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Correlation between AMR and PHE in LSMO thin films JENG-BANG YAU, Department of Applied Physics, Yale University, Y. BASON, L. KLEIN, Department of Physics, Bar Ilan University, Ramat Gan 52900, Israel, X. HONG, C.H. AHN, Department of Applied Physics, Yale University — In magnetic conductors, the dependence of resistivity on the angle θ between the current and magnetization, a phenomenon known as anisotropic magnetoresistance (AMR), is given by $E_x = \Delta\rho_\perp j_x + (\Delta\rho_\parallel - \Delta\rho_\perp) j_x \cos^2\theta$, where $\Delta\rho_\parallel$ and $\Delta\rho_\perp$ are the resistivities parallel and perpendicular to the magnetization, respectively. In addition, a transverse voltage, known as planar Hall effect (PHE), is generated with the angular dependence given by $E_y = (\Delta\rho_\parallel - \Delta\rho_\perp) j_x \sin\theta\cos\theta$. Doped manganite $La_{1-x}Sr_xMnO_3$ (LSMO) thin films have been demonstrated to exhibit both AMR and PHE with the expected angular dependencies[1]. However, while $\Delta\rho_{AMR}$ and $\Delta\rho_{PHE}$, the resistivities extracted from AMR and PHE with $\Delta\rho = (\rho_\parallel - \rho_\perp)$, are expected to be identical, we find that $\Delta\rho_{AMR} \geq \Delta\rho_{PHE}$ throughout our measurements. Further investigation of this apparent discrepancy reveals that for a fixed magnetic field, $\Delta\rho_{AMR}$ and $\Delta\rho_{PHE}$ become nearly equal at temperatures around (below) T_c. Moreover, the discrepancy between $\Delta\rho_{AMR}$ and $\Delta\rho_{PHE}$ becomes more substantial with increasing doping concentrations. We will discuss possible mechanisms responsible for this behavior.

[1]Y. Bason, L. Klein, J.-B. Yau, X. Hong, and C. H. Ahn, Appl. Phys. Lett. **84**, 2593 (2004)

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