Nanophysics, nanotechnology and materials science

Nanotechnology exploits material properties which are markedly different from the behavior observed on macroscopic as well as on molecular scales.

In the 10-100 nm submicron regime new phenomena emerge opening new routes to the design and fabrication of devices with novel functionalities as well as to the engineering of individual material parameters.

Horizon 2020

Excellent Science

Industrial Leadership

Societal Challenges

Horizon 2020

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European Research Council

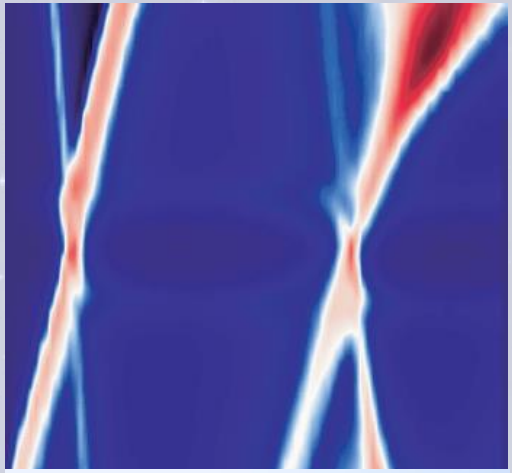
Future & Emerging Technologies

Ongoing ERC projects in the field of quantum-electronics and spin-dynamics:

Cooper pairs as a source of entanglement (CooPerEnt: 2011-2016)

Spin dynamics and transport at the quantum edge in low dimensional nanomaterials (SYLO: 2010-2015)

Cooper pairs as a source of entanglement (CooPerEnt: 2011-2016)



Szabolcs Csonka

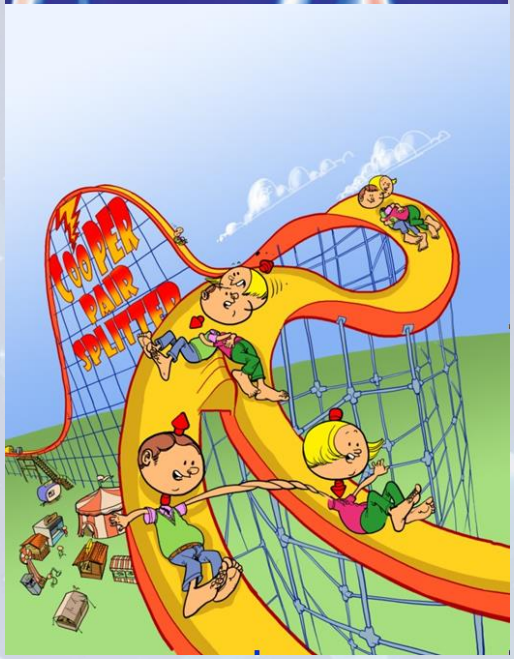
Nature (2009)
doi:10.1038/nature08432

nature Vol 461 15 October 2009 doi:10.1038/nature08432

LETTERS

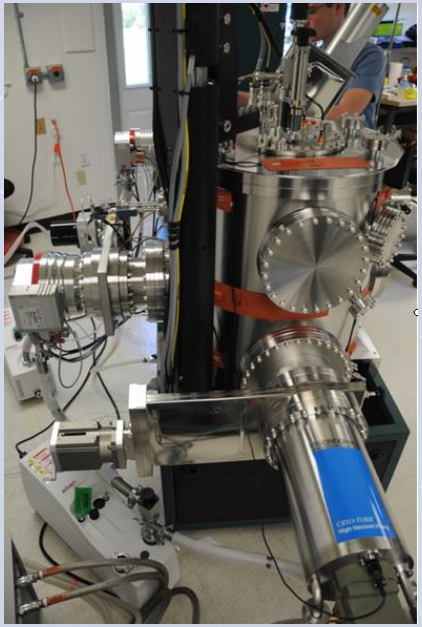
Cooper pair splitter realized in a two-quantum-dot Y-junction

L. Hofstetter[1]*, S. Csonka[1,2]*, J. Nygård[3] & C. Schönenberger[1]



Entanglement and non-locality are spectacular fundamentals of quantum mechanics and basic resources of future quantum-computation algorithms.

Cooper pairs as a source of entanglement (CooPerEnt: 2011-2016)

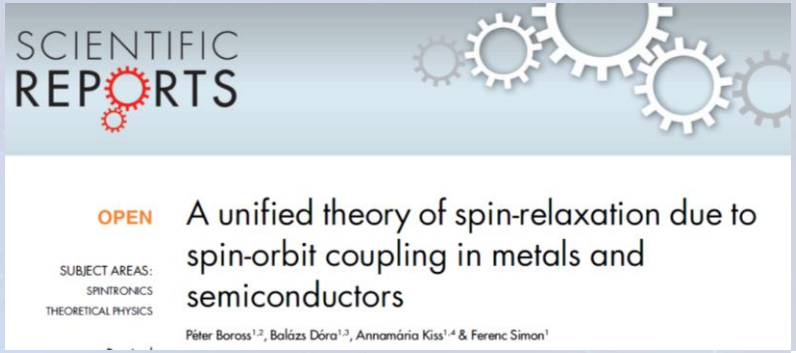


In order to preserve quantum coherence the thermal fluctuation has to be suppressed, which requires low temperature environment. Our laboratory is equipped with several cryogenic equipments to allow transport measurements in the temperature range of 300K-18mK.

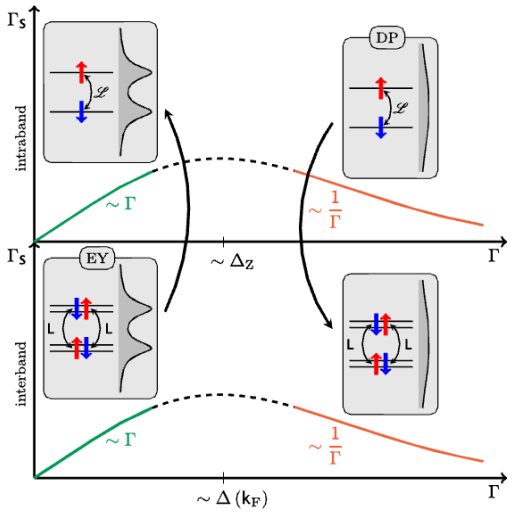
Spin dynamics and transport at the quantum edge in low dimensional nanomaterials (SYLO: 2010-2015)

Ferenc Simon

Nature Scientific Reports (2014)
doi:10.1038/srep03233



A promising route to maintain the exponential growth capability of the information technology is to turn the electron spins as information carriers rather than their charge.



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Industrial Leadership

Micro/Nanoelectronics & Photonics

Nanotechnology

MOMENTUM Research Teams

MOMENTUM RESEARCH TEAMS

István Kézsmárki
Magneto-optical Spectroscopy
2014-2019

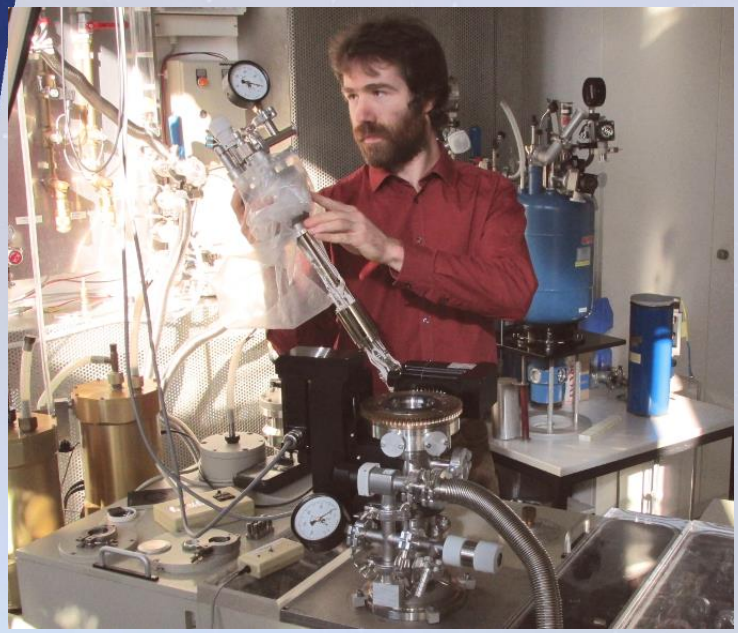
Robert Gyurcsányi
Chemical Nanosensors
2013-2018

Gábor Takács
Statistical Field Theory
2012-2017

Gergely Zaránd
Exotic Quantum Phase
2011-2016

Magneto-optical Spectroscopy (2014-2019)

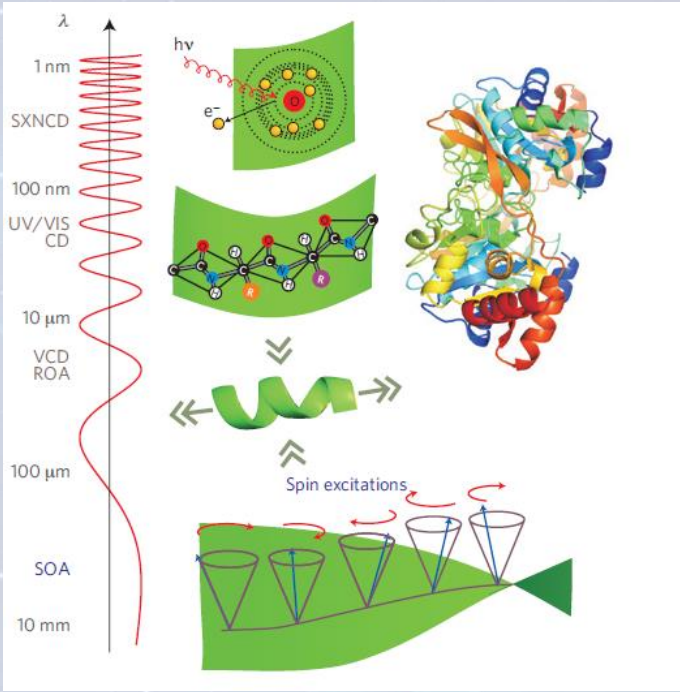
István Kézsmárki



Nature Physics (2012)
doi:10.1038/NPHYS2387

LETTERS
PUBLISHED ONLINE: 26 AUGUST 2012 | DOI: 10.1038/NPHYS2387
nature physics

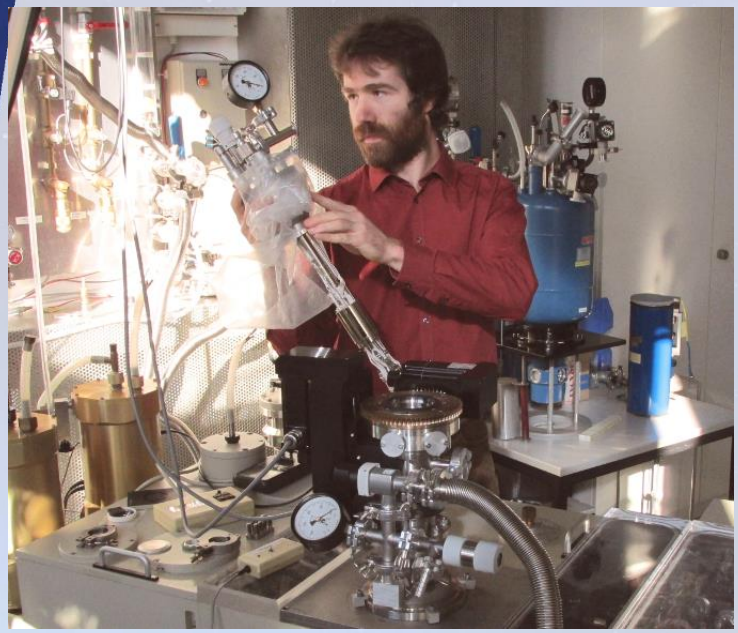
Chirality of matter shows up via spin excitations



Smart materials, like *multiferroics*, *magnetoelectric metamaterials* and *magnetic nanoparticles* — open new horizons in photonics, optical bio-sensing and optical diagnostics.

Magneto-optical Spectroscopy (2014-2019)

István Kézsmárki

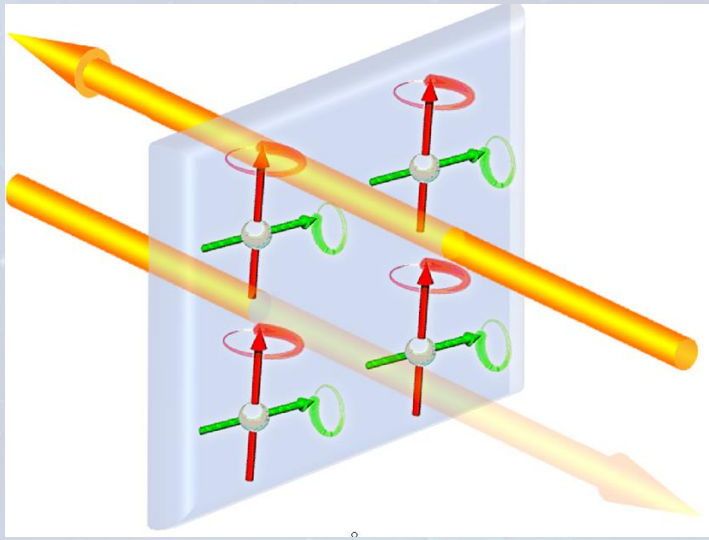


Nature Communications (2014)
doi:10.1038/ncomms4203

NATURE COMMUNICATIONS | ARTICLE

One-way transparency of four-coloured spin-wave excitations in multiferroic materials

I. Kézsmárki, D. Szaller, S. Bordács, V. Kocsis, Y. Tokunaga, Y. Taguchi, H. Murakawa, Y. Tokura, H. Engelkamp, T. Rõõm & U. Nagel

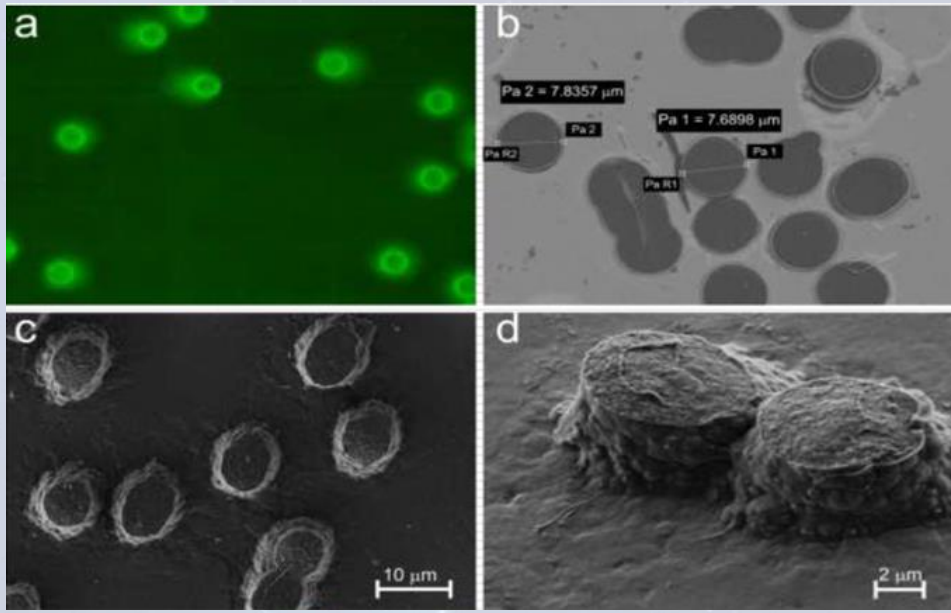


Smart materials, like *multiferroics*, *magnetoelectric metamaterials* and *magnetic nanoparticles* — open new horizons in photonics, optical bio-sensing and optical diagnostics.

Chemical Nanosensors (2013-2018)

BILL & MELINDA GATES foundation

Robert Gyurcsányi



Active nanostructure materials:

- potentiometric sensors, based on solidstate ion channel
- individual biological ion channels in a solid state environment
- fabrication of thin polymer films with a surface imprint capable of selectively binding proteins.

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Industrial Leadership

Micro/Nanoelectronics & Photonics

Nanotechnology

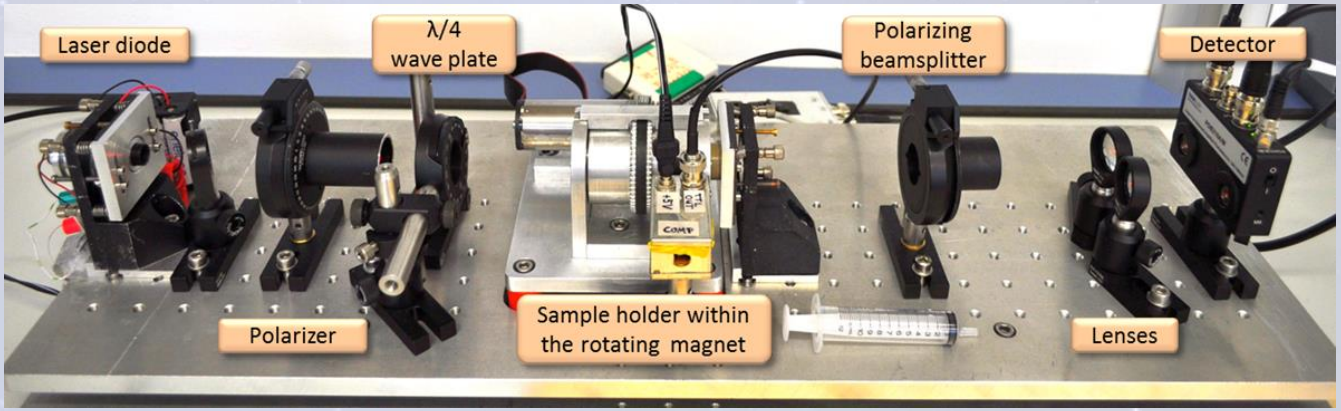
Societal Challenges

Bioeconomy

Health

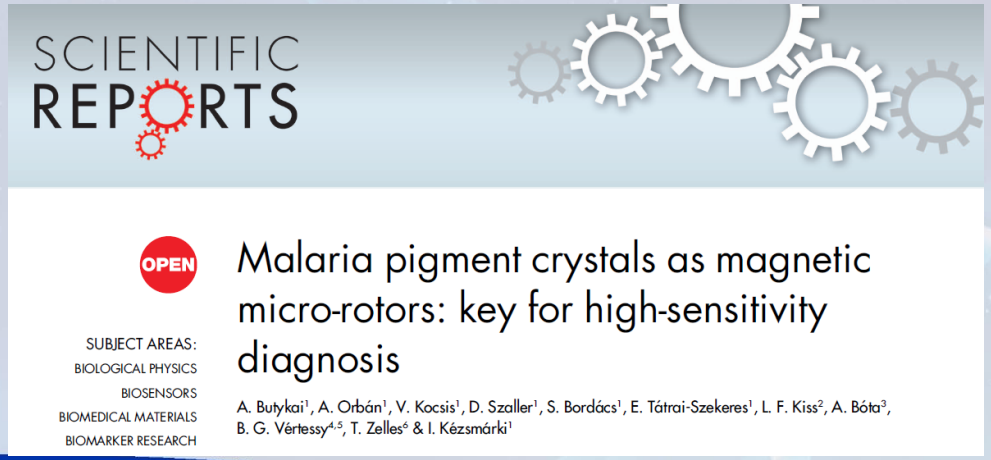
→ Chemo- and biosensors

Magnetic nanoparticle based optical biosensing



Easy-to-use and cost-effective device for the clinical and in-field malaria diagnosis.

Nature Scientific Reports
doi:10.1038/srep01431
(2013)


SCIENTIFIC REPORTS

OPEN

SUBJECT AREAS:
BIOLOGICAL PHYSICS
BIOSENSORS
BIOMEDICAL MATERIALS
BIOMARKER RESEARCH

Malaria pigment crystals as magnetic micro-rotors: key for high-sensitivity diagnosis

A. Butykai[1], A. Orbán[1], V. Kocsis[1], D. Szaller[1], S. Bordács[1], E. Tátrai-Szekeres[1], L. F. Kiss[2], A. Bóta[3], B. G. Vértessy[4,5], T. Zelles[6] & I. Kézsmárki[1]

Excellent Science
Industrial Leadership
Societal Challenges

Horizon 2020

Based on the research activities in natural sciences and the long-standing tradition in technological developments at our university we focus on such programs of Horizon 2020 like *Future & Emerging Technologies* (Excellent Science), *Micro/Nanoelectronics & Photonics*, and *Nanotechnology* (Industrial Leadership), as well as *Bioeconomy* and *Health (Societal Challenges).*

The utilization of the novel achievements in nanotechnology may provide revolutionary solutions for various current economical challenges.

Excellent Science
Industrial Leadership
Societal Challenges

Horizon 2020

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Academician, Honorary Chairman of Hungarian National Doctorate Council

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