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Tuning the Exchange Bias in Spin Valves by an Electric Current[1]

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An electrical current can transfer spin angular momentum to a ferromagnet. This novel physical phenomenon, called spin transfer, offers unprecedented spatial and temporal control over the magnetic state of a ferromagnet and has tremendous potential in a broad range of technologies, including magnetic memory and recording. Recently, it has been predicted [1] that spin transfer is not limited to ferromagnets, but can also occur in antiferromagnetic materials and even be stronger under some conditions. This talk will discuss our recent experiments [2] that demonstrate the transfer of spin angular momentum across an interface between ferromagnetic and antiferromagnetic metals. The spin transfer is mediated by an electrical current of high density (∼1012 A/m2) and revealed by variation in the exchange bias at the ferromagnet/antiferromagnet interface. We find that, depending on the polarity of the electrical current flowing across the interface, the strength of the exchange bias can either increase or decrease. This finding is explained by the theoretical prediction that a spin polarized current generates a torque on magnetic moments in the antiferromagnet. Current-mediated variation of exchange bias could be used to control the magnetic state of spin-valve devices, e.g., in magnetic memory applications. [1] A. S. Nunez, R. A. Duine, P. Haney, and A. H. MacDonald, Phys. Rev. B 73, 214426 (2006). [2] Z. Wei et al., cond-mat/0606462.

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