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A scientific session of the Division of General Physics and Astronomy and the Division of Nuclear Physics of the USSR Academy of Sciences was held on October 27 and 28 at the conference hall of the P. N. Lebedev Physics Institute. The following papers were delivered:

1. V. V. Ovsyankin and P. P. Feofilov, Cooperative Optical Phenomena in Condensed Media.
2. A. A. Abrikosov, Certain Properties of Metals with Magnetic Impurities.
3. I. M. Lifshitz and Yu. M. Kagan, The Quantum Mechanism of Phase-transformation Kinetics and the Problem of Metallic Hydrogen.
4. A. I. Alikhan'yan, Electromagnetic Emission of Ultrarelativistic Electrons.

We publish below brief contents of two of the papers.

V. V. Ovsyankin and P. P. Feofilov. Cooperative Optical Phenomena in Condensed Media.

A number of phenomena associated with transformation of electron-excitation energy (cooperative phenomena) are observed in systems of optically excited interacting particles in condensed media. Some of these phenomena are not only of considerable interest from the standpoint of the physics of the interaction of radiation and matter, but also open new avenues to the understanding of a number of extremely important processes many of whose aspects remain unclear today.

The greatest interest attaches to phenomena in which energy accumulates on one particle in the system of excited particles, with formation of high excited states. These phenomena, which are observed with greatest clarity in activated crystals, can be regarded as model phenomena with respect to more complex and more important phenomena in artificially created and natural heterogeneous systems (optical sensitization, photosynthesis). To demarcate the intrinsically cooperative processes of formation of high excited states from the phenomenologically similar processes of stepwise (sequential) excitation, we have a number of experimental criteria based on study of the characteristics of anti-Stokes luminescence from high excited states (the dependence on the intensity of the exciting radiation, interacting-particle concentrations, kinetics, excitation spectra).

The following cooperative energy-transformation processes have been observed in crystals with rare-earth activators: a) Summing of the energies of identical excited states. b) Summing of the energies of unlike excited states of identical ions. c) Summing of the energies of the excited states of unlike ions. d) Decay of an excited state of one particle with formation of a lower excited state of the same particle and excitation of a neighboring particle (relaxation of ion pairs). e) Summing of the excitation energies of two ions with simultaneous transfer of energy to a third ion (cooperative sensitization of luminescence). f) Decay of an excited state of a particle with excitation of two (or more) lower energy states of other particles.

In a number of cases, the accumulation of energy takes place with high probability; this makes it possible to treat the corresponding systems as efficient "step-up" frequency transformers for the incident radiation.

Processes in which virtual rather than real excited states are intermediate are also possible in activated crystals: a) Cooperative excitation of two interacting particles by one photon. b) Emission of one "cooperative" photon by two interacting particles. c) Cooperative amplification of light at the doubled (sum) frequency on its distribution in a medium with population inversion of the energy states of the interacting particles.

Cooperative processes of recombination of real electron levels of different particles are possible in interacting-particle systems: a) Raman excitation (absorption). b) Raman luminescence.

Cooperative accumulation of excitation energy manifested in anti-Stokes luminescence has been observed in a number of semiconductive crystals (silver halides, iodides of mercury and lead, thallium chloride and others) with a layer of energy-donor dye adsorbed onto their surfaces, and in photosynthetic systems (green leaves, Chlorella). The high efficiency of the accumulation process down to extremely low (subnanowatt) exciting-radiation densities, which can be observed in sensitized photographic emulsions, makes it possible to construct noncontradictory models of the primary acts of optical sensitization of photolytic (and photosynthetic) processes.

In a system of two interacting particles, one with discrete and one with continuous excited states (e.g., rare-earth ions and color centers), interference of these states, manifested in various peculiarities in the absorption spectra ("antiresonance"), is possible.

The data on which the presentation was based have been published in the following papers: V. V. Ovsyankin and P. P. Feofilov, ZhETF Pis. Red. **3**, 494 (1966); **4**, 471 (1967), **14**, 548 (1971) [JETP Lett. **3**, 322 (1966); **4**, 317 (1967), **14**, 377 (1971)]; Opt. Spektrosk. **20**, 526 (1966); **31**, 944 (1971); Dokl. Akad. Nauk SSSR **174**, 787 (1967) [Sov. Phys.-Dokl. **12**, 573 (1967)]; Zh. Prikl. Spektrosk. **7**, 498 (1967); Appl. Opt. **6**, 1828 (1967); the collection "Nelineĭnaya optika" (Nonlinear Optics), Nauka, 1968, p. 293; Trudy 9-ĭ Mezhdunarodnoĭ konferentsii po fizike poluprovodnikov-(Trans. Ninth International Conference on Semiconductor Physics), Vol. 1, Nauka, 1969, p. 251; the collection "Spektroskopiya kristallov" (Spectroscopy of Crystals), Nauka, 1970, p. 135; the collection "Molekulyarnaya fotonika" (Molecular Photonics), Nauka, 1970, p. 86; Biofizika **15**, 589 (1970); P. P. Feofilov and A. K. Trofimov, Opt. Spektrosk. **27**, 538 (1969); P. P. Feofilov, ibid. **31**, 849 (1971); V. V. Ovsyankin, ibid. **28**, 206 (1970); V. A. Arkhangel'skaya and P. P. Feofilov, ibid., p. 1215.

A. A. Abrikosov. Certain Properties of Metals with Magnetic Impurities (Kondo Effect).

It was observed back in the 1930's that the resistances of a whole series of metals begin at low temperatures to increase with decreasing temperature. This could be interpreted only as indicating the existence of a new electron-scattering mechanism whose effectiveness increases with decreasing temperature or energy of the electron. Subsequent experiments showed that this effect is related to the presence of magnetic impurities in the metal, i.e., impurities whose atoms have unfilled inner shells and retain their spin when situated in the host nonmagnetic metal. The effect was observed only at very low impurity concentrations ($<0.1\%$).

We now know many combinations of host metals and impurities in which this effect occurs. Temperature curves of resistivity were measured quantitatively in the mid-50's by Croft et al. on copper and by N. E. Alekseevskiĭ and Yu. P. Gaĭdukov on gold with a small iron impurity. It was found that resistivity is described at low temperatures by the formula $\rho = \rho_1 + \rho_2 \ln (1/T)$. A theory of this phenomenon was offered by the Japanese theoretician Kondo in 1964, and the effect has since borne his name. According to Kondo, the interaction of the electron with the impurity contains, in