

Abstract Submitted  
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**Spin pumping by magnetopolaritons**<sup>1</sup> YUNSHAN CAO, PENG YAN, Delft Univ of Tech, HANS HUEBL, SEBASTIAN GOENNENWEIN, Walther-Meißner-Institut, GERRIT BAUER, Tohoku University and Delft Univ of Tech — Recent experiments report the strong coupling of microwaves to the magnetic insulator yttrium iron garnet with weakly damped magnetization dynamics [1]. We developed a scattering approach to study the coupled magnetization and microwave cavities beyond the paramagnetic/macrospin and rotating wave approximations that are implicit in the Tavis-Cummings model [2]. To this end we solve the coupled Landau-Lifshitz-Gilbert and Maxwell's equations for a thin film magnet in a microwave cavity, leading to rich ferromagnetic spin wave resonance spectra of the transmitted or absorbed microwaves. Our method is valid for the full parameter range spanning the weak to strong coupling limits. We demonstrate strong coupling achievement not only for the FMR mode but also for standing spin waves, although the lowest excitation has a decisive leading role for coupling strength. Spin pumping in FI|N bilayers as detected by inverse spin Hall voltages provides additional access to study strong coupling electrically.

[1] H. Huebl et al., PRL 111, 127003 (2013); G. Stenning et al., Opt. Express 21, 1456 (2013); Y. Tabuchi et al., PRL 113, 083603 (2014); X. Zhang et al., PRL 113, 156401 (2014).

[2] J. M. Fink et al., PRL 103, 083601 (2009).

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