Generation of spin current by acoustic wave spin pumping

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Tohoku University, Japan Science and Technology Agency (JST) and Japan Atomic Energy Agency (JAEA) announced on August 22, 2011 that Kenichi Uchida, a PhD student, and Professor Eiji Saitoh of Tohoku University and their colleagues have succeeded in injecting spin current into a magnetic material by acoustic wave spin pumping.

This success was achieved under the support of JST and by the collaboration among Tohoku University, JAEA, and Technische Universitaet Kaiserslautern in Germany. Details are published in *Nature Materials*.

Heat generation associated with electronic charge current will be problematic in future high-density electronics. Spin angular momentum, another entity of electron, is expected to carry information without heat generation. In contrast to existing methods of injecting spin current, such as electromagnetic waves, researchers have shown that acoustic waves, or phonons, can inject spin current by using a $Ni_{81}Fe_{19}$/Pt bilayer wire on an insulating sapphire plate. Under a temperature gradient in the sapphire, the voltage generated in the Pt layer was shown to reflect the wire position, although the wire was insulated both electrically and magnetically. This non-local voltage is attributed to the coupling of spins and phonons generated by the temperature gradient, since phonons are the only possible carrier of information.

This is a demonstration of generating spin current by directly injecting acoustic waves to realize spin pumping. Researchers suggest that this

finding will open the door to acoustic spintronics, in which acoustic waves are exploited for making spin-based devices.

More information: K. Uchida, et al., "Long-range spin Seebeck effect and acoustic spin pumping", *Nature Materials* (2011) doi:10.1038/nmat3099

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