

SEMINAR ON MAGNETISM AND SUPERCONDUCTIVITY

We kindly inform You that on **Wednesday**

June 12th at 10:00

there will be a **seminar in room 203, building I**, where

dr Mircea Trif, prof. IF PAN

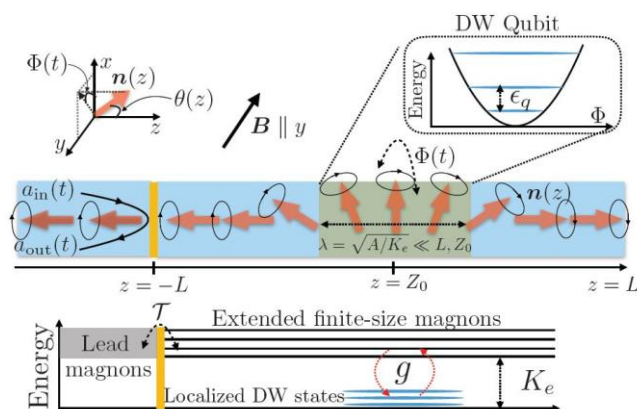
(International Research Centre Magtop, Institute of Physics, Polish Academy of Sciences,
Aleja Lotników 32/46, PL-02668 Warsaw, Poland)

will deliver a lecture on:

“Cavity magnonics with domain walls in insulating ferromagnetic wires”

Due to their inherent topological stability, magnetic domain-walls (MDWs) hold great potential for applications in spintronic devices, particularly for data storage and *classical* information processing purposes. Very recently, numerous theoretical works have delved into the use of MDWs as building blocks for *quantum* information processing tasks. However, so far no quantum-coherent degrees of freedom have been experimentally uncovered in these systems, mainly because of the extremely low temperatures (\sim mK) required to resolve the level structure and eventually reach the ground-state. In this talk, I will present a possible resolution to this problem that leverages the inherent magnons found in the insulating ferromagnetic wires that accommodate MDWs. Using the language of cavity optomechanics, I will show how to exploit a geometric Berry-phase interaction between the localized MDWs and the extended magnons in short ferromagnetic insulating wires to efficiently cool the MDW to its quantum ground state or to prepare nonclassical states exhibiting a negative Wigner function that can be extracted from the power spectrum of the emitted magnons. Moreover, we demonstrate that magnons can mediate long-range entangling interactions between qubits stored in distant MDWs, which could facilitate the implementation of a universal set of quantum gates. Instead of integrating additional degrees of freedom with the MDW, such as photons in microwave resonators -- which only adds to the complexity of the setups in the long run -- our approach is promising in terms of scalability, since it leverages only the degrees of freedom of the ferromagnetic wire. Our proposal can be naturally extended to explore the quantum dynamics of MDWs in ferrimagnets and antiferromagnets, as well as quantum vortices or skyrmions confined in insulating magnetic nanodisks.

[1] Mircea Trif and Yaroslav Tserkovnyak, *arXiv:2401.03164*.



The seminar will be given in English on-site in room 203 and the ZOOM transmission will be available too - the link is provided on the IP PAS website.

We sincerely invite You

Roman Puźniak / Andrzej Szewczyk / Henryk Szymczak