




SPINTECH comes to an end

The SPINTECH project has sadly come to an end after three and a half successful years. The Twinning project was focused on research excellence in superconducting spintronics and coordinated by Prof. Anatolie Sidorenko of D. GHITU Institutul de Inginerie Electronica și Nanotehnologii with the strong support of Stockholms Universitet and Universiteit Twente. A [project video](#) capturing the main outcomes has been recently published.



Prof. Dr. ANATOLIE SIDORENKO
COORDINATOR OF THE SPINTECH PROJECT

FULL MEMBER OF ACADEMY OF SCIENCES OF MOLDOVA, INTERNATIONALLY RECOGNIZED EXPERT IN THE FIELD OF NANOTECHNOLOGIES AND SUPERCONDUCTING NANOSTRUCTURES. HE WAS 12 YEARS DIRECTOR OF INSTITUTE OF ELECTRONIC ENGINEERING AND NANOTECHNOLOGIES IN MOLDOVA, AUTHOR OF OVER 400 SCIENTIFIC PUBLICATIONS, 54 PATENTS, PUBLISHED 4 BOOKS ABOUT FUNCTIONAL NANOSTRUCTURES AND SENSORS IN "SPRINGER", THE EDITOR OF SEVERAL THEMATIC SERIES "FUNCTIONAL NANOSTRUCTURES" IN BEILSTEIN JOURNAL OF NANOTECHNOLOGY (GERMANY), PRESIDENT OF THE MOLDAVIAN PHYSICAL SOCIETY, MEMBER OF DEUTSCHE PHYSIKALISCHE GESELLSCHAFT (DPG).

[SPINTECH Project Video](#)

Over the project, the Twinning partners implemented numerous staff-exchanges, workshops, conferences and summer schools. Through these activities, the partners advanced their knowledge and experience of advanced vacuum technologies development for fabrication of layered nanostructures for spintronics as well as the elaboration and testing of a superconducting spin-valves for switching and memory elements.

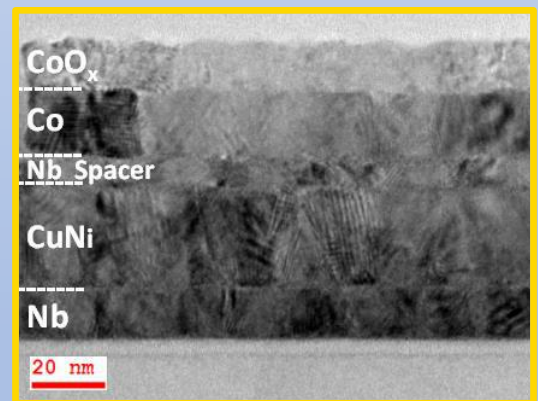


What is Spintronics?

Spintronics is a new field of research and engineering exploiting the influence of intrinsic electron spin on electrical transport. It is a rapidly developing area that allows insight into fundamental spin-dependent physical properties and exponentially expanding practical applications — such as the read head sensors for hard drives and memory elements for computers.

One of the main challenges in this field is the realization of spintronics based devices; in particular, there is intense research activity focused on combining superconductivity and spintronics, to enhance device functionality and performance. In this framework, strengthening IEEN's research excellence in superconducting spintronics will be achieved by focusing efforts on two sub-topics with the support of the Twinning partners:

- Advanced vacuum technologies development for fabrication of layered nanostructures for spintronics (IEEN and University of Stockholm), and
- Elaboration and testing of a superconducting spin-valve for switching and memory elements (IEEN and University of Twente)



Triplet spin valve nanostructures (layered hybrid structure); from bottom to top: Nb (Superconductor) / CuNi (Ferromagnet - 1) / Nb (Spacer) / Co (Ferromagnet - 2) / CoOx (Antiferromagnet).





SPINTECH summer and winter schools

Stockholm – May 2021 and Feb 2022

A summer school was held during 27-28 May 2021 at the University of Stockholm “Alba Nova” with a focus on non-von Neumann computers based on artificial neural network. The hybrid event attracted 13 participants in person and 31 online, who listened to nine lectures.



Prof. Anatolie Sidorenko and colleagues, Stockholm, May 2021

For the winter school held in Stockholm during 3-4 February 2022, lectures were given on “*Smart methods of nanostructures fabrication for spintronics*”, “*Nanofabrication of functional nanostructures using FIB process*”, “*In-situ analysis of magnetic states in nanostructured S/F heterostructures*”, and “*Josephson and proximity effects in superconductor/ferromagnet junctions*”. Also, training was provided on novel methods for investigating superconducting characteristics.

Chisinau – December 2021 and January 2022

A two-day winter school dedicated to “*Non-conventional Superconductivity Implementation in Spintronics*” was held at D. Ghitu Institute of Electronic Engineering and Nanotechnologies during 10-11 December 2021. The hybrid event attracted 19 participants in person and a further 18 online. On the first day, Prof. Anatolie Sidorenko presented the results achieved in SPINTECH, Prof. Igor Lukyanchuk presented the EU project “MELON”, and Prof. Valery Vinokur gave a lecture about the nature of High-T_c superconductivity and the concept of magnetic monopoles. On the second day, an Advisory Board meeting was held with Prof. Elena Achimova, Prof. Denis Nica and Dr. Sergei Railean.

A winter school dedicated to “*Hybrid Nanostructures*” was held during 20-22 January 2022. Notably, Prof. Yuriy Naydiuk and Prof. Gennadii Kamarchuk were invited guest speakers from Kharkiv, Ukraine, who gave lectures about the fundamentals of functional hybrid nanostructures and about new phenomena detected. The hybrid event attracted 15 participants in person and a further 18 online.

Twente – February 2022

For the winter school held in Twente during 10-12 February 2022, the research focus was on modelling, design and characterization of functional nanostructures. The participants learnt about smart methods of characterising nanostructured samples and listened to lectures on “*Modern methods of the nanostructures characterization by XRD-diffractometer*” and “*Advanced X-Ray Based Methods for Powder Characterisations*”. Also, training was provided on nanostructure characterisation in the Thin Films Fabrication Center of the University of Twente.





SPINTECH workshops

Twente – July and November 2021

A training workshop on “*Advanced methods of nanostructures characterization*” was held at Twente University during 12-13 July 2021. The workshop consisted in a mix of laboratory visits, presentations, and trainings focused on XRD diffractometry of nano-sized samples; Low-temperature measurements and advanced methods of brain-like circuits characterization; and SQUID-microscope installation and methods of magnetometry of nanostructures. The twenty-two participants also had the opportunity to visit the Centre of Materials and Structures Characterization (DANNALAB); Magnetometry Lab at Twente University; and “BRAINS Centre for Brain-Inspired Nano Systems”.



Visiting the Magnetometry Lab, Twente University

For the following workshop held during 10-13 November 2021, the main goal was to increase the knowledge of the 30 participants in the implementation of spintronics for the design of artificial neural networks (ANN) and to gain knowledge in the fabrication and characterisation of base elements of ANN.

Chisinau – Sept 2021 and Feb 2022

A training workshop dedicated to “*Artificial Neuronal Networks: from nanofabrication to deep-learning*” was held in Chisinau during 7-9 Sept 2021. The workshop was the subject of an [AVA TV](#) programme, which included an interview with esteemed workshop participant Prof. Isaak Bersuker of the University of Texas at Austin.



Prof. Isaak Bersuker, University of Texas at Austin

The workshop included talks on Ferroic nanomaterials for Artificial Neural Network; Jahn–Teller and Pseudo-Jahn–Teller Effects: From Particular Features to General Tools in Exploring Molecular and Solid State Properties; Mathematical modelling of nanofabrication; and Base elements of ANN – artificial neuron and synapse.

This was following by a workshop during 24-25 February 2022. The participants learnt about the newest application of spintronics to the design and engineering of ANN and artificial synapses. Notably, they heard talks on Fundamentals and Fabrication of Artificial Superconducting Synapses based on Superconductor-Ferromagnet Heterostructures; Ferromagnet/Superconductor Hybrid Magnonic Metamaterials; and Basics of superconducting spintronics.





12th International Conference on Intrinsic Josephson Effect and Horizons of Superconducting Spintronics

The conference was held during 22-25 September 2021 in Chisinau with the aim of bringing together leading experts from 16 countries - Japan, USA, Germany, France, Russia, Ukraine, Moldova, Romania, Netherlands, Sweden, Italy, UK, Spain, China, South Korea - to share their expertise and experience in superconducting electronics and spintronics. A major news feature about the conference was published in [Moldavskie Vedomosty \(Moldovan News\)](#).



7th International Conference on Superconductivity and Magnetism

During the 7th International Conference on Superconductivity and Magnetism (21-27 October 2021), Prof. Anatolie Sidorenko gave a lecture entitled "[Layered nanostructures for superconducting spintronics](#)" where he presented the main goals of SPINTECH and the project's latest scientific results.



Scientific paper published in the Beilstein Journal of Nanotechnology



BEILSTEIN JOURNAL OF NANOTECHNOLOGY

The SPINTECH consortium partners were proud to announce in August 2021 that their scientific paper "*In situ transport characterization of magnetic states in Nb/Co superconductor/ferromagnet heterostructures*" had been published in the Beilstein Journal of Nanotechnology (Impact Factor=3,65). To read the paper, please click on this [link](#).



SPINTECH presented at Horizon Europe launch event in Moldova

Prof. Anatoli Sidorenko had the proud privilege of presenting the SPINTECH project during the Horizon Europe launch event held in Moldova on 3 December 2021. A video of Prof. Sidorenko's presentation can be viewed [here](#).



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<https://www.researchgate.net/project/SPINTECH-superconducting-spintronics>



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