



School of Nano Science



IPM Condensed Matter &  
Statistical Physics Group

## Weekly Seminar

### Higher order contributions to the Anisotropic Interface Magnetoresistance(AIMR) in Ni/Pt layered structures

Invited Speaker:

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#### Abstract:

The influence of interfaces on the magnetotransport in systems with one ferromagnetic layer has attracted much attention. In Pt/Co/Pt the resistivity behaves as

$$\rho(\varphi, \theta) = \rho_t + \Delta\rho_{(ip)} \cos^2(\varphi) \sin^2(\theta) + \Delta\rho_{(op)} \cos^2(\theta)$$

where  $\varphi$  and  $\theta$  are the angles between magnetization  $\mathbf{M}$  and current direction  $\mathbf{j}$  and film normal  $\mathbf{n}$ , respectively [1]. While  $\Delta\rho_{(ip)}$  is caused by the conventional AMR (bulk effect) a  $\Delta\rho_{(op)} \propto 1/t_{(Co)}$  behavior was found for Pt(5nm)/Co(t)/Pt(3nm) sandwiches revealing that  $\Delta\rho_{(op)}$  originates at the Co/Pt interfaces (anisotropic interface magnetoresistance (AIMR)). Experimentally, the AIMR effect was observed for Py/Pt and Co/Pd layered structures so far, so that it seems to be a general phenomenon [2,3]. In order to answer the question if interfacial MR contributions also exist when stacking isoelectronic materials we investigated Ni/Pt systems. We prepared Pt(5nm)/Ni(t)/Pt(3nm) sandwiches with Ni thicknesses of 1–50nm by dc magnetron sputtering on Si<sub>3</sub>N<sub>4</sub> substrate.

While the results show again the typical  $\Delta\rho_{(ip)} \cos^2(\varphi)$  behavior for the AMR, the  $\rho(\theta)$  behavior can only be satisfactorily described when considering higher orders in the expansion of the MR up to  $n = 3$

$$\rho(\theta) = \rho_t + \sum_n \Delta\rho_{(op,2n)} \cos^{2n}(\theta) .$$

The thickness dependence of the amplitudes  $\Delta\rho_{(op,2n)}$  shows a  $|1/t_{Ni}|$  dependence revealing that the dominant contribution to the higher orders originates from the Ni/Pt interfaces.

- [1] A. Kobs et al., PRB 90, 016401 (2014)
- [2] Y.M. Lu et al., PRB 87, 220409 (2013)
- [3] J.-C. Lee et al., JAP 113, 17C714 (2013).

Monday, 20<sup>th</sup> of Day (1395) (January 9<sup>th</sup>, 2017), 15:00-16:00

Farmaniyeh Bldg, Room C