Abstract Submitted
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Anisotropy of spin relaxation in metals and ultrathin metallic films[1] NGUYEN H. LONG, PHIVOS MAVROPOULOS, BERND ZIMMERMANN, SWANTJE HEERS, STEFAN BLUGEL, YURIY MOKROUSOV, Peter Gruenberg Institut and Institute for Advanced Simulation, Forschungszentrum Juelich and JARA, 52425 Juelich, Germany — We predict a hitherto overlooked anisotropy of the spin relaxation time T_1 in non-magnetic metallic systems with respect to the orientation of the spin porlarization $\hat{s}$ of the injected electrons relative to the crystallographic directions. In the Elliott-Yafet mechanism, the spin relaxation time is related to the Elliott-Yafet parameter b^2 that quantifies the degree of spin-mixing of Bloch states due to spin-orbit interaction. It can be demonstrated that b^2 depends on $\hat{s}$ due to the directional dependence of the spin-orbit matrix-elements between Bloch states comprising directional orbitals. The directional dependence becomes very pronounced in the case of degeneracies or near-degeneracies leading to *spin-flip hot spots* or even extended *hot areas* on the Fermi surface. The calculated anisotropy can reach values as large as 830% for hcp Hf or 87% in W(110) 10-layer-films, as we find from first-principles calculations employing the Kohn-Korringa-Rostoker Green function method. The anisotropy offers interesting new functionalities in spintronics applications such as GMR, spin Hall effect as well as spin dynamics. [1] B. Zimmermann, P. Mavropoulos, S. Heers, N. H. Long, S. Blugel, and Y. Mokrousov, Phys. Rev. Lett., in press (arXiv:1210.1801).

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