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Spin Seebeck effect induced by magnon polarons

The spin Seebeck effect (SSE) [1] refers to the generation of a spin current in magnetic materials by a temperature gradient. In the SSE, a thermally generated magnon spin current in a magnet is converted into a conduction-electron spin current in a metal attached to the magnet via the interfacial spin-exchange interaction. The spin current is detected as an electric voltage via the inverse spin Hall effect in the metal. Recent studies revealed that the SSE provides a sensitive probe for magnon dynamics in magnetic materials [2,3].
In this talk, we report anomalous peak structures in the magnetic field-dependent SSE voltages induced by hybridized magnon-phonon excitation (or magnon polarons [4-6]) at the band (anti-)crossings between the magnon and phonon dispersion curves in Y3Fe5O12 (YIG). The SSE anomalies appear when the magnon and phonon dispersion curves touch, which maximizes the phase space of magnon-polaron formation. The experimental results are well reproduced by a Boltzmann equation including the magnetoelastic coupling. The peak structures of the SSE can thereby be attributed to the spin current carried by magnon polarons exhibiting longer lifetimes than pure magnons [4,5]. During the talk, we will also address the magnon-polaron features in the spin Peltier effect, the reciprocal effect of the SSE [7,8], referring to the heat-current generation as a result of a spin current.

[1] K. Uchida, H. Adachi, T. Kikkawa, A. Kirihara, M. Ishida, S. Yorozu, S. Maekawa, and E. Saitoh, Proc. IEEE **104**, 1946 (2016).
[2] S. Geprägs et al., Nat. Commun. **7**, 10452 (2016).
[3] J. Barker and G. E. W. Bauer, Phys. Rev. Lett. **117**, 217201 (2016).
[4] T. Kikkawa, K. Shen, B. Flebus, R. A. Duine, K. Uchida, Z. Qiu, G. E. W. Bauer, and E. Saitoh, Phys. Rev. Lett. **117**, 207203 (2016).
[5] B. Flebus, K. Shen, T. Kikkawa, K. Uchida, Z. Qiu, E. Saitoh, R. A. Duine, and G. E. W. Bauer, Phys. Rev. B **95**, 144420 (2017).
[6] L. J. Cornelissen, K. Oyanagi, T. Kikkawa, Z. Qiu, T. Kuschel, G. E. W. Bauer, B. J. van Wees, and E. Saitoh, Phys. Rev. B **96**, 104441 (2017).
[7] J. Flipse, F. K. Dejene, D. Wagenaar, G. E. W. Bauer, J. Ben Youssef, and B. J. van Wees, Phys. Rev. Lett. **113**, 027601 (2014).
[8] S. Daimon, R. Iguchi, T. Hioki, E. Saitoh, and K. Uchida, Nat. Commun. **7**, 13754 (2016).

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