金属ヘテロ構造界面におけるスピン運動量結合バンドの物質依存性

Material dependence of interfacial spin-momentum locked bands in metallic heterostructures

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Anisotropic photocurrents or photovoltages appear in samples with spin–momentum locked bands under illumination of circularly polarized light. This effect is commonly referred to as the circular photogalvanic effect (CPGE): it allows direct probing of spin–momentum locked bands. The CPGE has been studied in semiconductor heterostructures[1] and topological insulators[2], which have revealed the presence of spin-momentum locked bands of Rashba and/or Dresselhaus type.

We have studied the CPGE in (semi)metallic heterostructures and successfully observed signals due to spin–momentum locked bands at interfaces. The photocurrent induced by circularly polarized light was measured while the light helicity was continuously changed by rotating a quarter-wave plate inserted before the sample. We found photocurrent that clearly depended on the helicity of the light (Fig.1). The photocurrent was found to be anisotropic with respect to the light incidence plane, suggesting the presence of spin–momentum locked bands in the sample. We have studied the CPGE in various heterostructures to identify the origin of the interface electronic structure. We discuss the dependence of the CPGE-induced photocurrent on the materials that constitute the heterostructures.

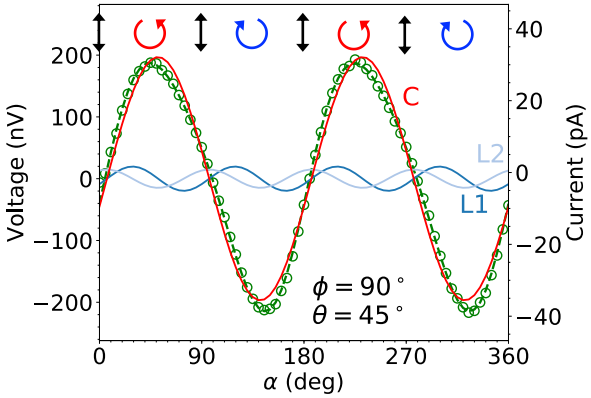

Figure1. The photocurrent measured in Cu/Bi bilayer. The CPGE is measured as a function of the angle (α) of the quarter-wave plate, which varies the light polarization. The device contacts lie perpendicular to the light incidence plane.

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[2] J. W. McIver, D. Hsieh, H. Steinberg, P. Jarillo-Herrero, and N. Gedik, Nat. Nanotechnol. 7, 96 (2012).