dislocation" interaction in crystals, has been experimentally successfully observed.

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M. A. Krivoglaz. The Fluctuon States of Electrons in Disordered Systems

The interaction of electrons with the fluctuations of some internal parameter of a nonmetallic medium is considered. If the variation of this parameter leads to the appearance of a sufficiently deep and wide potential well, then the electron localizes in it. The decrease in the energy of the electron on localization may turn out to be larger than the increase in the thermodynamic potential of the medium connected with the fluctuation and, then, the appearance of the fluctuation, in the vicinity of which the electron localizes, will be thermodynamically favorable. Under definite conditions the radius of the electron state turns out to be fairly large, considerably exceeding the interatomic distance.

Such type of large-radius formations in which an electron is localized near a change (fluctuation) in some internal parameter of a medium and maintains by means of its own field the stationarity of this fluctuation (the bound electron-fluctuation states) have been called fluctuons. They have been theoretically considered in[1-6]. Fluctuons should move in an external electric field, so that if fluctuons are thermodynamically favorable, they can play the role of current carriers. In order that a significant number of electrons will go over into fluctuon states, it is necessary that the characteristic relation time of the internal parameter be small compared with the life time of the electron in the potential well.

Fluctuons may be connected with fluctuations of the composition of solutions[1,3,4] (producing regions with sharply increased concentration of one of the components), with fluctuations of the magnetization in elementary magnets[2,4] (producing ferromagnetic regions in paramagnets or regions of enhanced magnetization in ferromagnets), with fluctuations of the long-range order in ordered crystals[4], with the fluctuations of the density in gases[4,5], etc. In systems which are close to a first-order phase transition point, an electron may localize at a heterophase fluctuation of the second phase, stabilizing the fluctuation and producing a phason—a particular type of fluctuon[1], which is characterized by the existence of a discontinuity in the variation of the internal parameter.

For the appearance of fluctuons of large radius, it is necessary that the energy of interaction of an electron with the internal parameter, A, be small compared with the width of the conduction band, but large compared with kT and the characteristic energy kT_c of the direct interatomic interaction (T_c is the Curie or critical temperature). It is significant then that in the considered examples, the formation of fluctuons turned out to be thermodynamically favorable only in a definite temperature range $T_1^* < T < T^*$, which includes the temperature T_c (but not $T = 0$), the transition to the fluctuon states occurring, for the majority of electrons, in a comparatively small temperature interval $\delta T \ll T^*$ and having the character of a diffuse phase transition. In this respect, fluctuons greatly differ from polarons[7] (with which, conceptually, they have much in common). The macroscopic nature of fluctuons is connected with the nonlinear dependence of the change in the internal parameter on the force exerted by the electron, and not with a long-range interaction as in the case of polarons.

The direct interatomic interaction can facilitate the formation of fluctuons. The effect manifests itself especially sharply in the vicinity of the critical points on a decay curve, on a gas-liquid curve, or in the vicinity of the Curie points[4]. Fluctuons are produced in this region at substantially smaller $|A|$ and have unique properties. In particular, no free-energy barrier is surmounted in their formation as is the case at points far from the critical region.

The formation of the fluctuons, perceived as a smeared phase transition in the electron subsystem, should lead to a qualitative change in all the electronic properties of the system--the electrical conductivity, the galvanomagnetic and thermoelectric effects, the optical properties (a new absorption band may appear owing to optical transitions in the fluctuon), the magnetic properties (because of the anomalously large magnetic moment of a fluctuon in an elementary magnet), etc. Certain atomic properties also change (fluctuons may strongly influence the kinetics of phase transitions, the scattering of x-rays, neutrons and light, the density of gases, etc.).

In particular, the mechanism underlying the mobility of the current carriers should qualitatively change when fluctuons are formed. This problem was investigated, using as an example, fluctuons in solutions and paramagnets, as well as phasons[6]. It turns out that fluctuons have no mean free path (its effective value is much less than the radius of a fluctuon) and their motion is connected with diffusion or with viscous flow in a medium. Therefore, a "hydrodynamic" approach, in which the energy dissipated in the medium during the motion of a fluction is calculated, was used to calculate the mobility u of fluctuons. In solutions u is proportional to the atomic coefficient of diffusion D and is n times smaller than the mobility of the ions (n is the effective number of atoms in the volume of a fluctuon). The effective mass of fluctuons M which determines the inertial force during their motion in high-frequency fields was also found. It is inversely proportional to D^2 and usually exceeds substantially the mass of the atoms.

The interaction of electrons with the inhomogeneities of internal parameters may qualitatively change the state of not only the current carriers but also the electrons localized near impurity centers. In particular, the existence of two self-consistent states (stable and metastable), having s-symmetry—hydrogenlike and fluctuon-type states—turns out to be possible at Coulomb centers of large radius. A transition of the electrons from one state to another should occur in the vicinity of a definite temperature [8]. Excitons may also have self-consistent fluctuon states of a different type[9]. Let us note that under definite conditions fluctuon complexes, containing two ("bifluctuons") or several electrons, will appear.

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F. F. Voronov. The Effect of Pressure on the Elastic Moduli of Solids

The paper is a review of the results of experimental investigations of the elastic properties of solids at high pressures. Basically, it describes the ultrasonic method of investigations and three sets of equipment, constructed at the Institute of High-pressure Physics of the USSR Academy of Sciences for investigations at hydrostatic pressures of up to 10 kbar, and at quasi-hydrostatic pressures of up to 30 and 100 kbar. Further, the results obtained are analyzed. It is shown that in a pressure range far from phase transitions, the elastic moduli increase with pressure and the effect of pressure ($\partial \ln M/\partial p$) is proportional to the compressibility of the investigated materials.

An equation of state of solids in the form of the Bridgman polynomial and valid up to 100 kbar, and the Murnagan equations of state are derived from the experimentally determined variation of the bulk modulus.

Analysis of the results of the investigation of the elastic characteristics of ionic crystals on the basis of the Born-Mayer central-force model showed that this model reproduces well the dependence of density on pressure even in the case of large deviations from the Cauchy relation (1 : 6, AgCl), satisfactorily describes the behavior of the bulk modulus under pressure (RbCl, RbI), and gives considerable deviations in the magnitudes of the shear constants and their derivatives with respect to pressure (RbCl).

The question of the anharmonicity of the lattice vibrations is considered—the Grüneisen constants are determined for long-wavelength sound vibrations in the investigated materials.

Distinctive features of the change in the elastic properties when a phase transition of the type NaCl → CsCl occurs in the rubidium halides, or when a 4f → 5d electron transition occurs in cerium, are demonstrated.

Results of investigations of the velocity of sound in polycrystals of NaCl, CsCl and AgCl at pressures of up to 100 kbar are given, and the prospects for the use of the ultrasonic method of investigations of the elastic properties of solids in the condensed state in a wide range of pressures, especially for the study of the properties of high-pressure phases, are noted.

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S. A. Al'tshuler. Spin-phonon Interactions and Mandel'shtam-Brillouin Scattering of Light in Paramagnets

The observation of the Mandel'shtam-Brillouin scattering of light in paramagnetic crystals may give valuable information about the interaction of the spin