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Spin Phenomena in Reduced Dimensions

University of Regensburg



SFB 689



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SFB-Seminars

Winter term 2017

30.01.2018 Tue 14:15 PHY 9.2.01	Prof. Sergio Valenzuela (University of Barcelona) "tba"
23.01.2018 Tue 14:15 Phy 9.2.01	Dr. Denis Kochan (Universität Regensburg) "Spin relaxation in graphene based systems"
16.01.2018 Tue 14:15 PHY 9.2.01	Dr. Magdalena Marganska-Lyzniak (Universität Regensburg) "Topology tutorial: how to follow those fashionable talks"
11.01.2018 Thu 10:15 PHY 2.0.31	Dr. Anatolie Migioglu (High Field Magnet Laboratory (HFML - EMFL), Radboud University, Nijmegen) "Magneto-Optical Investigation of Strained 2D WSe ₂ Monolayers" (PDF)
14.12.2017 Thu 15:15 PHY 5.0.21	Prof. Mairbek Chshiev (Univ. Grenoble Alpes) "Theoretical insights into spintronic and spinorbitronic phenomena in magnetic nanostructures using first-principles and tight-binding approaches" (PDF)
12.12.2017 Tue 14:15 PHY 9.2.01	Prof. Dr. Peter Fulde (Max-Planck-Institut für Physik komplexer Systeme, Dresden) "Ultrathin superconducting films in a magnetic field" (PDF)
05.12.2017 Tue 14:15 PHY 9.2.01	Jacob Fuchs (Universität Regensburg) "Hybrid structures of topological insulators and superconductors - a possible realization of Copper pair splitting?" (PDF) Notes: IRTG - Vorstellungsvorträge
05.12.2017 Tue 14:15 PHY 9.2.01	Thomas Mayer (Universität Regensburg) "Transport properties of 3D Topological Insulators and interaction of topological surface states with ferromagnets in TI/FM structures: Project goals, preliminary work and current status" (PDF) Notes: IRTG - Vorstellungsvorträge
28.11.2017 Tue 14:15 PHY 9.2.01	Patrick Grössing (Universität Regensburg) "Transport Computations for Quantum Wires: Application to Weyl metals" (PDF) Notes: IRTG - Vorstellungsvorträge
28.11.2017 Tue 14:15 PHY 9.2.01	Nico Leumer (Universität Regensburg) "Problems of scattering processes through electromagnetic barriers" (PDF) Notes: IRTG - Vorstellungsvorträge
22.11.2017 Wed 11:00	Matthias Stosiek (Universität Regensburg)

PHY 4.1.13 "PVSC-DTM: A matrix-free numerical approach to tight-binding Hamiltonians"
[Journal Club](#)

21.11.2017
 Tue 14:15
 PHY 9.2.01 **Prof. Mikhail Titov**
 (Radboud Universiteit Nijmegen, Netherlands)
 "Magnetization dynamics in Rashba ferromagnet" ([PDF](#))

14.11.2017
 Tue 14:15
 PHY 9.2.01 **Andreas Berezuk**
 (Universität Regensburg)
 "Towards universal Hong-Ou-Mandel-correlations in topological insulators"
 Notes: IRTG - Vorstellungsvorträge

14.11.2017
 Tue 14:15
 PHY 9.2.01 **Christian Baumgartner**
 (Universität Regensburg)
 "Mixed filling factors in QHE regime in charge carrier modulated graphene"
 Notes: IRTG - Vorstellungsvorträge

07.11.2017
 Tue 14:15
 PHY 9.2.01 **Dr. Cosimo Gorini**
 (Universität Regensburg)
 "Theory of spin-charge coupled transport: From normal metals to Dirac fermions" ([PDF](#))

24.10.2017
 Tue 14:15
 PHY 9.2.01 **Dr. Bozhko**
 (TU Kaiserslautern)
 "Magnonic supercurrents" ([PDF](#))

20.10.2017
 Fri 09:00
 Lecture Hall
 H24,
 Vielberth-
 Building **D. Hofstadter, P. Wiegmann, D. Weiss, M. Koshino, V. Falco**
 ()
 "Symposium "Hofstadter Butterfly"" ([PDF](#))

17.10.2017
 Tue 14:15
 PHY 9.2.01 **Prof. Mikito Koshino**
 (Osaka University)
 "Physics of topological nodal semimetals" ([PDF](#))

12.10.2017
 Thu 10:00
 PHY 7.3.14 **Felix Büttner**
 (MIT, Cambridge, USA)
 "Isolated skyrmions in a ferromagnet: From fundamentals to roomtemperature applications" ([PDF](#))

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Seminarankündigung

(gem. mit Festkörpertheorie-Seminar)

- Sprecher: **Prof. Mairbek Cshiev**
SPINTEC, Univ. Grenoble Alpes
- Ort: PHY 5.0.21
- Zeit: Donnerstag, 14. Dezember 2017, 15.15 Uhr
- Thema: Theoretical insights into spintronic and spinorbitronic phenomena in magnetic nanostructures using first-principles and tight-binding approaches

Abstract

This talk will be devoted to an overview of spintronic phenomena in layered structures based on interfaces between ferromagnetic (FM) and non-magnetic (NM) materials with attention paid to demonstrating how theory helps advancing device applications.

The first part of the talk is devoted to theory of spin transfer torques (STT) in magnetic tunnel junctions (MTJ) which in particular allowed prediction of STT voltage dependences and provided solutions for magnetic random access memory (STT-MRAM) applications [1,2]. STT properties in case of various cases of asymmetric MTJs will be discussed [2,3]. Also the properties of interlayer exchange coupling (IEC) in MTJs under different growth and interfacial oxidation conditions as well as IEC oscillations as a function of ferromagnetic electrode thickness are discussed [4].

The second part of the presentation addresses spin-orbit coupling based phenomena such as perpendicular magnetic anisotropy (PMA) [5,6,7,8,9] and Dzyaloshinskii-Moriya interaction (DMI) [10,11,12,13] at interfaces between FM metal and NM insulator or metal. First, the nature of PMA control at Fe|MgO interfaces is unveiled by evaluating the orbital and layer resolved contributions to magnetic anisotropy in Fe/MgO interfaces and MTJs with different interfacial conditions [6]. Mechanisms of the optimization of the effective anisotropy as well as of its electric field control are discussed [7,8,9]. Next, the main features and microscopic mechanisms of DMI behavior are elucidated in Co/Pt and other Co/NM bilayers [10]. Furthermore, several approaches for DMI enhancement and manipulation will be presented including, in particular, physical mechanisms of DMI behavior in Pt/Co/MgO structures [11,12] allowing observation of room temperature skyrmions [12]. A possibility of electric field control of DMI in such structures is also discussed [11].

In the last part of the talk the behavior of PMA and DMI will be addressed for nanostructures comprising Co/graphene interfaces [8,13] which may be of strong interest for graphene spintronics [14]. Finally, the mechanisms inducing the magnetism in graphene via magnetic insulators (MIs) proximity effect will be discussed including four cases of different magnetic insulators were studied: europium oxide (EuO), europium sulfite (EuS), cobalt ferrite CoFe_2O_4 (CFO) as well as yttrium iron garnet $\text{Y}_3\text{Fe}_5\text{O}_{12}$ (YIG) [15].

- [1] I. Theodonis et al, *Phys. Rev. Lett.* 97, 237205 (2006); M. Chshiev et al. *IEEE Trans. Mag.* 44(11) (2008); A. Manchon et al, *J. Phys. Cond. Mat.* 20, 145208 (2008); A. Kalitsov et al, *Phys. Rev. B* 79, 174416 (2009).
[2] S.-C. Oh et al, *Nature Physics* 5, 898 (2009).
[3] A. Kalitsov et al, *Phys. Rev. B* 88, 104430 (2013); C. Ortiz Pauyac et al, *Phys. Rev. B* 90, 235417 (2014); A. Useinov et al, *Phys. Rev. B* 91, 064412 (2015).
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[7] A. Hallal et al, *Phys. Rev. B* 90, 064422 (2014).
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[11] H. X. Yang et al, arXiv:1603.01847
[12] O. Boule et al, *Nature Nanotechnology* 11, 449 (2016).
[13] H. X. Yang et al, arXiv:1704.09023
[14] S. Roche et al, *2D Materials* 2, 030202 (2015)
[15] H. X. Yang et al, *Phys. Rev. Lett.* 110, 046603 (2013); A. Hallal et al, *2D Materials* 4, 025074 (2017).