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Effects of Charge Fluctuations on Massless Dirac Fermions in Organic Conductor α-(BEDT-TTF)$_2$I$_3$ TARO KANAO, HIROYASU MATSUURA, MASAO OGATA, Department of Physics, University of Tokyo, Bunkyo, Tokyo 113-0033, Japan — A quasi-two-dimensional organic conductor α-(BEDT-TTF)$_2$I$_3$ has attracted much interest both for its charge ordering (CO) transition and for its remarkable transport properties at high pressure which appear when the transition suppressed. The latter has been revealed to be due to massless Dirac fermions (MDFs) at the Fermi energy, by measurements such as transport, NMR, and specific heat. Recently, the MDF phase has been re-examined, and some behaviors beyond non-interacting MDFs has been reported. In transport measurements, the resistivity shows a logarithmic increase at low temperatures. Also, NMR measurements show deviations from the non-interacting behaviors. The cause of these behaviors has not been clarified. Since the transition between the MDF phase and the CO phase is almost continuous, charge fluctuations are important there. As a cause of the behaviors above, we investigate effects of charge fluctuations using a minimal model for this system. We analyze this model by a self-consistent renormalization (SCR) theory, which can deal with effects of fluctuations precisely. On this basis, electric resistivity (or damping rate), specific heat, and one-particle density of states are calculated. Relevance to the experimental facts is discussed.

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