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EINLADUNG zum IFP-SEMINAR

Magnetic Noise and Spin Transport in Magnetic Tunnel Junctions

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Host:	Ernst Bauer
Termin:	Mittwoch, 20. Dezember 2017, 16:00 Uhr
Ort:	Institut für Festkörperphysik, TU Wien
	Wiedner Hauptstraße 8-10, 1040 Wien
	Seminarraum DC rot 07 (roter Bereich, 7. OG)

Abstract:

A magnetic tunnel junction (MTJ) consists of the free layer (FL), pinned layer (PL), and the antiferromagnetic (AFM) layer. The AFM layer fixes the PL's magnetization orientation via exchange coupling. The FL and PL are separated by a thin, crystalline MgO barrier. Electrons can tunnel through the MgO insulating layer resulting in electrical conductivity, which depends on the relative orientation between the magnetizations of the FL and PL. The PL is assumed to be perfectly fixed while the FL is free to move in response to the external magnetic field.
Even though it is assumed that the PL is fixed, it is in fact pinned by a finite energy. Room-temperature thermal magnetization fluctuations of both the FL and PL are the main source of magnetic noise and can be quantified by their ferromagnetic resonance (FMR) modes.
Another source of magnetization dynamics in MTJs is the current-induced spin-torque effect, which describes a direct transfer of angular momentum from the spin-polarized electrons to the local magnetization. This effect influences the thermal magnetization fluctuations, and its contribution can be directly seen in the measured FMR spectrum.
MTJs also exhibit nonlinear characteristics—nonlinear bias voltage dependence of the tunneling magnetoresistance (TMR) and spin-torque effects. The interaction between the MTJs' linear magnetization dynamics and nonlinear characteristics results in nonlinear magnetization dynamics. The latter can be quantified by the sub-harmonics of the FL and PL FMR modes.
Lastly, in an open forum, we will discuss possible modeling approaches, which could help interpret the experimental observations of the resultant nonlinear magnetization dynamics.