MIP: PARADIM at Cornell University, DMR-1539918

2016

Low Symmetry Valleytronic Materials Enable Energy Efficient Switching for Magnetic Memories

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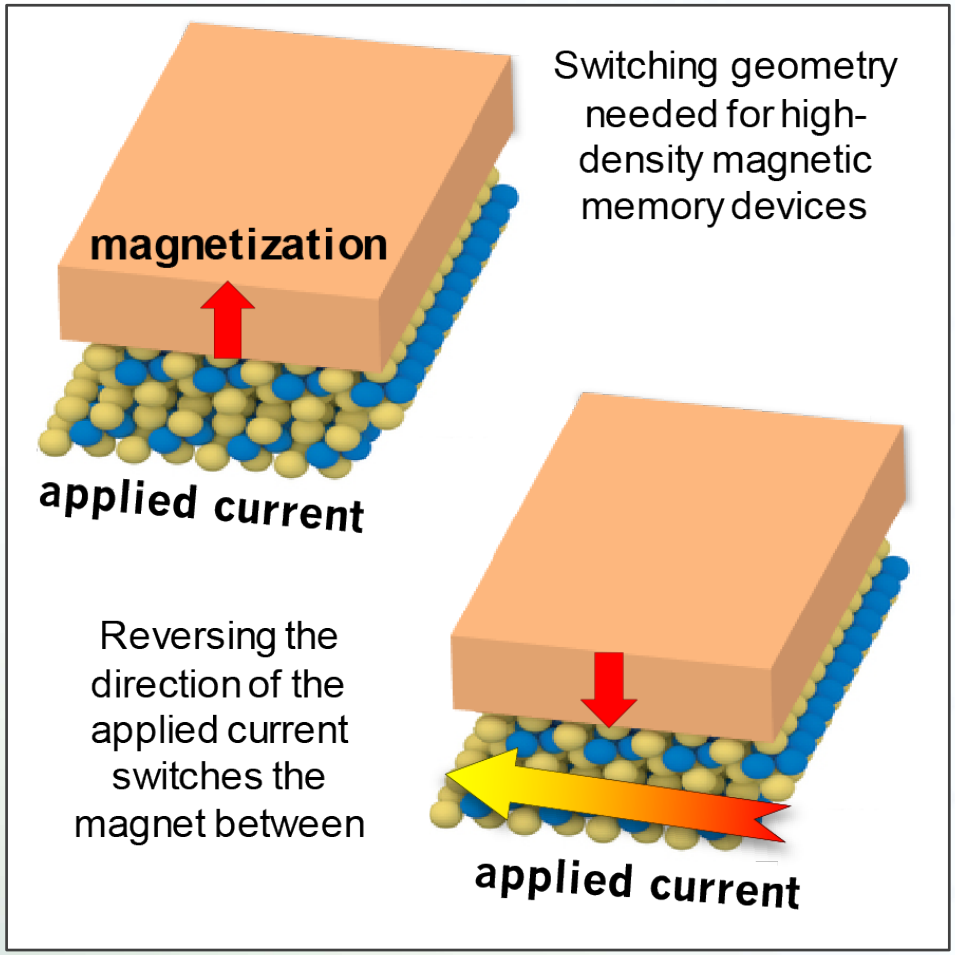
Building on their growing expertise with interface materials, PARADIM researchers discovered a new mechanism for reorienting magnetization that is 10 times more energy efficient than prior techniques. An electrical current is passed through a low symmetry valleytronic material containing heavy atoms that is positioned under a magnetic layer. A phenomenon known as "spin-orbit coupling" allows this current to exert a strong torque on the magnetization. Ordinary heavy metals used for this purpose are really good at controlling the magnetization when it points horizontally, but not when it points perpendicular to the plane of the device (as shown in the figure), which is the geometry needed for high-density magnetic memories. By using a low symmetry valleytronic material, WTe_2, we demonstrated that it is possible to rotate the "spin-orbit torque" into the direction needed to control vertically-oriented magnetic devices. In the coming year we will attempt to understand and increase the strength of this effect, so as to enable magnetic memories that can out-perform conventional electronics.



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D. MacNeill et al.,
Nature Physics **13** (2017) 300–305.

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