larger than the flux of Be^9 nuclei, and at the same time the flux of the Be^7 nuclei should not be smaller than the flux of the light nuclei in the solar cosmic rays, since the fluxes of the different nuclei of the L group, at least, do not exceed the flux of the Be^9 nuclei (the latter follows from their abundance on the sun), and the probability of production of light nuclei is the same as for Be^7 production. It should be noted that even if the concentration of the hydrogen in the region of the flare is decreased by two orders of magnitude, the Be^7 flux will still remain not smaller than the flux of the L-group of nuclei.

Since there are no data at present on the flux of the L-group of nuclei in solar cosmic rays, it is of interest to estimate the possible flux of Be^7 nuclei by means of formula (1). For the 120 - 204 MeV/nucleon interval, it amounts to 1.2×10^{-3} $m^{-2}sec^{-1}sr^{-1}$.

The possibility that the flux of a radioactive isotope will exceed that of the stable one can be realized also for cobalt nuclei. The cross section of the reaction $Fe^{56}(p, n)Co^{56}$ has a sharp maximum at a proton energy ~10 MeV ($\sigma \approx 400$ mb), followed by $\sigma \approx 20$ mb at 30 MeV and a slow decrease to a value $\sigma \approx 3$ mb at a proton energy 400 MeV [6,7]. When accelerated iron nuclei move through the solar atmosphere, the aforementioned reaction will produce cobalt nuclei having the same energy per nucleon; it follows then from the same considerations as for Be^7 that $F_{Co56}/F_{Co59} > 1$ for the 5 - 30 MeV/nucleon region. For energies 30 - 400 MeV/nucleon, the flux of radioactive cobalt is several per cent of the flux of the stable isotope.

It should be noted that an experimental investigation of the flux of radioactive isotopes will yield new information on the parameters of the region where cosmic rays are generated on the sun (such as n_H and l). The half-life of the nuclei in question is sufficiently large (53.6 and 77.3 days for beryllium and cobalt, respectively) to permit their observation on their earth orbit.

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POSSIBILITY OF OBSERVING A NEW TYPE OF PHOTOCONDUCTIVITY INDUCED BY THE ACTION OF STRONG LIGHT ON CARRIERS

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Nonlinear optical effects connected with semiconductor carriers have been recently predicted [1-3]. Wolff and Pearson [1] calculated the harmonic generation resulting from the nonlinear dependence of the electron velocity v on the quasimomentum p in a nonparabolic (np) band $H_0(p)$. Patel, Slusher, and Fleury observed this effect [4].

We wish to call attention to the fact that the nonlinear dependence of v on p leads to the appearance of a new photoeffect. If a sample carrying a direct current $j_0 = \sigma E_c$ is exposed to light, then an additional direct current $J_{np} \sim E_0^2 E_c$ is induced in it (E_c is the constant field and $E_0 \cos \omega t$ is the electric vector of the light). The current J_{np} can be calculated by the density-matrix method. We present a solution of the equation for the statistical operator $\hat{\rho}$ of an electron in an electric field of arbitrary magnitude and for an arbitrary dispersion law $H_0(p)$:

$$\hat{\rho} = \exp[-H_0(\hat{p} - \Delta p)/kT], \quad \Delta p = \int_{t_0 \to -\infty}^{t} dt' F(t'). \tag{1}$$

Here F(t) is the force acting on the electron and Δp is the increment of momentum acquired by the electron from the instant t_0 when the field is turned on.

We consider a case when the deviation of the dispersion from parabolic is described by Kane's model [1] and take into account the term $-p^4/4m^2 eg$ in the expansion of $H_0(p)$ (m is the electron effective mass and E_g is the width of the forbidden band). We calculate the current $J_c = neSp\hat{v}_c\hat{\rho}/Sp\hat{\rho}$, including only terms that describe the effect of interest to us:

$$J_{np} = -\frac{e^2 E_0^2}{2\omega^2 m E_g}(1 + 2\cos^2\theta) J_0. \tag{2}$$

θ is the angle between the vectors of the constant and alternating fields. The increase of the momentum under the influence of the force eE_c is limited here by the momentum relaxation time. If we focus the radiation of a Q-switched CO_2 laser, we can obtain an appreciable