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Detection of topological surface states by spin pumping at room temperature Y. T. FANCHIANG, C. K. CHENG, M. HONG, Graduate Institute of Applied Physics and Department of Physics, National Taiwan University, Taipei 10617, Taiwan, H. Y. LIN, K. H. CHEN, S. R. YANG, C. N. WU, J. KWO, Department of Physics, National Tsing Hua University, Hsinchu 30013, Taiwan, S. F. LEE, Institute of Physics, Academia Sinica, Taipei 11529, Taiwan — Spin pumping on heterostructures made of ferrimagnetic YIG film and topological insulator Bi_2Se_3 films has been performed at room temperature. In the presence of topological interface states, spin pumping induced non-equilibrium spin density caused significant resonance field shifts (H_{res} shifts) of YIG/Bi_2Se_3 with respect to bare YIG. The uncommon H_{res} shifts correspond to clearly resolved changes of gyromagnetic ratio of YIG. As the Bi_2Se_3 thickness varied from 4 nm to 20 nm, increasing H_{res} shifts were observed, while the enhancement of damping constant saturated at the spin diffusion length of Bi_2Se_3, suggesting the two parameters were of different origins. Bi_2Se_3 thickness dependence of spin pumping revealed that Rashba-split 2DEG has comparable effects on the magnetization dynamics. From the change of gyromagnetic ratio, we calculated the imaginary part of spin mixing conductance to be one order of magnitude larger than the real part. Our results showed that with clean and well-defined interface, spin pumping may serve as an effective way to detect spin-polarized surface states.

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