



# NATO Advanced Research Workshop

RPTU

## Functional Spintronic Nanomaterials for Radiation Detection and Energy Harvesting



### Electrophysical and magneto-resistive properties of tri-layer films with spin-dependent electron scattering

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Dimensional effects in the magnetoresistive properties of  $\text{Fe}_x\text{Co}_{1-x}/\text{Cu}/\text{Fe}_x\text{Co}_{1-x}$  three-layer magnetically ordered films obtained by layer-by-layer metal condensation followed by heat treatment in the temperature range of 300–550 K were studied experimentally and theoretically using generalized Dieny formulas. It is shown that in the case when the cover layer thickness is much smaller (greater) than the base layer thickness, the numerical value of the magnetoresistance ratio  $\delta$  is negligible due to shunting of the covering layer resistance by the resistances of the base layer and the nonmagnetic layer (shunting of the resistances of the base layer and the nonmagnetic layer by the resistance of the covering magnetic layer). If the thickness of the base and cover layers are the same, the value of  $\delta$  becomes maximum due to the absence of the shunting effect. If the thickness of the non-magnetic layer increases, provided that the thicknesses of the base and magnetic layers of the metal do not change, the magnetoresistance ratio monotonically decreases with increasing spacer thickness.