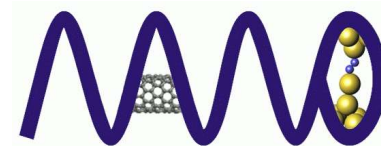
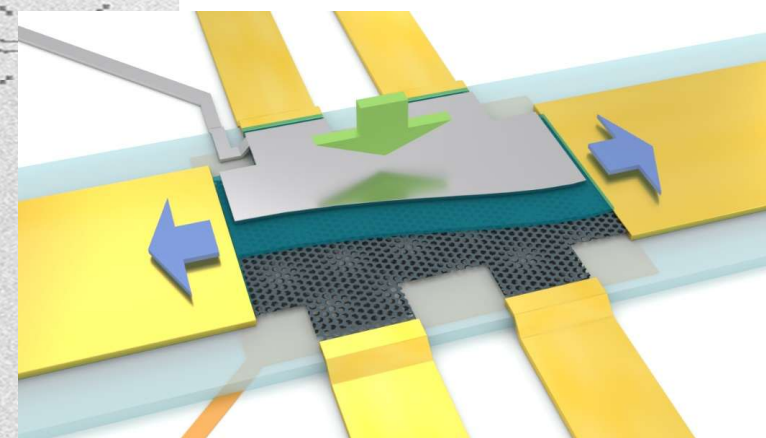
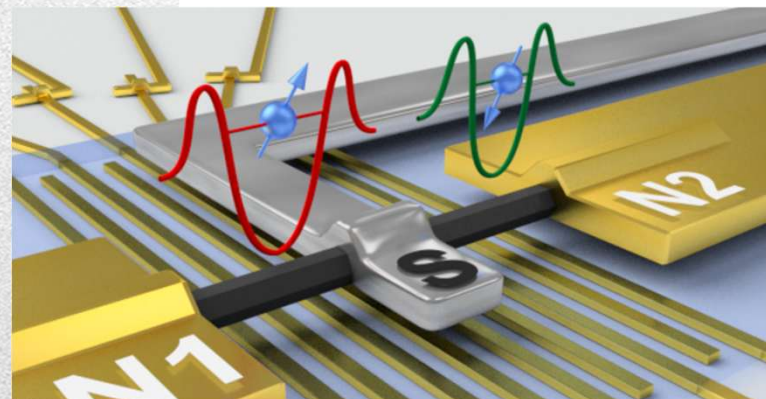


Quantum Electronics Lab

Péter Makk
Department of Physics, BME

<http://nanoelectronics.physics.bme.hu/>



Email: csonka.szabolcs@ttk.bme.hu, makk.peter@ttk.bme.hu



Contact info



NANOELECTRONICS RESEARCH LAB
Department of Physics



ATOMIC AND MOLECULAR ELECTRONICS

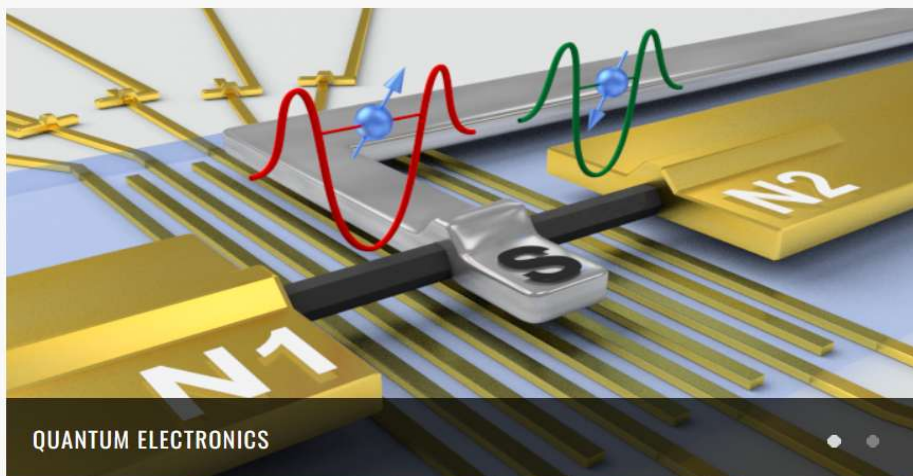
QUANTUM ELECTRONICS

LAB TOUR

EDUCATION

CONTACT

BEYOND PHYSICS



QUANTUM ELECTRONICS

GRAPHENE WORKSHOP 6

The graphene workshop organized for the 6th times was a great success with leading scientists from all over Europe. See you next year!

CONGRATULATIONS TO DR. BÁLINT FÜLÖP



Congratulations on successfully defending his thesis work titled "v.d.Waals heterostructures: from fabrication to hydrostatic pressure experiments"

GROUP LEADERS



András
Halbritter



Szabolcs
Csonka



Péter
Makk

SEMINARS / EVENTS

2022. 11. 07. 10:15

SPIN-WAVE-BASED COMPUTING FOR
FUTURE ELECTRONICS
Csaba György (Pázmány)

2022. 10. 17. 09:15

ROLE OF E-E INTERACTION IN
ANDREEV SPIN QUBITS
Zoltán Scherübl

2022. 10. 10. 09:15

ROLE OF E-E INTERACTION IN
ANDREEV SPIN QUBITS
Zoltán Scherübl

2022. 09. 27. 14:30

THE MATTER OF QUANTUM

Sz. Csonka



P. Makk



Email:

makk.peter@ttk.bme.hu
csonga.szabolcs@ttk.bme.hu

<http://nanoelectronics.physics.bme.hu/>



The Quantum Electronics team

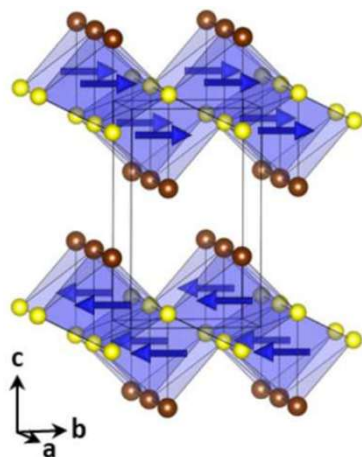
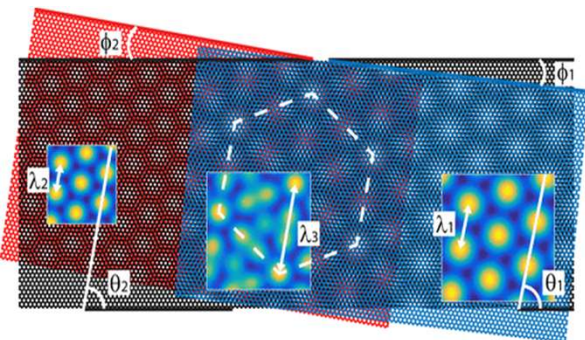


YOU ?

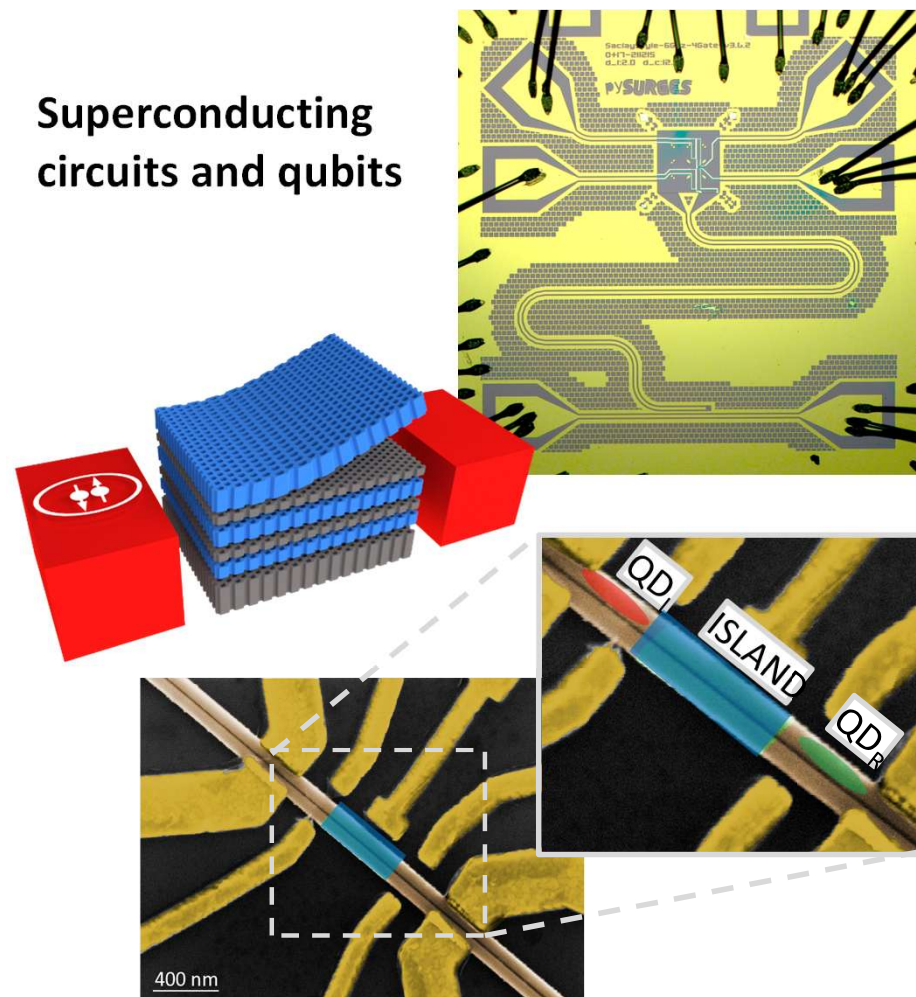
**6 senior researchers, 3 Postdocs, 10
PhD students, 6 MSc, and 3 BSc**



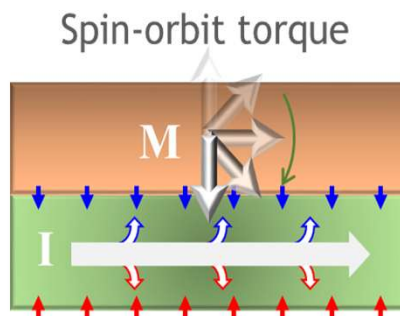
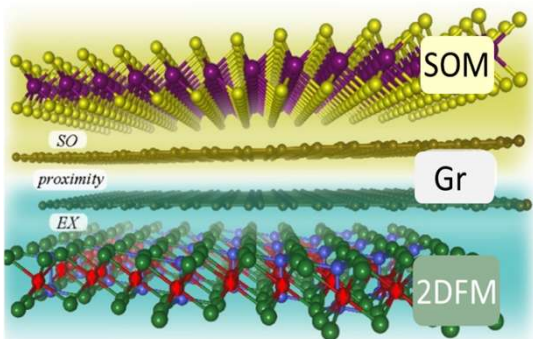
Novel 2D and correlated materials



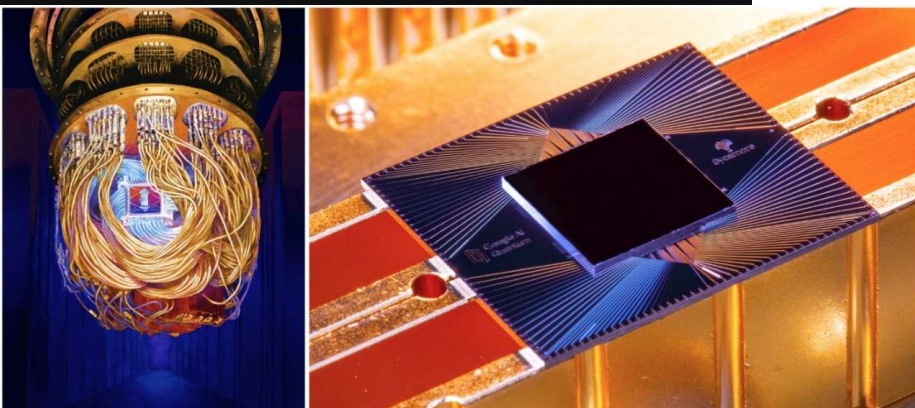
Superconducting circuits and qubits



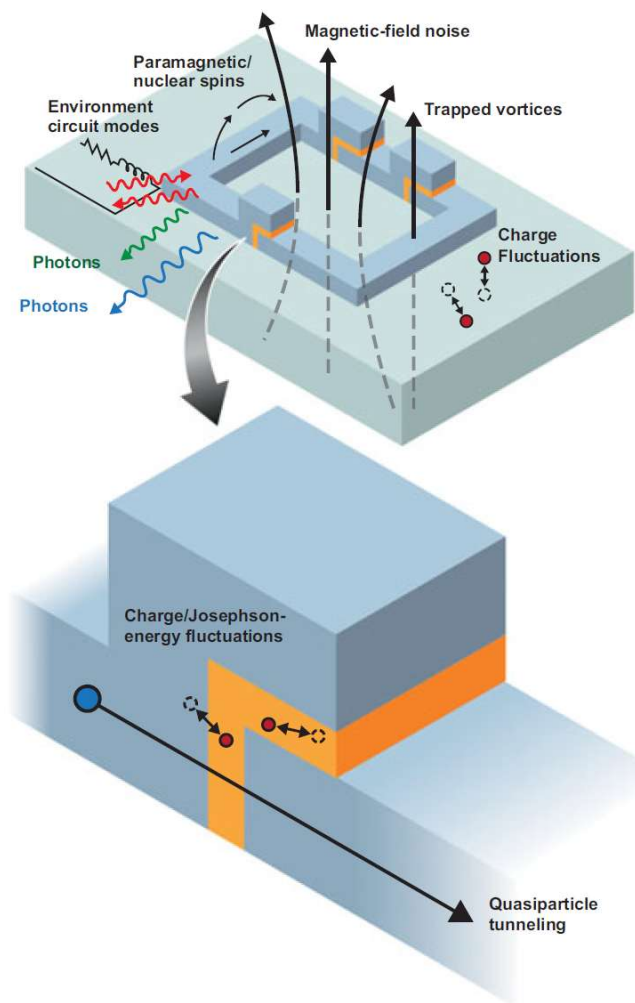
Spintronics



Google says quantum computer completed 10,000-year task in 3 minutes, 20 seconds



Information loss



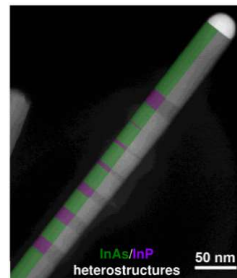
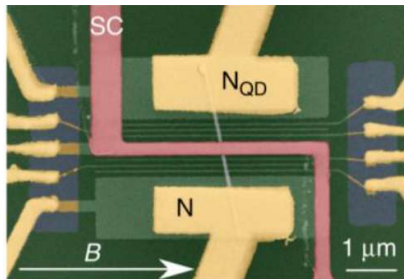
Quantum computation and topological protection

Lendületes kutatók mesterséges atomokra építenék a jövő kvantumszámítógépét

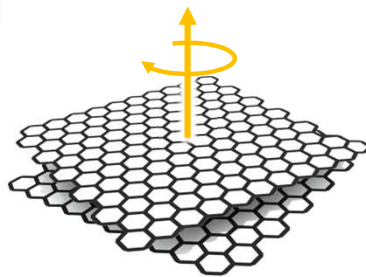
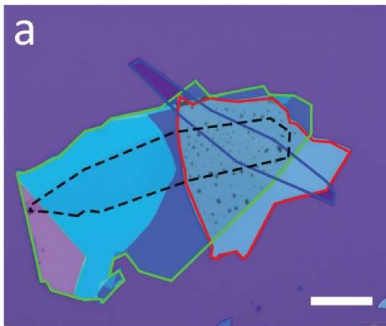
A kvantumszámítógépek alapját jelentő kvantumbitek gyakorlati megvalósítása a mai napig hatalmas technológiai kihívás. A BME-n működő Nanoelektronika és Egzotikus Kvantumfázisok Lendület-kutatócsoportok új eredménye szerint az általuk előállított mesterséges atomok használata vezethet el egy iparilag is hatékonyan alkalmazható gyártási eljáráshoz.

2020. JÚLIUS 22.

Novel quantum materials are required

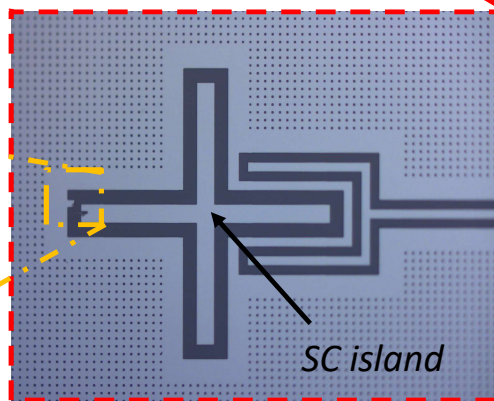
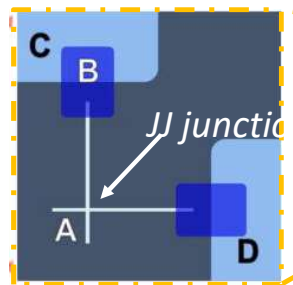
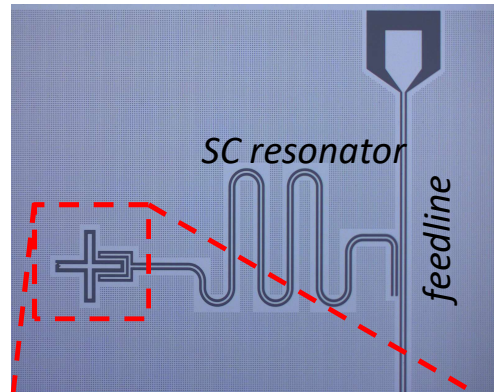
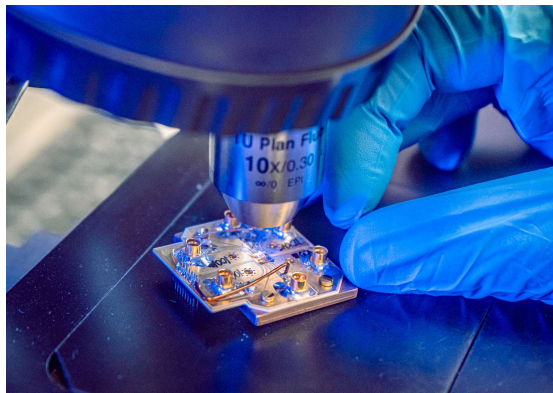


1D wire-based architectures

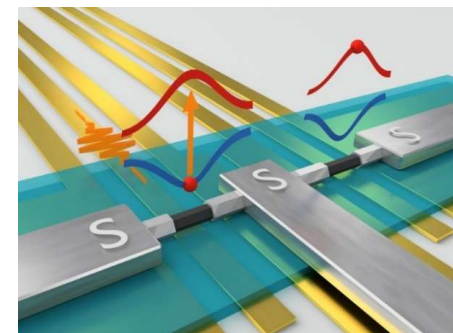
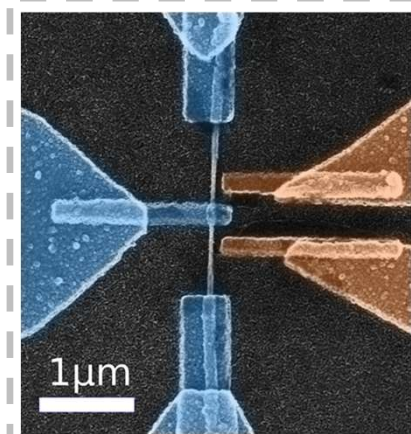
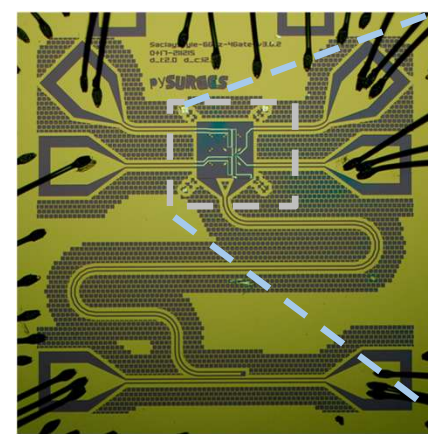


2D material-based architectures

“Conventional SC qubits”

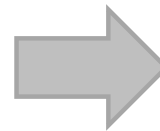
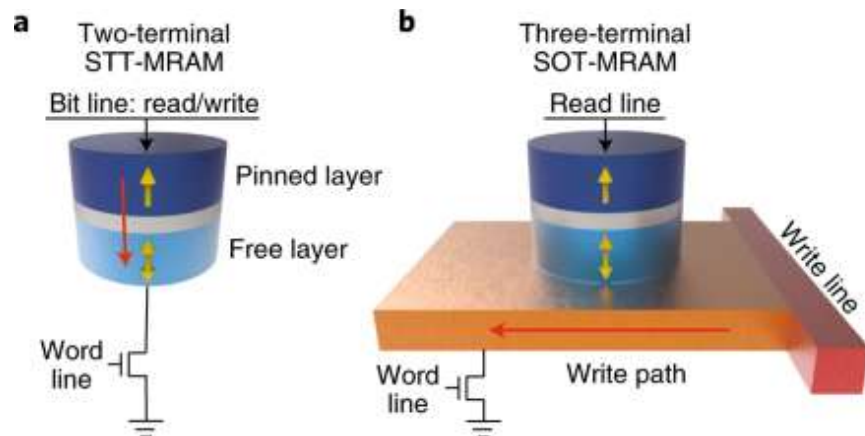


“Novel qubit types”

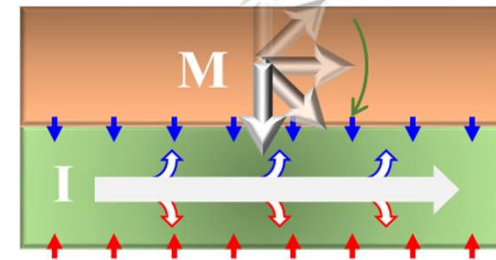


Protected behaviour?

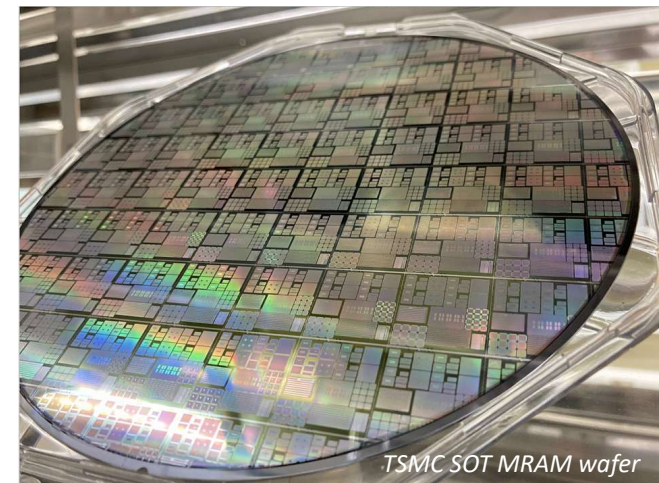
Novel magnetic architectures



Spin-orbit torque

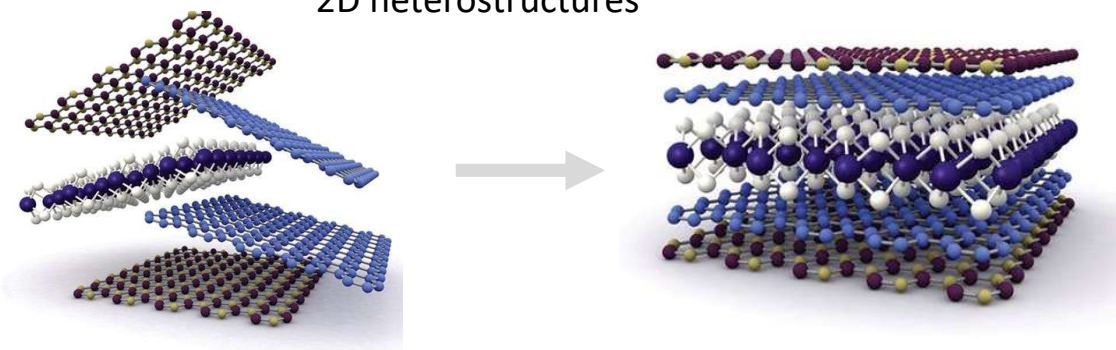


2023 IEEE International Electron Devices Meeting (IEDM 2023)

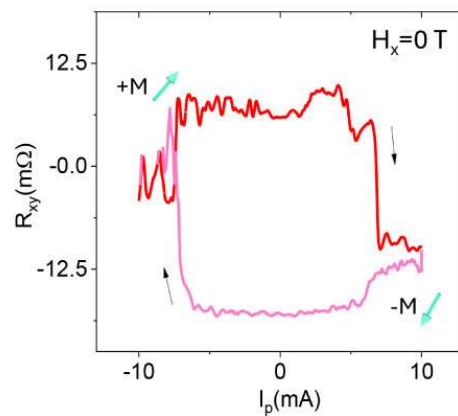
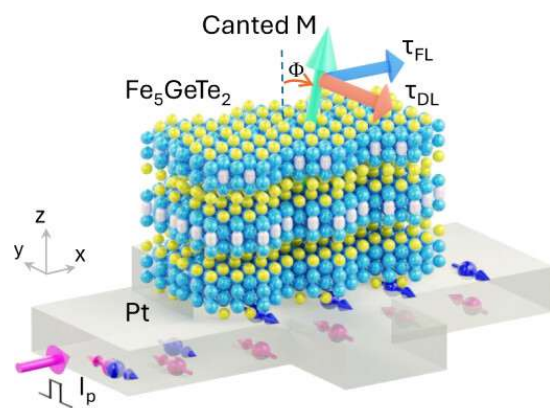


Spin Orbit Torque – next generation of memories

2D heterostructures

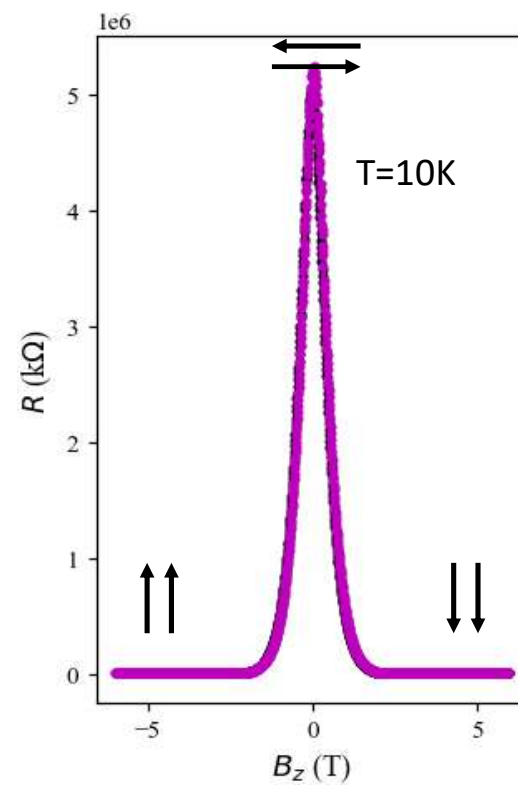


Example: Pt/Fe₅GeTe₂ spin-orbit torque

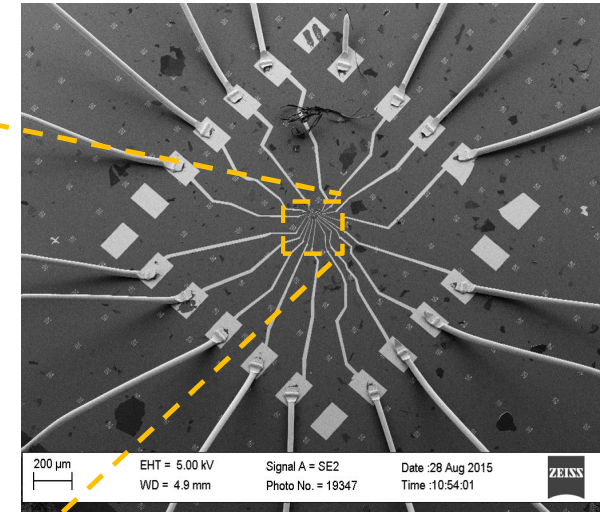
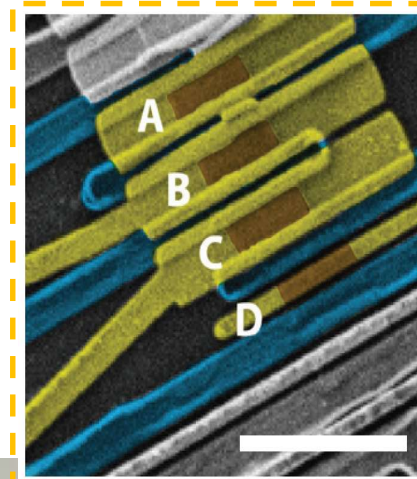
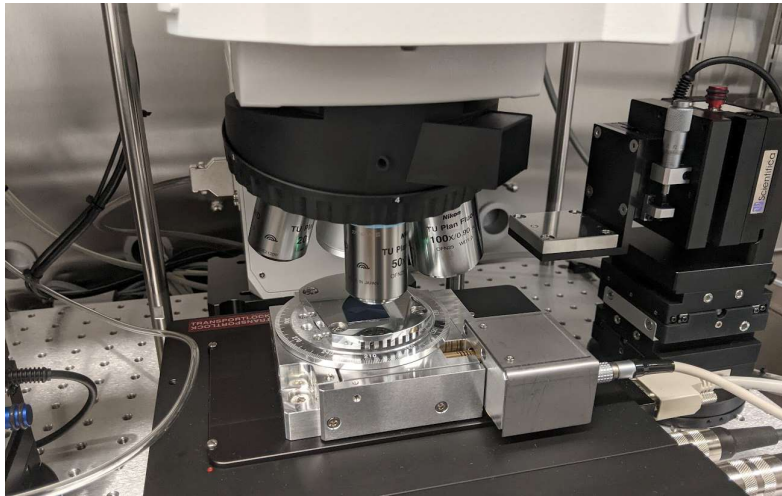


ACS Nano (2025)

Colossal magnetoresistance in 2D heterostructures!

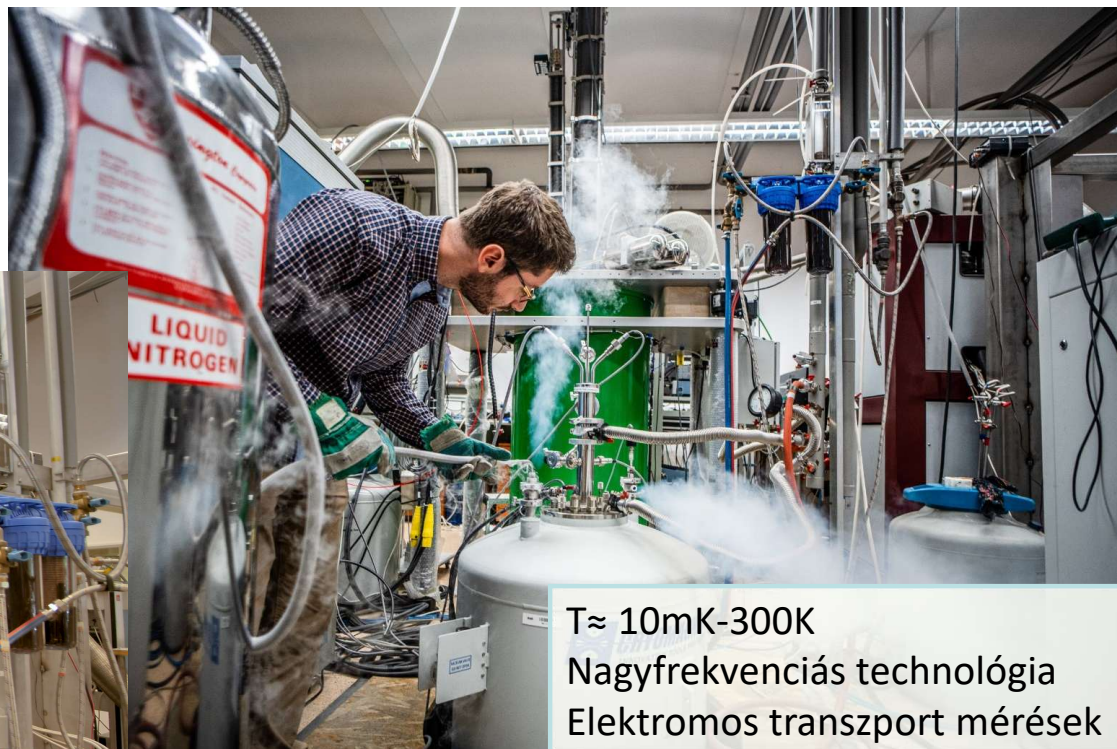
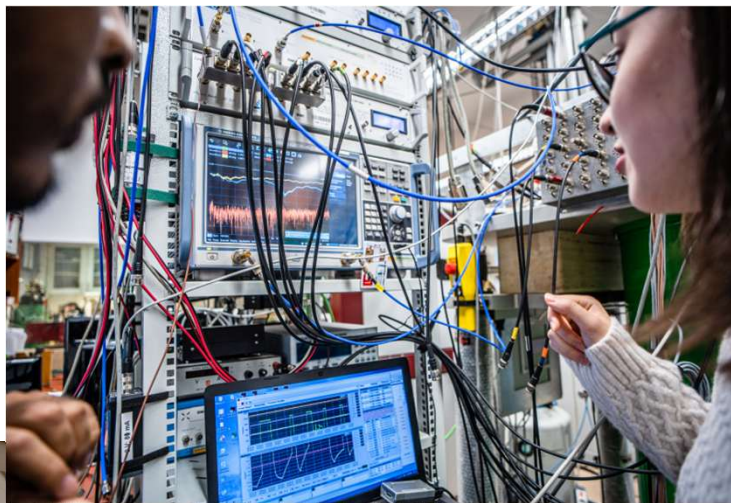


Device fabrication

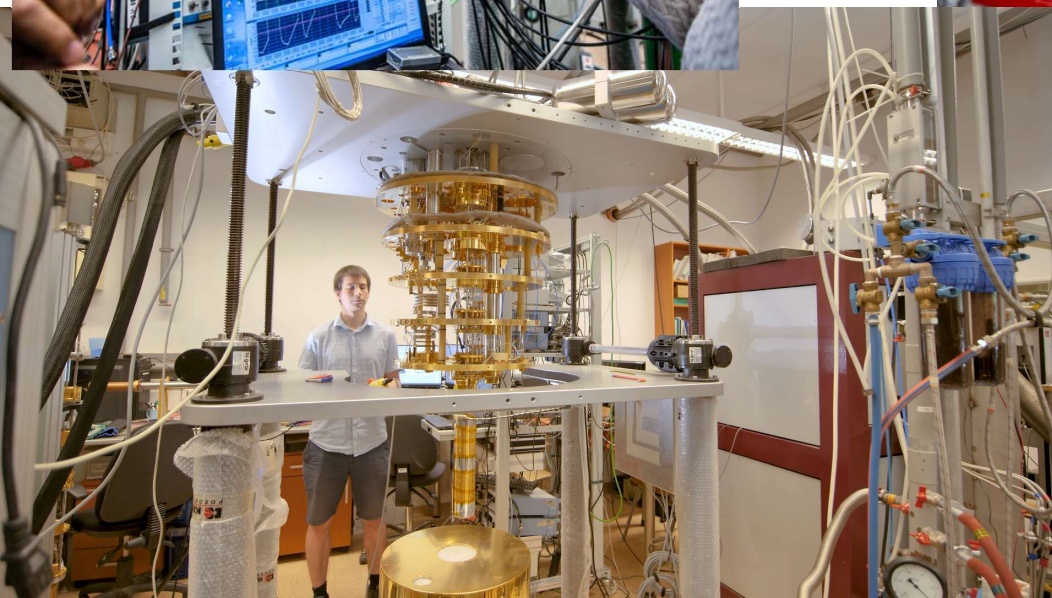


Fabrication at BME & MFA
(Energy Research Institute)

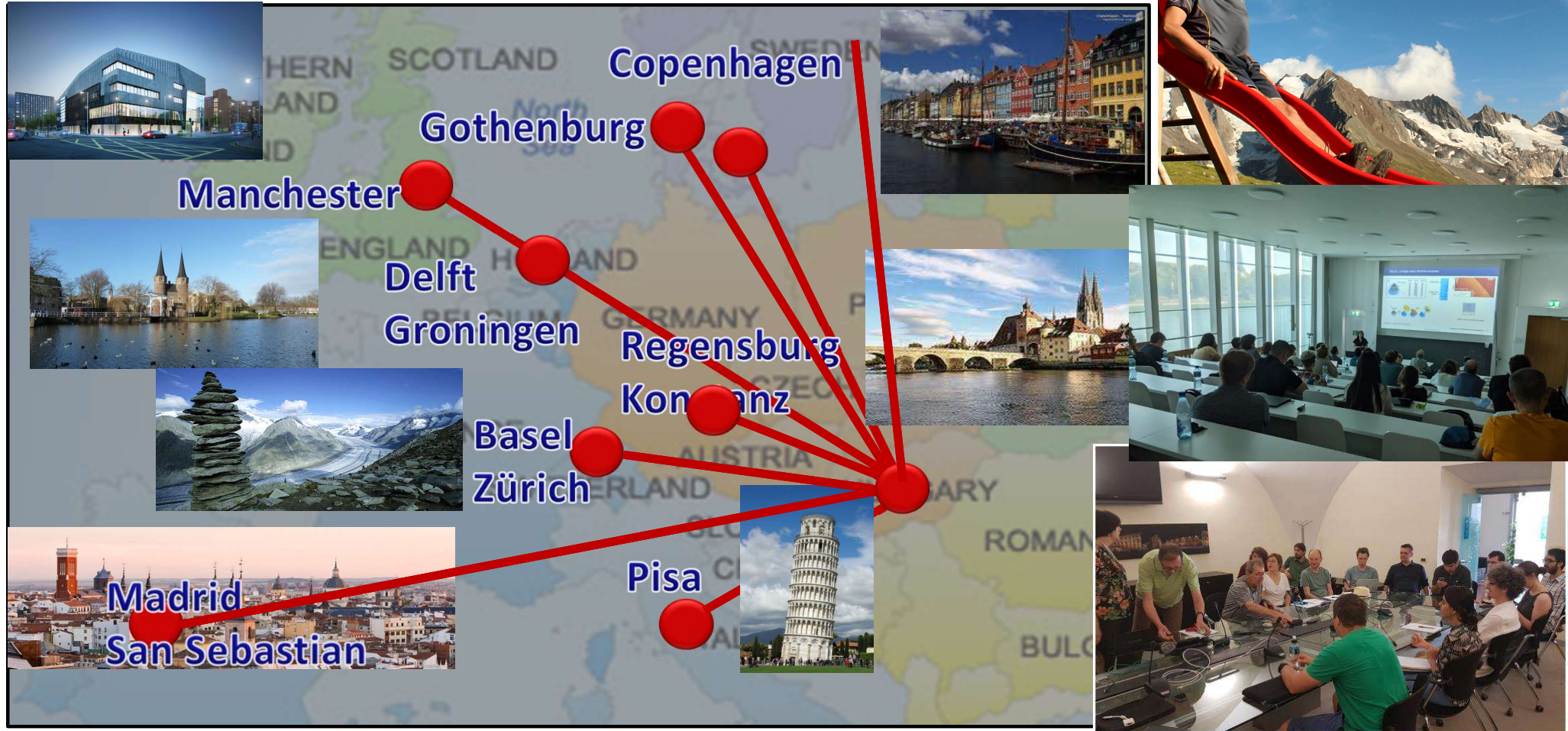
Ultra-low T measurements



$T \approx 10\text{mK}-300\text{K}$
Nagyfrekvenciás technológia
Elektromos transzport mérések
Nagy mágneses terek 17T-ig
Hélium cseppfolyósító



National and international collaborations



Study here!



Nanophysics seminar

The schedule of the seminar (spring, 2013)

Previous seminars

Recent interesting articles

Interesting articles for future seminars

Contents [hide]

- 1 Samuel d'Hollosy (EA), Fülöp Bálint(JC) 2013. április 26.
- 2 2013. április 12.
- 3 Fülöp Bálint(EA), Pósa László(JC) 2013. április 5.
- 4 Pasou Moca (EA), Scherzöl Zoltán(JC) 2013. március 29.
- 5 Thomas Müller (EA), Gubicza Ági(JC) 2013. március 22.
- 6 Palotás Krisztián (EA), Tóvári Endre(JC) 2013. márc. 08.
- 7 Pósa László (EA), Balogh Zoltán(JC) 2013. márc. 01.
- 8 Rákyta Péter (EA), Fülöp Gergő(JC) 2013. febr. 22.
- 9 Tóvári Endre (EA), Sárkány Lőrinc(JC) 2012. december 13.
- 10 Gubicza Ági (EA), Pósa László(JC) 2012. december 6.
- 11 Balogh Zoltán (EA), Gubicza Ágnes(JC) 2012. november 29.
- 12 Aszóthi János (EA), Tóvári Endre(JC) 2012. szeptember 13.
- 13 Balogh Zoltán(JC), Makk Péter (EA) - 2012. október 11.
- 14 Scherzöl Zoltán(JC), Fülöp Bálint(EA) 2012. október 18.
- 15 Eötvös Csaba(JC), Balogh Zoltán(EA) 2012. október 25.

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toolbox

BMETE11MF53

Course data

Course name: Fundamentals of Nanophysics
Neptun ID: BMETE11MF53
Responsible teacher: András Halbritter
Department: *Department of Physics*
Programme: Courses for Physicist MSc students
Course data sheet: *BMETE11MF53*

Requirements, Informations

COURSE INFORMATION

- **Lecturers:** András Halbritter, Szabolcs Csonka, Peter Makk

TDK



Kezdőlap > Természettudományi Kar > Kísérleti fizika

Kísérleti fizika

I. helyezett Pro Progressio alapítvány különdíja

Szupravezetők kapuzásának vizsgálata keresztkorrelációval

Szerző: Berke Martin
 Konzulens: Dr. Csonka Szabolcs (Fizika)

Quantum Computing Architectures

Course Information, 2018

- **Lecturers:** András Pályi, Péter Makk
- **Responsible lecturer:** András Pályi
- **Language:** English
- **Location:** building H, room H601
- **Time:** Wednesdays, 12:15-13:45
- **Schedule:** first lecture: Sep 5; no lecture on
- **Neptun Code:** BMETE15MF60
- **Credits:** 3
- **Exam:** Short written test + oral exam. Date

Slides

BMETE11MF24

Course data

Course name: Transport in Complex Nanostructures
Neptun ID: BMETE11MF24
Responsible teacher: Péter Makk
Department: *Department of Physics*
Programme: Courses for Physicist MSc
Course data sheet: *BMETE11MF24*

Requirements, Informations

COURSE INFORMATION

BMETE11MF58

Tantárgy adatok

Tárgy címe: Nanotechnológia és anyagtudomány
Neptun kód: BMETE11MF58
Felelős oktató: Dr. Csonka Szabolcs
Felelős tanszék: *Fizika Tanszék*
Képzés: MSc fizikus
Tantárgy adatlapja: *BMETE11MF58*

After studies:

**ETH, Princeton, Uni Basel,
 Tech. Univ. Delft, Univ.
 Manchester, Grenoble,...**



Funding



Lendület
program

QNL Quantum Information
National Laboratory
HUNGARY



European Research Council

Established by the European Commission



GRAPHENE FLAGSHIP



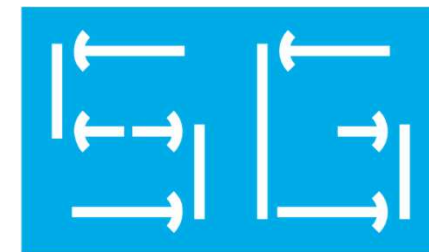
FLAG-ERA



QUANTERA



AndQC



NATIONAL RESEARCH, DEVELOPMENT
AND INNOVATION OFFICE
HUNGARY

PROJECT
FINANCED FROM
THE NRDI FUND
MOMENTUM OF INNOVATION

OTKA
Hungarian Scientific Research Fund



Beyond physics...



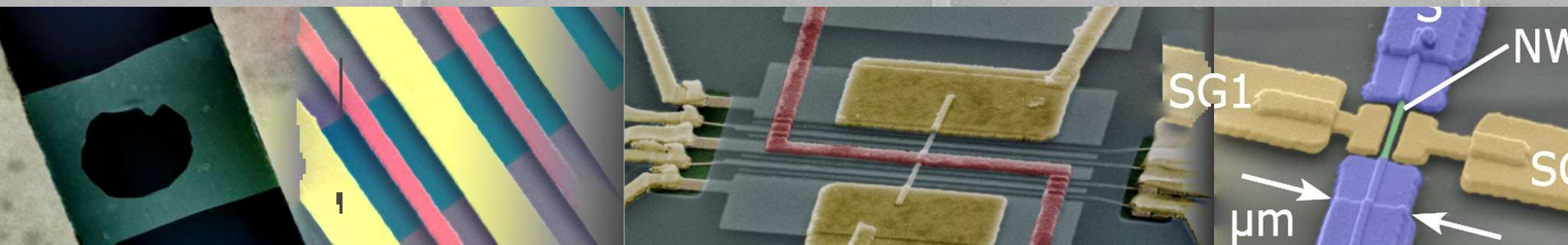
Labor kepek

Fenyvespuszta - Group Meeting



Thank you!

I ♥ nano



Email: csonka.szabolcs@ttk.bme.hu, makk.peter@ttk.bme.hu