Observation of such a transfer is of interest, since the energy of the excited manganese center is lower than the energy radiated by the copper center. Consequently, this transfer violates Stokes rule.

It is impossible for the time being to describe in greater detail the mechanism of such a transfer. We can only point out that the energy necessary to cover the difference between the orange and the blue quantum is most likely to be provided by the field.

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LIGHT-REACTION ACCELERATION OF MACROPARTICLES OF MATTER

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We describe in this communication the first experiments on the acceleration of macroparticles of matter by the action of laser radiation. As shown in [1] the recoil pressure during evaporation can exceed the direct light pressure by a factor of thousands or tens of thousands, and therefore the "light-reaction" method of particle acceleration, proposed in [1], is more effective than acceleration with light pressure, especially when the path is small or the acceleration time is short.

We used for the acceleration the radiation from a Q-switched ruby laser. The radiation was focused on a thin transparent film (or thin foil), on which were sprinkled (with the beam acting from below) or glued particles with dimension on the order of a fraction of a millimeter. Metal filings and corundum powder were used.

A piezoelectric micrometeorite recorder was placed at a distance of 15 cm along the direction of particle motion. The particle velocities, as estimated from the delay time of the piezoelectric recorder pulse, were of the order of 10^6 cm/sec. Such velocities correspond to a not very high ratio of the initial mass to the final mass, $v_{fin} \approx u_{esc}\ln(M_0/M_{fin}) \sim u_{esc}$, since the particle dimensions were larger than the dimensions of the craters left after single flashes on the target.

To investigate the action of the accelerated particles on matter, glass or metal plates were placed in their path, and a metallographic microscope was used to investigate the craters produced by impacts of particles with different masses.

Figure 1 shows a crater on a glass plate, magnified 600 times, and Fig. 2 shows, with magnification 120x, the opening pierced by another particle in a copper foil 20 μ thick.

The appearance of the produced craters recalls the damage effected by large micrometeorites.

Fig. 1

Fig. 2

When the laser radiation is used under optimal conditions and the variation of the particle mass is large, a particle velocity up to 10^7 cm/sec and higher can be attained. The particles can be accelerated not only by the pressure of the particle evaporation jets, but also under the influence of the pressure of the flux of matter from the flare on the surface or from the light spark in the focus of the laser, and also under the influence of the so-called "radiometric" forces which are produced when matter moves from the heated surface of the particle.

The optical-gasdynamic acceleration of particles can be used to obtain artificial micrometeorites and to investigate their action on materials, to develop methods of protection against micrometeorites or man-made particles projected in space by acting on them with laser beams, and also to divert dust particles and droplets from a powerful laser beam and prevent the scattering or blocking of the beam by clouds. The accelerated particles are of particular interest in connection with the proposal [2] of obtaining a thermonuclear burst by letting fast particles strike a target.

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MAGNETIC-IMPURITY RESONANCE IN SEMICONDUCTORS

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We consider in this note semiconductors with several energy valleys in p-space. The purpose of the note is to point out a unique resonant dependence which can be exhibited in such semiconductors by the probability of electron scattering by impurities, accompanied by a transition between individual valleys, as a function of the magnetic field. The presence of such resonances can lead to oscillations of the static electric conductivity (and also of a number of other kinetic coefficients) as the magnetic field is varied.

Conduction electrons belonging to a certain valley α have in a magnetic field a spectrum consisting of a system of Landau levels, whose position is given in the simplest case (to which we confine ourselves here) by the formula

$$\epsilon_\alpha(n_\alpha,\sigma_\alpha) = \hbar\Omega_\alpha\left(n_\alpha + \frac{1}{2}\right) + \mu_\alpha H\sigma_\alpha + \Delta\epsilon_\alpha. \tag{1}$$

Here $n_\alpha = 0, 1, 2, \ldots$, $\Omega_\alpha = eH/m_{\perp\alpha}$, c is the cyclotron frequency, e the charge of the electron, $m_{\alpha\perp}$ the corresponding "transverse" effective mass, H the magnetic field, μ_α the effective magneton determining the splitting of the electron spin levels, $\sigma_\alpha = \pm 1$, and $\Delta\epsilon_\alpha$ characterizes the position of the bottom of the α-th valley relative to a certain origin which is common to all the valleys.

The density of the electron states has in a magnetic field a singularity (sharp maximum) at energy values coinciding with the positions of the corresponding Landau levels. In calculating the probability of the intervalley transition for electrons with a given energy, it is necessary to average over the initial states and sum over the final ones. As a result, the expression for the transition probability contains the product of the densities of the initial and final states. This product has a maximum when the position of two Landau levels