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Intrinsic spin Hall effect in platinum metal GUANG-YU GUO, Department of Physics, National Taiwan University, Taipei 106, Taiwan, SHUICHI MURAKAMI, Department of Physics, Tokyo Institute of Technology, Tokyo 152-8551, Japan, TSUNG-WEI CHEN, Department of Physics, National Taiwan University, Taipei 106, Taiwan, NAOTO NAGAOSA, Department of Applied Physics, University of Tokyo, Tokyo 113-8656, Japan — Spin Hall effect (SHE) is studied with first-principles relativistic band calculations for platinum, which is one of the most important materials for metallic SHE and spintronics. We find that intrinsic spin Hall conductivity (SHC) is as large as $\sim 2000(\hbar/e)(\Omega\mathrm{cm})^{-1}$ at low temperature, and decreases down to $\sim 200(\hbar/e)(\Omega\mathrm{cm})^{-1}$ at room temperature [1]. It is due to the resonant contribution from the spin-orbit splitting of the doubly degenerated d-bands at high-symmetry L and X points near the Fermi level. By modeling these near-degeneracies by an effective Hamiltonian, we show that SHC has a peak near the Fermi energy and that the vertex correction due to impurity scattering vanishes. We therefore argue that the large SHE observed experimentally in platinum is of intrinsic nature. [1] G.Y. Guo, S. Murakami, T.-W. Chen, and N. Nagaosa, arXiv:cond-mat/07050409.

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