



## Joint workshop of the project SUPERSPIN-IM-26 and ERA-CHAIR-project LAMatCU

### *Opportunities for collaborations in the fields of superconductivity and 2D materials*

**Goals.** The main goals of the workshop are: 1) Review important current trends and activities in the fields of superconductive and 2D materials; 2) Review current capabilities in the field of superconductivity and 2D materials in Slovakia; 3) Identify opportunities for collaboration; 4) Identify opportunities for pursuing domestic and international funding.

**Venue.** (being finalized)

**Logistics.** We will provide small refreshments during coffee breaks. We will make an effort to pay hotels for people traveling from outside of Bratislava.

**Lectures structure.** In your lectures please include brief introduction for nonexperts, current state-of-the-art, research expertise of the group highlighting the most relevant recent results, perspectives (fundamental and applied), and opportunities for future research in the field. The allotted time for your lecture includes 5 min. for questions. Please prepare your lectures in English.

### PRELIMINARY PROGRAM

#### Thursday, June 8, 2023 - SUPERCONDUCTIVITY

08:15-08:45 Arriving + Welcome Coffee

08:45-09:00 Opening remarks: **Denis Kochan, Milan Sýkora, Jaroslav Fabian**

#### *Morning session 1 (open to public):*

09:00-09:30 Speaker: **Peter Makk** (Budapest, HU)

Title: Supercurrent in graphene Josephson junctions

09:30-10:00 Speaker: **Tomáš Samuely** (Košice, SK)

Title: Ising superconductivity in bulk layered superconductors

10:00-10:30 Speaker: **Andreas Costa** (Regensburg, DE)

Title: Supercurrent diode effect in 2DEG-based Josephson junctions

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10:30-10:40 *Coffee break*

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#### *Morning session 2 (open to public):*

10:40-11:05 Speaker: **Simon Reinhard** (Regensburg, DE)

Title: Sign reversal of the supercurrent diode effect in ballistic Josephson junctions

11:05-11:30 Speaker: **Max Geier** (Copenhagen, DK)

Title: Non-reciprocal superconductivity in planar superconductor-semiconductor heterostructures

11:30-11:55 Speaker: **Denis Kochan** (Bratislava, SK)



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Title: Anisotropic vortex squeezing in synthetic Rashba superconductors

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11:55-13:30

Lunch break

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**Afternoon session 1 (open to public):**

13:30-13:55 Speaker: **Andrew Higginbotham** (Wien, AT)

Title: 0,1,...,N: Exploring superconductor-semiconductor hybrids by adding Josephson junctions

13:55-14:20 Speaker: **Neven Barišić** (Zagreb, HR)

Title: High-Tc cuprates – story of two electronic subsystems

14:20-14:45 Speaker: **Pavol Szabo** (Košice, SK)

Title: Superconducting – insulating transitions in highly disordered superconducting thin films

14:45-15:10 Speaker: **Szabolcs Csonka** (Budapest, HU)

Title: Realization of Andreev molecule in superconductor - parallel InAs nanowire hybrid

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15:10-15:20

Coffee break

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**Afternoon session 2 (open to public):**

15:20-15:45 Speaker: **Wolfgang Lang** (Wien, AT)

Title: Vortex zoology in nanopatterned copper-oxide superconductors

15:45-16:10 Speaker: **Marko Milivojević** (Bratislava, SK)

Title: General classification of possible superconducting pairings with Rashba spin-orbit coupling: an example of Ising superconductor NbSe<sub>2</sub>

16:10-16:35 Speaker: **Jaroslav Tóbiš** (Bratislava, SK)

Title: Dynamical symmetry breaking in magnetic systems

16:35-17:00 Speaker: **Peter Stano** (Tokyo, JP)

Title: K-dot-p models of holes in low-dimensional nanostructures

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17:00-17:10

Coffee break

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**Discussion panel (closed session):**

17:10-18:00 Opportunities for collaborations among Central European and Danube Region countries

Discussion lead: **Neven Barišić** (Zagreb, HR)

Panelists: **Szabolcs Csonka** (Budapest, HU), **Wolfgang Lang** (Wien, AT), **Jaroslav Fabian** (Regensburg, DE), **Peter Šiffalovič** (Bratislava, SK), **Ján Minár** (Plzeň, CZ), **Vladimír Cambel** (Bratislava, SK), **Milan Sýkora** (Bratislava, SK)

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From 18:30

Group dinner

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## Friday, June 9, 2023 – 2D MATERIALS

08:30-09:00 Arriving + Welcome Coffee

### ***Overview talks (open to public):***

- 09:00-09:15 Speaker: **Milan Sýkora** (Bratislava, SK)  
Title: Establishing Laboratory for Advanced Materials at Comenius University
- 09:15-09:45 Speaker: **Jaroslav Fabian** (Regensburg, DE)  
Title: Current trends in physics of 2D materials
- 09:45-10:15 Speaker: **Peter Šiffalovič** (Bratislava, SK)  
Title: TBD

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10:15-10:25 *Coffee break*

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### ***Theory and Modeling talks (open to public):***

- 10:25-10:50 Speaker: **Ľuboš Mitaš** (North Carolina, USA)  
Title: Quantum Monte Carlo for systems with strong correlations and spin-orbit interactions
- 10:50-11:10 Speaker: **Ivan Štich** (Bratislava, SK)  
Title: DFT and Quantum Monte Carlo calculations of 2D materials
- 11:10-11:35 Speaker: **Marius Kadek/ Michal Repiský** (Tromsø, NO)  
Title: First-principles modelling of 2D materials using relativistic all-electron Dirac-Kohn-Sham theory based on Gaussian-type orbitals
- 11:35-12:10 Speaker: **Martin Gmitra** (Košice, SK)  
Title: Aspects of proximity effects in van der Waals heterostructures
- 12:10-12:45 Speaker: **Ján Minár** (Plzeň, CZ)  
Title: Electronic structure, correlations and excited states of topological quantum materials

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12:45-14:00 *Lunch break*

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### **Afternoon Session:**

#### ***Experimental talks (open to public):***

- 14:00-14:25 Speaker: **Michaela Sojková** (Bratislava, SK)  
Title: Preparation of 2D Materials by CVD and PVD methods
- 14:25-14:50 Speaker: **Milan Sýkora** (Bratislava, SK)  
Title: 2D Nanomaterials Prepared by Bottom-up Chemical Methods
- 14:50-15:15 Speaker: **Martin Hulman** (Bratislava, SK)  
Title: Raman Spectroscopy of 2D Materials



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15:15-15:40 Speaker: **Viera Skákalová** (Bratislava, SK)

Title: Conductance fluctuations in graphene and quantum Hall states

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15:40-15:50

*Coffee break*

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***Discussion (closed session, speakers and invited guests only):***

15:50-16:50 Discussion: Current trends and collaborations opportunities.

Discussion lead: **Jaroslav Fabian** (Regensburg, DE)

The main goals of the session are to discuss following questions: 1.) Given the current trends in 2D materials research and the local capabilities, are there opportunities for meaningful local collaboration(s)? 2.) What are the opportunities for pursuing domestic and international funding? 3) What are the best strategies for pursuing those opportunities?

16:50-17:00 Closing notes: **Milan Sýkora**

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From 17:30

*Group dinner*

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