

Nanospintronic Design and Realization

International conference – May 21 - 25, 2007



Scientific Coordinators:

[Stefan Blügel](#) (Forschungszentrum Jülich, Germany)

[Patrick Bruno](#) (Max-Planck-Institut für Mikrostrukturphysik Halle, Germany)

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Summary

Spintronics is currently among of the most active research themes in condensed matter physics. The field is progressing very fast and continues branching into an increasingly wider area of condensed matter: these involve the strongly correlated electron systems, the connection to semiconductors in terms of diluted magnetic semiconductors, to organic and inorganic molecules in terms of molecular magnets, to carbon nano-tubes in the field of nanospintronics or even to ferro-electric materials in terms of multiferroics. This is a field where first-principles theory meets transport theory, mesoscopic physics and device oriented concepts. It is thus a field providing a challenge for our community. The conference provided an international forum for theoretical and experimental researchers, in the rapidly developing field of nanospintronics. In the many invited and contributed talks and posters the conference covered a wide range of subjects in the field including:

- overviews of our current understanding of the physics of spin transport in (magnetic) semiconductors and hybrid magnetic/semiconductor structures including the problems of spin-injection and the possibility the magnetic semiconductors can offer
- open discussions the latest developments in spin-dependent phenomena employed in nano-(opto-) electronics and computing applications
- assessment of the effects of temperature in nanospintronics, spin-lifetime and coherence
- presentations on relativistic effects like the Spin-Hall effect and related issues
- research on new materials and spintronic problems such as multiferroic materials or ferroelectric tunnelling barriers with magnetic leads.

Program

Sunday, May 20

18:00 - 19:00 Registration

Monday, May 21

09:00 - Registration

13:00 Opening

13:20 - 14:00 Albert Fert

Spin transport in a lateral channel between spin-polarized source and drain: Advantage of carbon nanotubes on semiconductors

14:00 - 14:40 Jonathan Finley

Manipulating charge and spin in quantum dot nanostructures

14:40 - 15:20 Laurens Molenkamp

Spin-orbit effects in HgTe quantum wells and nanostructures

15:20 - 16:00 Bart van Wees

Electronic spin transport and spin precession in single graphene layers at room temperature

Coffee break

16:30 - 17:30 ICNDR07-Colloquium

Hiroshi Katayama-Yoshida

Computational nano-materials design for semiconductor spintronics

Tuesday, May 22

- 09:00 - 09:40 Taro Nagahama
Giant tunneling magnetoresistance in magnetic tunnel junctions with MgO(001) barrier
- 09:40 - 10:20 Phivos Mavropoulos
High-temperature properties of ferromagnets for magnetic tunnel junctions: Calculations based on first principles
Coffee break
- 11:00 - 11:40 Evgeny Tsymbal
Ferroelectric and multiferroic tunnel junctions
- 11:40 - 12:20 Ingrid Mertig
Spintronics on the subnanometer scale
- 12:30 - 14:00 Lunch
- 14:00 - 15:30 Poster session I
- 15:30 - 16:00 Coffee break
- 16:00 - 16:40 Ron Jansen
Tunable spin-tunnel contacts to silicon
- 16:40 - 17:20 Jaroslav Fabian
Theory of spin-polarized tunneling through single, double, and tripple barrier magnetic junctions
- 17:20 - 18:00 John Schliemann
Zitterbewegung and side jump motion in the two-dimensional electron gas

Wednesday, May 23

- 09:00 - 09:40 YoshiChika Otani
Spin accumulation and spin Hall effect in metallic systems
- 09:40 - 10:20 Teruo Ono
Manipulation of nano-spin-structure by electric current
- 10:20 - 11:00 Coffee break
- 11:00 - 11:40 Hiroshi Kohno
Microscopic theory of current-driven spin dynamics
- 11:40 - 12:20 Dale Kitchen
Atomic scale studies of magnetic atoms substituted into GaAs(110) one atom at a time
- 12:30 - 13:00 Lunch
- 14:00 - 14:40 Junsaku Nitta
Spin control by electric field in semiconductor 2DEGs
- 14:40 - 15:20 Thomas Schäpers
Spin-orbit coupling and Zeeman effect in semiconductor nanostructures
- 15:45 - Excursion into Dresden's old city centre

Thursday, May 24

- 09:00 - 09:40 Hisazumi Akai
Transport properties of half-metallic antiferromagnetic semiconductors
- 09:40 - 10:20 Inanc Adagideli
Creation and detection of current-induced spin accumulations: Voltage signatures and spin transfer torque
- 10:20 - 11:00 Coffee break
- 11:00 - 11:40 Sergio Valenzuela
Spin dynamics and the spin Hall effect in metallic nanostructures
- 11:40 - 12:20 Jörg Wunderlich
Extraordinary magnetoresistance effects and local control of magnetocrystalline anisotropy in (Ga,Mn)As devices
- 12:30 - 14:00 Lunch

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| 14:00 - 15:30 | Poster session II |
| 15:30 - 16:00 | Coffee break |
| 16:00 - 16:40 | Claude Ederer First principles investigation of magnetic ferroelectrics |
| 16:40 - 17:20 | Manuel Bibes Multiferroics for spintronics |
| 17:20 - 18:00 | Neil Mathur Phase separation mimics nanopatterning in manganite devices |

Friday, May 25

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| 09:00 - 09:40 | Alexey Kimel Femtosecond opto-magnetism |
| 09:40 - 10:20 | Gerrit Bauer Spin caloritronics |
| 10:20 - 11:00 | Coffee break |
| 11:00 - 11:40 | Jörg Wrachtrup Single electron and nuclear spins in a carbon material: Readout and interaction with environment |
| 11:40 - 12:20 | Sergey Ganichev Zero-bias spin separation |

Poster Contributions

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| Hadi Akbarzadeh | Crystal structure of ferromagnetic CrAs thin films on GaAs(001) |
| Farkhad Aliev | Low frequency noise in magnetic tunnel junctions |
| Nicolae Atodiresei | Towards biospintronic devices |
| Gabriel Autes | Theoretical study of spin dependent transport in iron atomic contact |
| Samvel Badalyan | Effect of exchange and correlation on the spin Coulomb drag in a 2DES of finite thickness |
| Alexej Bagretz | Ab initio calculations of molecular conductance: How theory meets experiment |
| Swarnali Bandopadhyay | Circulating currents in multichannel mesoscopic ring |
| Cyrille Barreteau | Orbital contribution to the magnetic properties of iron from bulk to clusters |
| Dario Bercioux | Coherent spin ratchets |
| Lars Bergqvist | Halfmetallic antiferromagnetic diluted magnetic semiconductors |
| Bernd Beschoten and Gernot Güntherodt | Anisotropic electron spin lifetime in (In,Ga)As/GaAs(110) quantum wells |
| Karel Carva | Ab initio calculations of spin-mixing conductances |
| Dinh Van An | Spinodal decomposition thermodynamics and nano-scale phase separations in half-Heusler compounds XYZ from first principle calculations |
| Hubert Ebert | Ab initio calculations of tunnelling anisotropic magneto-resistance (TAMR) in Fe/GaAs/Au trilayer |
| Tetsuya Fukushima | First-principles design of fabrication process for tera-bit-density nano-magnets in dilute magnetic semiconductors |
| Martin Gradhand | Amorphous iron and magnetic tunnel junctions |
| Claudio Grimaldi | Electron-phonon effects on strongly spin-orbit coupled systems |
| Martina Hentschel | Many-body effects in the mesoscopic x-ray edge problem |
| Mahbube Hortamani | Ab-initio study of exchange interactions and critical temperature of bulk MnSi and ultrathin films MnSi/Si(001) |
| Perla Kacman | Spin-dependent tunneling in modulated structures of (Ga,Mn)As |
| Hideaki Kasai and Kunikata | Dissociative adsorption of O ₂ on Pt/Fe(001) |

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| Shininchi | |
| Nikolay Kiselev | 1. Multidomain states and enhanced stray field effects in perpendicularly polarized multilayer structures 2. Transformation of polariton spectrum of thin-layers antiferromagnetic/nonmagnetic superlattice in the constant external electric field |
| Stavros Komineas | Rotating vortex dipoles in ferromagnets |
| Josef Kudrnovsky | Tc vs conductivity ratio: GaMnAs as a case study |
| Koichi Kusakabe | A first-principles study on meta-magnetic materials in the MgCu ₂ structure |
| Andrey Leonov | Reorientation effects, multidomain states and domain walls in diluted magnetic semiconductors |
| Marjana Lezaic | Magnetism and spin polarization of multicomponent half-metallic ferromagnets at finite temperatures |
| Zelia Maria Da Costa Ludwig | Formation of metallic nanoparticles in soda-lime-silica based glasses |
| Frantisek Maca | Mn-doped Ga(As,P) and (Al,Ga)As ferromagnetic semiconductors |
| Jacek A. Majewski | Theory of spin transport across domain-walls in (Ga,Mn)As |
| Francesc Malet Giralt | Ground state and conductance of quantum wires with Rashba and Dresselhaus spin-orbit interactions: Exchange-correlation effects |
| Maciej Misiorny | Switching of magnetic molecules attached to ferromagnetic leads |
| Yuriy Mokrousov | Supple magnetism in monoatomic 3d transition-metal chains |
| Hitose Nagara | Design of p-electron half-metals |
| Rashid Nazmitdinov | Simple model for spin-orbit effects in two-dimensional semiconductors in magnetic fields |
| Andreas Neudert | Spin-wave modes in patterned thin films investigated by time-resolved Kerr microscopy |
| Masako Ogura | First principles calculation of the magnetic and transport properties of La _{1-x} Ca _x MnO ₃ |
| Tomoya Ono | First-principles study on quantum transport through thin films |
| Frederic Piechon | Boltzmann theory of spin transfer torque in continuous magnetic textures |
| Kay Potzger | Structural investigations of magnetic nanocrystals embedded in semiconductors using synchrotron radiation x-ray diffraction |
| Ponniah Ravindran | Density-functional studies on the origin of magnetoelectric behavior in BiFeO ₃ |
| Vidya Ravindran | Effect of d-band filling on spin, charge, and orbital ordering in YbT ₂ O ₅ (T = Mn, Fe, Co) |
| Ivan Rungger | Bound states in electronic transport through Fe/MgO tunneling junctions |
| Leonid Sandratskii | Heisenberg-Hamiltonian description of complex itinerant-electron systems |
| Kazunori Sato | Spinodal decomposition and super-paramagnetism in dilute magnetic semiconductors |
| Sashi Satpathy | Effect of vacancy of ferromagnetism in the nitride-based dilute magnetic semiconductors |
| Matthias Scheid | Zeeman ratchets: Rectification of spin currents via magnetic fields |
| Lars Schreiber | Proof of coherent electrical spin injection across a Fe/GaAs interface |
| Nicholas Sedlmayr | Transport properties of non-collinear magnetic nanowires |
| Llorens Serra | Evanescent states in quantum wires with Rashba spin-orbit coupling |
| Alexander Sukhov | Temperature dependent magnetization reversal in magnetic nanoparticles |
| Rudolf Sykora | Transmission and reflection of spin-polarized electrons propagating through a model domain wall |
| Milan Tadic | Quantum mechanical coupling in stacks of strained quantum rings in a magnetic field |
| Georg Talut and Helfried Reuther | Ferromagnetism in GaN induced by Fe ion implantation |
| Piotr Trocha | Coherent transport through the systems of coupled quantum dots |
| Ilja Turek | Current-induced spin-transfer torques in non-collinear spin valves from Green's functions |
| Michel Viret | Magneto-resistance in atomic contacts |

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| Nengping Wang | Spin-dependent transport in ferromagnetic nanowires |
| Steven Watts | Electrical detection of spin pumping |
| Maarten Wegewijs | Quantum phase interference and spin-parity effects in transport through single-molecule magnets |
| Ireneusz Weymann | Spin-polarized transport through quantum dots in the cotunneling regime |
| Daniel Wortmann | All electron calculations of electronic transport: Applications to magnetic tunnel junctions |
| Karol Izydor Wysokinski | Thermoelectric effects in strongly interacting quantum dot coupled to normal and ferromagnetic leads |
| Peter Zahn | The spin diffusion length in metals: Ab initio treatment of impurity scattering in Cu |

List of participants

1. Inanc Adagideli
2. Hisazumi Akai
3. Hadi Akbarzadeh
4. Farkhad Aliev
5. Nicolae Atodiresei
6. Gabriel Autès
7. Samvel Badalyan
8. Alexej Bagrets
9. Swarnali Bandopadhyay
10. Cyrille Barreteau
11. Gerrit Bauer
12. Dario Bercioux
13. Bernd Beschoten
14. Manuel Bibes
15. Karel Carva
16. Elisa De Ranieri
17. Van An Dinh
18. Claude Ederer
19. Hubert Ebert
20. Jonathan Eroms
21. Jaroslav Fabian
22. Paolo Ferriani
23. Albert Fert
24. Jonathan Finley
25. Tetsuya Fukushima
26. Sergey Ganichev
27. Martin Gradhand
28. Claudio Grimaldi
29. Gernot Güntherodt

30. Seyed Javad Hashemifar
31. Martina Hentschel
32. Mahbube Hortamani
33. Perla Kacman
34. Hideaki Kasai
35. Hiroshi Katayama-Yoshida
36. Nikolay Kiselev
37. Stavros Komineas
38. Jens Kortus
39. Josef Kudrnovsky
40. Koichi Kusakabe
41. Andrei Leonov
42. Marjana Lezaic
43. Zélia Maria Da Costa Ludwig
44. Frantisek Maca
45. Jacek A. Majewski
46. Francesc Malet Giralt
47. Neil Mathur
48. Phivos Mavropoulos
49. Ingrid Mertig
50. Maciej Misiorny
51. Yuriy Mokrousov
52. Laurens Molenkamp
53. Hitose Nagara
54. Rashid Nazmitdinov
55. Andreas Neudert
56. Junsaku Nitta
57. Masako Ogura
58. Teruo Ono
59. Tomoya Ono
60. YoshiChika Otani
61. Man Hon Samuel Owen
62. Frederic Piechon
63. Kay Potzger
64. Uzma Rana
65. Ponniah Ravindran
66. Vidya Ravindran
67. Helfried Reuther
68. Ivan Rungger
69. Leonid Sandratskii
70. Kazunori Sato

71. Sashi Satpathy
72. Thomas Schäpers
73. Matthias Scheid
74. John Schliemann
75. Lars Schreiber
76. Nicholas Sedlmayr
77. Llorens Serra
78. Kunikata Shininchi
79. Tatsuya Shishidou
80. Alexander Sukhov
81. Rudolf Sykora
82. Milan Tadic
83. Georg Talut
84. Piotr Trocha
85. Evgeny Tsybal
86. Ilja Turek
87. Sergio Valenzuela
88. Bart van Wees
89. Michel Viret
90. Nengping Wang
91. Steven Watts
92. Maarten Wegewijs
93. Ireneusz Weymann
94. Daniel Wortmann
95. J. Wrachtrup
96. Karol Izidor Wysokinski
97. Peter Zahn