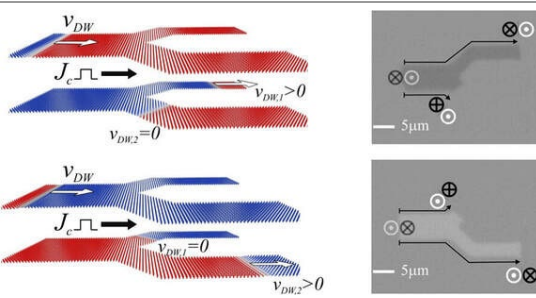

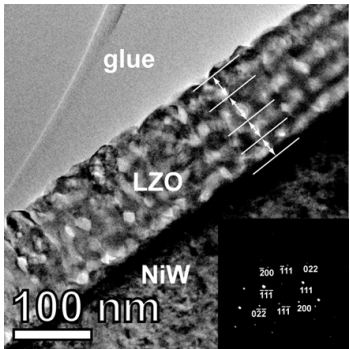


# CENTER OF SUPERCONDUCTIVITY, SPINTRONICS AND SURFACE SCIENCE

## Contact details

Name	Center of Superconductivity, Spintronics and Surface Science	
Acronym	C4S	
Logo		
Site	<a href="http://www.c4s.utcluj.ro">http://www.c4s.utcluj.ro</a>	
Address	26-28 G. Baritiu Str., 400027, Cluj-Napoca, Romania	
Faculty Department	Faculty of Material and Environment Engineering Physics and Chemistry Department	
Telephone	+40 264 401475, +40 733 274 834	
Fax	+40 264 592055	
Director	Prof. Dr. Phys. Traian Petrișor	
e-mail	<a href="mailto:traian.petrisor@phys.utcluj.ro">traian.petrisor@phys.utcluj.ro</a>	

## Areas of expertise

**SUPERCONDUCTIVITY:** Investigation of different artificial pinning center incorporation in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> (YBCO) thin films for efficient vortex pinning; development of environmentally friendly, i.e. fluorine-free, chemical solution deposition (CSD) processes for YBCO thin film growth; oxide thin films elaboration for buffer-layer architecture in high-temperature superconducting coated conductor applications. **Responsible/contact:** [traian.petrisor@phys.utcluj.ro](mailto:traian.petrisor@phys.utcluj.ro)

**SPINTRONICS:** Elaboration and study of novel magnetic spintronic and spin-orbitronic systems concerning the use of spin-orbit coupling in magnetic and nonmagnetic materials to generate, detect and exploit spin-polarized currents, with the aim to design and manufacture individual spin based electronic devices for applications in the field of sensors, data storage and processing. **Responsible/contact:** [mihai.gabor@phys.utcluj.ro](mailto:mihai.gabor@phys.utcluj.ro)

**MATERIALS CHEMISTRY.** Within this topic the following axes are developed: precursors (synthesis, characterization, single crystal growth, molecular modeling), thin films, nanoparticles and nanostructuring. Using chemical preparation methods (sol-gel) different thin oxide films with a large range of applications in electronics, optics, catalysis, wear resistance, corrosion protection and superconductivity are prepared, e.g. La<sub>0.66</sub>Sr<sub>0.33</sub>MnO<sub>3</sub>, La<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub>, YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub>, BaZrO<sub>3</sub>, GaFe<sub>2</sub>O<sub>4</sub>. **Responsible/contact:** [lelia.ciontea@chem.utcluj.ro](mailto:lelia.ciontea@chem.utcluj.ro)

## Team

Prof. Dr. Phys. Traian Petrișor, Prof. Dr. Lelia Ciontea, Assoc. Prof. Dr. Mihai Gabor, Assoc. Prof. Dr. Amalia Mesaroș, Assoc. Prof. Dr. Traian Petrișor Jr., Assist. Prof. Dr. Ramona Bianca Șonher, Assist. Prof. Dr. Mircea Năsui, Assist. Dr. Eng. Elena Mirela Ștețco

## Representative projects

**Gate voltage controlled chiral magnetic domain wall spin-orbitronic devices**, PN-IV-P1-PCE-2023-1548, 15PCE/08.01.2025

**Nanostructured hybrid architectures with tunable magneto-luminescent properties**, PN-III-P4-PCE-2021-1561 No. 82/2022, <https://c4s.utcluj.ro/Nano-Mag@Lu/Nano-Mag@Lu.html>

**Spin-orbit torque driven field-free artificial synapses and neurons**, PN-III-P4-ID-PCE-2020-1853 No. 182/04/01/2021, <https://c4s.utcluj.ro/SPINSYNE/spinsyne.html>

**Spin-orbitronic devices for non-volatile magnetic memory elements**, PN-III-P1-1.1-TE-2016-2131 No. 24/02.05.2018,

**High temperature superconducting RF coil fabrication on flexible ceramic substrates for magnetic resonance imaging applications (SupraFlex)**, PN-III-P1-1.1-TE-2019-1777, contract nr. 171/2021 (2021-2022), <https://supraflex.weebly.com>

**Nano-engineered REBCO Superconducting Tapes for High Fields Application**, ENR-MFE19.ENE-04, Eurofusion H2020 (2019-2020)

**ExNanoMat Supporting excellence in nanotechnology and advanced materials research**, PNIII-P1-1.2- 1.2.2 PFE, (2018-2020)

**EUROTAPES** - "European development of Superconducting Tapes: integrating novel materials and architectures

into cost effective processes for power applications and magnets”, FP6, (2012-2016)  
 ”Unexplored magnetic vortex regimes relevant for fusion applications of superconductors.” FP7 - EUROFUSION Enabling Project  
**SPINCOD- ”Advanced spintronic devices for communication and data storage technologies based on Heusler compounds”** PN-II-RU-TE-2014-4-1820 – SPINCOD (2015-2017)  
**MAGPIN-”Nano-engineered Magnetic Pinning Centers in High Temperature Superconducting Epitaxial Thin Films”**, PN-II-RU-TE-2014-4-2848 MAGPIN (2015-2017)  
**SPINTRONIC- ”Cercetarea si dezvoltarea de dispozitive spintronice la scara mezoscopica”**, POS-CCE, (2010-2013)

## Significant results

### The most representative publications of the past 5 years:

1. Diode and Selective Routing Functionalities Controlled by Geometry in Current-Induced Spin–Orbit Torque Driven Magnetic Domain Wall Devices, E.M. Stetco, T. Petrisor jr., O.A.Pop, M. Belmeguenai, I. M. Miron, M. S. Gabor, Nano Lett. 2024, 24, 44, 13991–13997 (2024)
2. Bulk and interface spin-orbit torques in Pt/Co/MgO thin film structures, M. S. Gabor, M. Belmeguenai, and I. M. Miron, Phys. Rev. B 109, 104407 (2024)
3. I. Perhatia, L. E. Muresan, A. Belcovici, A. Popa, G. Borodi, A. Mesaros, and L. B. Tudoran, "Influence of different additives on the morphology, defect state and luminescence of ZnO nanoparticles," Colloids and Surfaces A- Physicochemical and Engineering Aspects, vol. 684, Mar 2024.
4. Thickness dependence of magnetic properties of Ir/FeV-based systems, D Ourdani, Y Roussigné, SM Chérif, MS Gabor, M Belmeguenai, Phys. Rev. Materials, 7, 034408 , 9, 2200690 (2023)
5. A. Mesaros, A. Garzón, M. Nasui, R. Bortnic, B. Vasile, O. Vasile, F. Iordache, C. Leostean, L. Ciontea, J. Ros, and O. Pana, "Insight into synthesis and characterisation of Ga<sub>0.9</sub>Fe<sub>2.1</sub>O<sub>4</sub> superparamagnetic NPs for biomedical applications," Scientific Reports, vol. 13, Oct 2023
6. Effect of Chiral Damping on the dynamics of chiral domain walls and skyrmions, CK Safeer, M-A Nsibi, J Nath, MS Gabor, H Yang, I Joumard, S Auffret, G Gaudin, I-M Miron, Nature Communications , 13, 1192(2022)
7. A. Daniel, M. Nasui, T. Petrisor Jr., R. B. Sonher, A. Augieri, C. Pop, A. Palau, A. Vannozzi, G. Celentano, L. Ciontea and T. Petrisor, Investigation of diethanolamine (DEA) as a chelating agent in the fabrication of fluorine-free propionate route YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> (YBCO) thin films, Supercond. Sci. Technol. 35, 054010 (2022)
8. Magneto-Ionics in Annealed W/CoFeB/HfO<sub>2</sub> Thin Films, R Pachat, D Ourdani, MA Syskaki, A Lamperti, S Roy, S Chen, A Di Pietro, L Largeau, R Juge, M Massouras, C Balan, JW van der Jagt, G Agnus, Y Roussigné, MS Gabor, SM Chérif, G Durin, S Ono, J Langer, D Querlioz, D Ravelosona, M Belmeguenai, LH Diez, Advanced Materials Interfaces, 9, 2200690 (2022)
9. Mechanism of Spin-Orbit Torques in Platinum Oxide Systems, J Nath, AV Trifu, MS Gabor, A Hallal, S Auffret, S Labau, A Mahjoub, E Chan, AK Chaurasiya, AK Mondal, H Yang, E Schmoranzero, MA Nsibi, I Joumard, A Barman, B Pelissier, M Chshiev, G Gaudin, IM Miron, Adv. Electron. Mater. , 2101335(2022)
10. R.B. Sonher, M. Nasui, M.S. Gabor, T. Petrisor Jr., L. Ciontea, T. Petrisor, Effect of glycerol on the thermal decomposition behavior of nickel propionate-based precursor, Journal of Analytical and Applied Pyrolysis 159 (2021) 105289
11. A. A. Armenio, L. Piperno, T. Petrisor Jr, A. Vannozzi, V. Pinto, F. Rizzo, A. Augieri, A. Mancini, A. Rufoloni, R. B. Mos, L. Ciontea, T. Petrisor, G. Sotgiu and G. Celentano, Nanostructured templates for critical current density enhancement in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> films, Supercond. Sci. Technol. 33, 094033 (2020)

## The offer addressed to the economic environment

Research & development	The Centre has longstanding expertise in superconducting, magnetic, and oxide thin films grown both by physical and chemical methods. Within the Superconductivity axis, the major topic relates to the YBa <sub>2</sub> Cu <sub>3</sub> O <sub>7</sub> high-temperature superconducting epitaxial thin film fabrication technology using chemical methods and related topics: oxide buffer layer templates, artificial pinning centers and flux pinning studies. The second topic, Spintronics and Spinorbitronics, involves thin film elaboration, device patterning, magneto-opto-electric characterization, to fabricate and study novel devices by employing materials with tailored interface functionalities. The Materials Chemistry research axis focuses on the synthesis of a wide area of complex materials in different forms (thin films, nano-particles, powders). They cover a large spectrum of applications including, but not restricted to superconductivity and magnetism. Since the Center focuses on developing systems with reduced dimensionality, i.e., thin films and nano-particles, Surface Science is an intrinsic aspect of our research.
Consulting	Consulting may be offered in the following areas: materials science, thin film elaboration and characterization tools (structural, morphological, magnetic properties), patterning using UV lithography techniques and ion beam/chemical etching, clean room facilities, high vacuum and ultra high vacuum deposition tools, chemical elaboration strategies for thin films and nanoparticles
Training	Training courses may be delivered in the following topics: 1. Physical vapor deposition of thin films, 2. Chemical methods for thin film growth, 3. Characterization tools and methods for thin films