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**Theory of Zener tunneling and breakdown in solids** NAOYUKI SUGIMOTO, Department of Applied Physics, University of Tokyo, SHIGEKI ONODA, RIKEN, NAOTO NAGAOSA, Department of Applied Physics, University of Tokyo, CERC, CREST — Tunneling and breakdown phenomena are among of the most important problems in condensed matter physics. We study the Zener tunneling and breakdown phenomena in a bulk system taking into account the dissipation due to impurity scatterings in terms of the Keldysh formalism. Three distinct regions are recognized for the current-field characteristics, which are identified as the impurity-conduction, the Zener tunneling, and the Zener breakdown, respectively. The crossovers among them are described in a unified fashion. By examining the local density of states, which can be measured by scanning tunneling spectroscopy, we find that the Zener tunneling and breakdown can be understood as the conduction due to the finite local density of states at the Fermi energy originating from the hybridization between the conduction and valence bands induced by the electric field.

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