Mode coupling in spin-torque oscillators: first-principle derivation OLLE HEINONEN, Argonne Natl Lab, YAN ZHOU, Hong Kong University, DONG LI, Hong Kong Baptist University — A number of recent experimental works have shown that the dynamics of a single spin torque oscillator can exhibit complex behavior that stems from interactions between two or more modes of the oscillator. Examples are observed mode-hopping or mode coexistence[1−3]. There has been some initial work indicating how the theory for a single-mode (macro-spin) spin torque oscillator should be generalized to include several modes and the interactions between them. In the present work, we derive such a theory starting with the Landau-Lifshitz-Gilbert equation for magnetization dynamics. We compare our results with the single-mode theory, and show how the coupled-mode theory is a natural extension of the single-mode. Argonne National Laboratory is a US DOE Science Laboratory operated under Contract No. DE-AC02-06CH11357 by UChicago Argonne, LLC. References: [1] S. Bonetti, V. Tiberkevich, G. Consolo et al., *Phys. Rev. Lett.* **105**, 217204 (2010). [2] P. Muduli et al., *Phys. Rev. Lett.* **108**, 207203 (2012). [3] R. Dumas, E. Iacocca, S. Bonetti et al., *Phys. Rev. Lett.* **110**, 257202 (2013).

Olle Heinonen
Argonne Natl Lab

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