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ABSTRACTS

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[1] A. V. Chumak et al., Nat. Phys. 11, 452-461 (2015) [2] Lin Xue et al., Phys. Rev. Lett. 108, 147201 (2012) [3] H. An et al., Nat. Commun. 7, 13069 (2016) [4] G. Okano et al., Phys. Rev. Lett. 122, 217701 (2019)

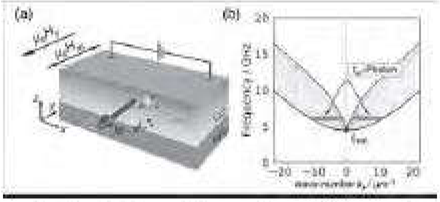

Fig.1 Schematic illustrations of (a) experimental setup and (b) magnon band configuration for parallel pumping.

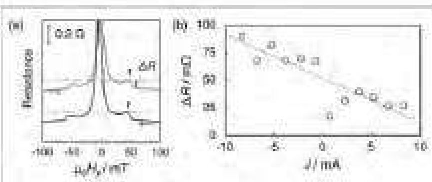

Fig.2 (a) AMR curves under the application of microwave with $J = -9$ mA. (b) J-dependence of ΔR.

C5-03. Sensing Stray Fields From Magnetic Nanocircuits With Nitrogen-Vacancy Defects. *A. Solyom*[1], M. Caouette-Mansour[1], B. Ruffolo[1], P.M. Braganca[2], M. Pioro-Ladrière[3,4], L. Childress[1] and J. Sankey[1] *1. Physics, McGill University, Montreal, QC, Canada; 2. Western Digital Corp, San Jose, CA, United States; 3. Institut Quantique and Département de Physique, Universite de Sherbrooke, Sherbrooke, QC, Canada; 4. Quantum Information Science Program, Canadian Institute for Advanced Research, Toronto, ON, Canada*

We discuss our latest efforts toward using a single, optically active nitrogen-vacancy (NV) spin sensor (implanted in a single-crystal diamond substrate) to measure magnetic thermal noise modified by spin Hall torques [1] in a Py/Pt nanowire [2]. In this poster, we first present our subtractive method for fabricating magnetic nanocircuits on diamond, and initial characterization of working Py(5 nm)/Pt(5 nm) nanowires. We reliably achieve contacts with few-ohms of resistance and 200 nm of overlap at each end of the 2-μm-long, 400-nm-wide wire, and we observe an anisotropic magnetoresistance of 0.4%. Importantly, we observe that the subtractive patterning process (masked ion milling) used to define the devices reduces the NV spin resonance contrast by a factor of ~5, but that subsequent exposure to an oxygen plasma returned the contrast to its nominal level without affecting the nanowire behavior. Finally, we present progress toward using transport measurements to estimate thermal time scales in these systems (while calibrating the RF current in the nanowire), as well as preliminary NV readout of spin-transfer-controlled magnetic thermal noise.

[1] C. Du, T. van der Sar, et al., Science, 357, 195-198 (2017) [2] A. Solyom, Z. Flansberry, et al., Nano Lett., 18, 6494-6499 (2018)

C5-04. The Structure and Dynamics of Magnetic Vortices and Solitons in Multilayer Ferromagnetic Nanostructures. *K. Samsonov*[1], S. Stepanov[3], G. Antonov[5], A. Ekomasov[3], R. Kudryavtsev[2], A. Gumerov[3], K. Zvezdin[4] and E. Ekomasov[3,1] *1. Department of Physical Processes and Systems Modeling, University of Tyumen, Tyumen, Russian Federation; 2. Institute of Molecule and Crystal Physics UFRC RAS, Ufa, Russian Federation; 3. Department of theoretical physics, Baskirskij Gosudarstvennyj Universitet, Ufa, Russian Federation; 4. Institut obsej fiziki imeni A M Prohorova RAN, Moskva, Russian Federation; 5. Baskirskij Gosudarstvennyj Universitet, Ufa, Russian Federation*

The structure and dynamics of magnetization in a vortex spin-transfer nanooscillator, which is a three-layer spin-valve magnetic nanopillar with a small diameter, is studied during the passage of a spin-polarized current. Using micromagnetic simulation [1,2], we studied the dynamic change in the vortices structure, the formation of the C-structure vortex state and edge vortices, the trajectory of movement and the time it takes to reach different dynamic modes. The time needed for the vortices to reach different dynamic modes was found. The possibility of the dynamic generation of radial edge vortices without the presence of a Dzyaloshinsky field or an external inhomogeneous magnetic field is shown. We demonstrate that a vortex in a thick magnetic layer can be a generator of spin waves in a thin magnetic layer with an adjustable oscillation frequency. We consider also multilayer magnetic structures, which are periodically alternating layers of two materials with different physical properties. In such systems it is possible to generate localized magnetization waves (LMW) of the magnetic solitons and breathers type [3]. Special interest in magnetic solitons and breathers is currently associated with the appearance of new experimental techniques that allow to study formation and propagation of localized magnetization waves of nanometer dimensions and their interaction with domain walls (DW). The possibility of controlling the structure and dynamic parameters of magnetic solitons and breathers using an external magnetic field is shown [4]. Dependences of the center of the DW and amplitudes of the LMW on time are constructed and analyzed in the presence of three, five and seven layers. It is shown that the LMW vibrations for the case of five layers can be described by two harmonic oscillators, for the case of seven layers, three harmonic oscillators. This work was supported by RFBR, project No19-02-00316\19 and No20-31-90048.

1. A.E. Ekomasov et al., Journal of Magnetism and Magnetic Materials, 471, 2019, 513-520; 2. E.G. Ekomasov et al., Chelyabinsk Physical and Mathematical Journal. 2020. Vol. 5, iss. 2. P. 161–173; 3. A.M. Gumerov et al., Journal of Physics: Conference Series. VII Euro-Asian Symposium "Trends in Magnetism". 2019. V. 1389. p. 012004: 1–6; 4. E.G. Ekomasov et al., Letters on Materials 10 (2), 2020 pp. 141-146.

C5-05. Mutual Synchronization of Spin-Torque Oscillators With a Perpendicular Polarizer. *M. Castro*[1,2], D. Mancilla[1], N. Strelkov[2], A. Litvinenko[2], M. Ibarra[2], S. Allende[1], B. Dieny[2], U. Ebels[2] and L. Buda-Prejbeanu[2] *1. Universidad de Santiago de Chile, Santiago de Chile, Chile; 2. Univ. Grenoble Alpes, CEA, CNRS, Grenoble INP, IRIG-SPINTEC, 38000, Grenoble, France*

The implementation of Spin-torque nano-oscillators (STNOs) in wireless communication [1] and neuromorphic computing [2] requires the use of a large array of coupled STNOs. While most of the theoretical [3] and experimental studies considered single STNO devices, mutual synchronization of several oscillators [4, 5] remains a challenging task. As a first step in this direction, we apply the analytical approach based on the spin-wave formalism [3] to the mutual synchronization of two STNOs, consisting of a perpendicular polarizer and an in-plane free layer, see Fig. 1. This STNO configuration can be realized experimentally, and leads under a strong out-of-plane field to symmetric out-plane precession modes generating strong dynamic dipolar coupling fields. We derived analytical expressions for the phase difference, as well as the oscillation amplitudes and the locking range for the general case of non-identical oscillators, differing in their