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Evanescent-wave current through nanometer-scale conductor with generalized channel decomposition in non-equillibrium Green's function theory[1] HIROSHI SHINAOKA, Dept. of Applied Physics, Univ. Tokyo, TAKEO HOSHI, Dept. of Applied Mathematics and Physics, Tottori Univ. and JST-CREST, TAKEO FUJIWARA, Center for Reserch and Development of Higher Education, Univ. Tokyo and JST-CREST — In optics, evanescent wave is known as a decay mode without dissipation, which appears at total reflecting surfaces and surfaces of nanoparticles. Even though such decay mode can be found, in principle, also in electronic current in nanometer-scale conductors, the evanescent wave effect has not yet been investigated systematically, in materials with electronic structure. We present a novel eigen-channel decomposition method in non-equilibrium Green's function formalism. By applying this method to nanometer-scale d-band metal wires, we found decaying behavior of electron density and backward current flows near electrodes, which is evidence of evanescent waves. We also found that the evanescent waves cause conductor-length dependence of the transmission, which is detectable in experiments. Dependence of the evanescent waves on materials and structures are also discussed from a point of view of band structures and their connectivity at electrodes.

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