Photoinduced Phase Transitions and Dynamics in Organic Conductors

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Transitions from insulator to metal phases, ionic ferroelectric to neutral paraelectric phases, nonmagnetic to paramagnetic phases, etc. can be achieved by photoirradiation of organic materials [1]. Charge order patterns are shown to be changed in some organic conductors and assembled metal complexes. These electronic phases are realized by an infinite number of interacting electrons. Under normal conditions, photoexcitations simply create electrons and holes and deform local structures, but the supplied energy dissipates in the environments. To achieve photoinduced phase transitions, we need certain circumstances which allow the photoinduced change to spread over the whole material. On the nanosecond time scale, the time evolution can be coarse-grained and described in a stochastic manner. On the picosecond time scale, we need to treat electrons and phonons directly and the time evolution should be described mainly in a deterministic manner. Progress in our understanding of their mechanisms will be introduced [2].

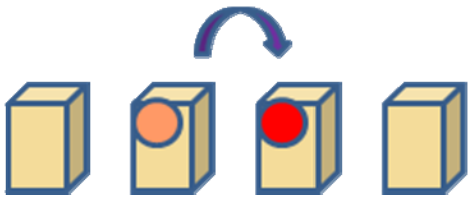

Fig. 1 Charge-transfer excitation creates an electron and a hole.

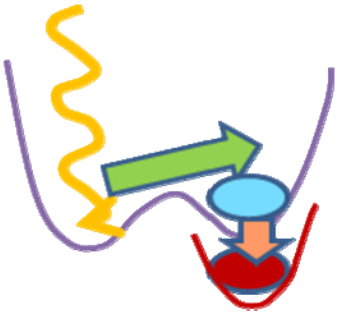

Fig. 2 Photoexcitation deforms the structure around the electron and the hole.

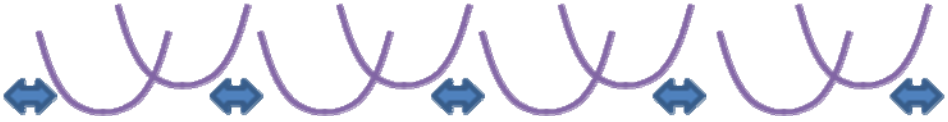

Fig. 3 If intermolecular couplings satisfy some conditions, the photoinduced change spreads.

[1]. Special Topics on "Photo-Induced Phase Transitions and their Dynamics," J. Phys. Soc. Jpn. **75**, 011001–011008 (2006).

[2]. K. Yonemitsu and K. Nasu, Phys. Rep. **465**, 1 (2008).