ICPYS-LTP 2017

**VIII International Conference**

**for Professionals & Young Scientists**

**"LOW TEMPERATURE PHYSICS"**

**May 29 - June 2, 2017**

# Conference Program

# &

# Book of Abstracts

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**LOW TEMPERATURE PHYSICS**
**ICPYS LTP 2017**

**Organised by** B. Verkin Institute for Low Temperature Physics and Engineering (ILTPE) of the NAS of Ukraine
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***CONFERENCE HALL*** **MAGNETISM AND MAGNETIC MATERIALS**

*Chair* *Tatyana Gaydamak*

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*[1]Taras Shevchenko National University of Kyiv, 01601 Kyiv, Ukraine*
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*Taras Shevchenko National University of Kyiv, 64/13, Volodymyrska Str., Kyiv, 01601, Ukraine*

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# ARTIFICIAL MAGNETIC MATERIALS: CURVATURE INDUCED ONE-DIMENSIONAL MAGNONIC CRYSTALS

**A. I. Korniienko[1], O. V. Pylypovskyi[1], V. P. Kravchuk[2], D. D. Sheka[1], Yu. Gaididei[2]**

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Artificial periodic structures are of great interest in many fields of physics due to their applied advantages and generality of theoretical approach. Starting from semiconductor physics, the concept of band structures is incapsulated in metamaterials optics and radio engineering, especially for photonic crystals at the nanoscale. In magnetism, the counterpart of photon is a magnon and the magnetic analogue is the magnonic crystal, artificial magnetic structures with periodic distribution of the constituent materials or periodic modulation of magnetic parameters [1]. Magnonic crystals are promising for controlling and manipulation the magnon currents [2] and used for the realization of logic operations [3].

Magnonic crystals are produced by spatial periodic variation of the saturation magnetization, exchange constant and geometrical parameters [1]. In this study we propose a new type of magnonic crystals, namely curvature induced magnonic crystals. We consider a planar wave-shaped ferromagnet nanowire with strong easy-tangential anisotropy. The curvature of the wire is a periodic square wave function. Statics and dynamics of magnetization in this system is described using the recently developed approach [4] for arbitrary shaped wires. Competition between spatially inhomogeneous anisotropy and exchange interaction results in the appearance of the effective Dzyaloshinskii-Moriya interaction and an additional anisotropy in plane of the sample. While the ground magnetization state of a straight wire is strictly tangential, the curvature effective Dzyaloshinskii-Moriya interaction results in a deviation of the magnetization from the strictly tangential distribution. Fig. 1 shows the azimuthal magnetization angle counted from the tangential direction as function of a coordinate along the wire. Peaks are exponentially localized at points where the curvature $\kappa$ changes a sign to the opposite one. Periodic structure of the magnetization ground state plays a role of periodic potential for magnon excitations.

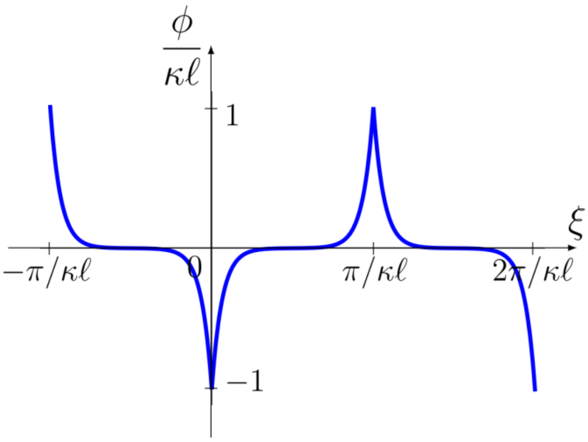


Fig. 1 The ground state of magnetization in a wave-shaped wire; $\xi$ is a dimensionless coordinate along the wire, $\varphi$ is an azimuthal magnetization angle, $\kappa$ is a curvature and $\ell$ is a magnetic length.

The spin-wave spectrum of this magnonic crystal derived using the Floquet technique and the empty lattice approximation. The bandgap width is proportional to the $\kappa^3$. The minimal spectrum frequency decreases with increasing of curvature $\kappa$ and the gap at zero wave vector disappears for critical curvature $\kappa_c\ell \approx 0.6$.

[1] S. O. Demokritov and A. N. Slavin (eds.), *Magnonics: From Fundamentals to Applications* (Topics in Applied Physics), Springer Berlin Heidelberg, Berlin New York (2013).
[2] Schneider, T. et al. *Realization of spin-wave logic gates*. Appl. Phys. Lett. **92**, 022505 (2008).
[3] A. V. Chumak, V. I. Vasyuchka, A. A. Serga, and B. Hillebrands, Nat. Phys., **11**, 453 (2015).
[4] D. D. Sheka, V. P. Kravchuk and Y.Gaididei, J. of Phys. A: Math. and Theor., **48**, 125202 (2015).