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Efficient Synchronization of Dipolarly Coupled Vortex-Based Spin Transfer Nano-Oscillators

Locatelli N., Hamadeh A., Abreu Araujo F., Belanovsky A., Skirdkov P., Lebrun R., Naletov V., Zvezdin K., Muñoz M., Grollier J., Klein O., Cros V., De Loubens G.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2015, Nature Publishing Group. All rights reserved. Due to their nonlinear properties, spin transfer nano-oscillators can easily adapt their frequency to external stimuli. This makes them interesting model systems to study the effects of synchronization and brings some opportunities to improve their microwave characteristics in view of their applications in information and communication technologies and/or to design innovative computing architectures. So far, mutual synchronization of spin transfer nano-oscillators through propagating spinwaves and exchange coupling in a common magnetic layer has been demonstrated. Here we show that the dipolar interaction is also an efficient mechanism to synchronize neighbouring oscillators. We experimentally study a pair of vortex-based spin transfer nano-oscillators, in which mutual synchronization can be achieved despite a significant frequency mismatch between oscillators. Importantly, the coupling efficiency is controlled by the magnetic configuration of the vortices, as confirmed by an analytical model and micromagnetic simulations highlighting the physics at play in the synchronization process.

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