On-line SPICE-SPIN+X Seminars

Wednesday, 13th April 2022, 15:00 (CET)

The seminar will be via Zoom (Meeting ID: 899 9810 9355) and live streamed in the SPICE YouTube Channel.

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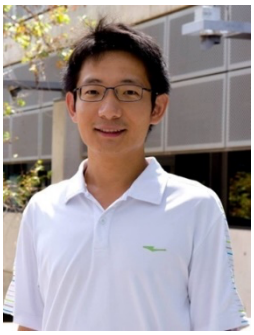
Driving Exchange Mode Resonance as Adiabatic Quantum Motor with 100% Mechanical Efficiency



An insulating ferromagnet (FM)-topological insulator (TI)-FM trilayer heterostructure can be operated as an adiabatic quantum motor by virtue of the combined effect of voltage-induced torque and its reverse effect—topological charge pumping. Unlike traditional current-driven systems, such a voltage-driven system can achieve 100% mechanical efficiency because the output current is purely adiabatic which does not incur Joule heating as dissipative currents do. This mechanism enables the excitation of the high-frequency exchange mode resonance in an FM-TI-FM system, where the two FM precess with a 180° phase difference, without producing any waste heat. Even in the presence of leakage currents and other imperfections, our proposed setup can still realize a mechanical efficiency two orders of magnitude larger than current-driven magnetic resonances. On the theoretical side, the voltage-induced torque is determined by the Berry curvature jointing time and crystal momentum, which has been previously overlooked in the study of topological materials. Our findings will facilitate the development of ultrafast spintronic devices consuming extremely low power.