

GCOE 国際会議 報告書

2009年1月29日

文責：遠山貴己

開催会議名：国際滞在型研究会 ”Spin Transport in Condensed Matter”

開催日時：2008年 10月27日～11月28日

開催場所：京都大学基礎物理学研究所

主催：京都大学基礎物理学研究所

後援：京都大学 G-COE

西宮市

実行委員会メンバー：

氏名（所属・身分）

河野 浩（阪大基礎工・准教授）、遠山 貴己（京大基研・教授）、
多々良 源（首都大都市教養・准教授）、村上 修一（東工大理・准教授）、
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齊藤 英治（慶大理工・講師）、小野 輝男（京大化研・教授）、
木村 剛（阪大基礎工・教授）、Gerrit E.W. Bauer（デルフト工科大・教授）

国別出席者数（計147名）：

日本（100名）、アメリカ合衆国（13名）、韓国（9名）、オランダ（6名）、
ドイツ（5名）、フランス（3名）、チェコ（2名）イギリス（1名）、
イスラエル（1名）、イラン（1名）、カナダ（1名）、シンガポール（1名）、
中国（1名）、スイス（1名）、ノルウェー（1名）、スロベニア（1名）

会議の意義、内容、成果等の概要

電子のスピン自由度が中心的役割を演ずる伝導現象は、異常ホール効果や近藤効果など古くから研究がなされてきた。最近も、新しい現象（電流による磁化操作、量子スピンホール効果、マルチフェロイック系）や新しい観点（「スピントロニクス」、「新量子凝縮相の物理」）を加え、活発に研究されている。これら種々の現象は、スピン流という中心概念を共有しており、分野を越えた「滞在型ワークショップ」を企画して、分野間の交流を深め、各分野の研究の発展を促すことを目指した。特に、最先端研究を一層推し進めるために必要な学問的視野の拡大を目指し、第一線級の研究者による各分野の入門的講義を企画した。

ワークショップで議論されたテーマは以下のとおり。

●ナノ磁性体：

トンネル磁気抵抗効果、スピン注入・スピン蓄積、スピントルク現象（電流による磁化反転・磁壁移動、など）、磁化ダイナミクスによる電流・電圧生成、光によるスピン注入・磁化反転、超伝導との接合系

●スピン軌道結合系：

スピンホール効果（含：量子スピンホール効果、逆スピンホール効果、電流によるスピン生成、異常ホール効果）、スピントランジスタ、マルチフェロイック系、トポロジカル超伝導

●新規物質系、その他：

グラフェンのスピン伝導、磁性半導体、ハーフメタル、マルチフェロイック系、第一原理計算、光のスピン物性、核スピン物性、半導体ドットにおけるスピン操作・スピン輸送

ワークショップは、組織委員会の議論に基づいて選定された招待講演者による発表を中心に構成された口頭講演（65講演）と、一般参加者によるポスター講演（5回、計29件）から成った。招待講演者は、基本的に各分野の第一線級の研究者から選ばれたので、参加者からも、質の高い講義・セミナーをじっくりと聴くことができ、大変満足している、といった感想が多く聞かれた。ポスター発表にも優秀な研究が多く、活発な議論がなされていた。若手研究者からは、第一線級の研究者とも十分議論が出来て、有意義であったとの感想もあった。また、参加者も若手からシニアまで幅広く、当初の予想（100人）を大きく上回る150人近くを集めることができた。

Schedule ([updated](#) on 2008/11/20)

Lectures/Seminars

- Seminars (1 hr) = talk (40 min) + discussion (15 min) + break (5 min).
- Lectures (1.5 hr, 2 hr) : time allocation is left to the lecturer.
- Each speaker is requested to chair the next talk. (Chairperson of the first morning session is the last speaker of the previous day.)

Date	Time	Speaker	Title
10/27 (Mon)	10:25	opening	
	10:30 -12:00	S. Parkin	The Spin on Electronics!
	14:00 -15:30	M. Stiles	Current-induced magnetization dynamics
	15:30 -16:00	Coffee Break	
	16:00 -17:00	W. Rippard	Spin Transfer Driven Dynamics in Perpendicularly Magnetized CoNi Nanocontacts
	17:00 -18:00	Y. Suzuki	RF properties of the magnetic tunnel junctions — Negative resistance and amplification effect —
10/28 (Tue)	10:00 -11:00	S. Yuasa	Spin-Dependent Tunneling through a Crystalline MgO(001) Barrier — Physics and Applications —
	11:00 -12:00	A. Brataas	Scattering theory of Gilbert damping
	14:00 -15:00	S. Zhang	Unconventional spin torques
	15:00 -16:00	K.-J. Lee	Nonlocal Spin-Transfer Torque Induced by Lateral Spin Diffusion in Magnetic Layers with Inhomogeneous Magnetization
	16:00 -	preview talk + poster	
	18:00 -	Party	
10/29 (Wed)	10:00 -12:00	Lu J. Sham	1. Physics of a semiconductor spintronics logic device driving a circuit 2. Single electron spin for quantum technology
		Excursion	
10/30 (Thu)	10:00 -12:00	H. Ohno	Exploring Ferromagnetism in III-V Semiconductors — Spin-current and electric-field manipulations of magnetization —
	14:00 -15:00	T. Ono	Current-induced magnetization dynamics: domain wall & vortex core
	15:00 -16:00	M. Kläui	Interactions between spin currents and nanoscale magnetic elements in different materials classes
10/31 (Fri)	10:00 -11:00	H. Katayama-Yoshida	Computational Nano-Materials Design and Control of Spin Current for Semiconductor Nano-spintronics
	11:00 -11:30	M. Shirai	Theoretical design of highly spin-polarized interfaces between half-metals and non-magnetic materials
	11:30 -12:00	H. Itoh	Electronic structure and spin-dependent transport in ferromagnetic silicide and Heusler alloy / semiconductor junctions
11/3 (Mon)		(Holiday)	
11/4 (Tue)	10:00 -11:00	M. Hayashi	Current controlled dynamics of magnetic domain walls
	11:00 -12:00	J. Ieda	Current-induced domain wall motion in inhomogeneous nanowires
	14:00 -15:00	R. Duine	Generation of Electric Current by a Moving Domain Wall
	10:00 -11:00	H. Akai	First-Principles Calculation of Spin Transport

11/5 (Wed)	11:00 -12:00	K. Xia	Spin transfer torques calculated from first principles
	14:00 -15:00	A. Thiaville	Study of spin dependent transport of hot electrons by ballistic electron emission microscopy
	15:00 -	preview talk + poster	
11/6 (Thu)	10:00 -11:00	G.E.W. Bauer	Spin Caloritronics <i>Newly scheduled!</i>
		Excursion	
11/7 (Fri)	10:00 -12:00	Th. Rasing	Controlling Spins with Light
	14:00 -15:00	Y. Nakatani	Computer simulation of current induced vortex core switching in nano dots
	18:00 -	Party	
11/10 (Mon)	10:00 -11:00	Y. Tokura	Quantum spin transport in magnetic-field-engineered nano-structures
	11:00 -12:00	J. Nitta	Spin Transport and Manipulation in Rashba 2DEG Systems
	14:00 -15:00	I. Adagideli	Theory of spin Hall effect in quantum dots
	15:00 -16:00	Takashi Kimura	Manipulation of spin currents and spin Hall effects in metallic systems
11/11 (Tue)	10:00 -12:00	J. Sinova	Anomalous Hall transport in metallic spin-orbit coupled systems
	14:00 -15:00	H. Kontani	Novel Intrinsic Hall Effect in d,f-Electron Systems
	15:00 -15:30	A. Kovalev	Keldysh formalism description of the anomalous Hall effect in Rashba systems: identifying the hybrid skew scattering regime
	15:30 -	preview talk + poster	
11/12 (Wed)	09:30 -10:30	Tsuyoshi Kimura	Introduction to magnetoelectric multiferroics
	10:30 -12:00	D. Khomskii	Spin-driven dynamics in Mott insulators: spontaneous currents, polarization and multiferroic behavior 1. Multiferroics: different ways to combine magnetism and ferroelectricity 2. Electronic Orbital Currents and Polarization in Mott Insulators: are electrons really localized?
	13:30 -14:30	N. Nagaosa	Role of spin current in multiferroic behavior
	14:30 -15:30	M. Mostovoy	Toroidal ordering and linear magnetoelectric effect
	15:30 -16:00	Coffee Break	
	16:00 -17:00	S. Onoda	Far-Infrared Spin-Current Dynamics from Quasi-One-Dimensional Multiferroics: two-phasons and chiral solitons
11/13 (Thu)	10:00 -11:00	M. Onoda	Generation and Application of Optical Tornadoes in Photonic Crystals
	11:00 -12:00	K. Sawada	Berry phase effects on nonlinear optical wave propagation in deformed crystals
		Excursion	
11/14 (Fri)	10:00 -12:00	P. J. Kelly	Computational Spintronics
	14:00 -16:00	K. S. Novoselov	Graphene & Its Chemical Derivatives
	16:00 -16:30	Coffee Break	
	16:30 -17:30	Y. Tserkovnyak	Spin torques, fictitious gauge fields, and dissipation in itinerant ferromagnets
	18:00 -	Party	
	10:00 -12:00	D. Loss	Spin Effects in Quantum Dots and 2DEGs due to Hyperfine and Spin Orbit Interactions
	14:00 -16:00	S. Tarucha	Detection and Manipulation of Two Spin Qubits with Quantum Dots in a Slanting Zeeman Field

11/17 (Mon)	16:00 -16:30	Coffee Break	
	16:30 -17:30	M. Eto	Spin injection using semiconductor nanostructures with spin-orbit interaction
11/18 (Tue)	10:00 -11:00	M. Shiraishi	Molecular spintronics using π-electron molecules
	11:00 -11:30	T. Kontos	Quantum coherent spintronics with carbon nanotubes
	11:30 -12:00	M. Zareyan	Spin-dependent transport in graphene ferromagnet-superconductor contacts
	14:00 -15:00	A. Cottet	Mesoscopic circuits with spin-active interfaces
	15:00 -	preview talk + poster	
11/19 (Wed)	10:00 -11:00	J. A. Folk	Ballistic Spin Resonance
		Excursion	
11/20 (Thu)	14:00 -15:00	S. Katsumoto	Coherent transport in quantum dot systems with spin
	15:00 -16:00	K. Kobayashi	Tuning of the Spin-dependent Transport in Quantum Point Contacts
11/21 (Fri)	14:00 -15:00	N. P. Stern	Imaging electrical spin generation and the spin Hall effect in semiconductors
	15:00 -16:00	S. Murakami	Quantum Spin Hall Phase and Topological Numbers in Bismuth Ultrathin Films
	16:30 -17:30	E. Saitoh	Spin-Hall effects and spin-Seebeck effect in a metal (Moved from Nov. 6)
	18:00 -	Party	
11/24 (Mon)		(Holiday)	
11/25 (Tue)	10:00 -12:00	S.-C. Zhang	The quantum spin Hall effect and the topological magneto-electric effect
	14:00 -16:00	L. W. Molenkamp	Spin Hall Effects in HgTe Quantum Well Structures
11/26 (Wed)	10:00 -11:00	Q. Niu	Ferro-Josephson electromotive force induced by a moving domain wall
	11:00 -12:00	B. A. Bernevig	Persistent Spin Helix and exact SU(2) symmetry in spin-orbit coupled systems
	14:00 -14:30	Y. Tanaka	Topological spin-current in non-centrosymmetric superconductors
	14:30 -15:30	N. Nagaosa	Role of electron correlation in Spin Hall Effect
	15:30 -	preview talk + poster	
	18:00 -	Party	
11/27 (Thu)	10:00 -11:00	S. Takahashi	Nonlocal spin injection and spin Hall effect in metallic nanostructures
	11:00 -11:20	K. Ando	Interaction between spin currents and magnetization dynamics
	11:20 -11:40	T. Tanaka	Giant Extrinsic Spin Hall Effect due to Rare-Earth Impurities
	11:40 -12:00	M. Yamamoto	Spin-dependent electronic transport in nanowires in the presence of spin-orbit coupling
		Excursion	
11/28 (Fri)	10:00 -11:30	S. Maekawa	Spin Transport in Condensed Matter — Past, Present and Future —
		closing	

Posters

- Size of the poster boards: 175cm (height) x 86cm (width).
- A session of short preview talks (5 min per poster) will be held just before the poster session.

No.	Week	Presenter	Title
P-01	1,2	H.-W. Lee	Current-induced domain wall motion: Effect of coupling to environment
P-02	1	Hyunsoo Yang	Tunneling spectroscopy in junctions with magnetic and superconducting electrodes
P-03	1	C.-Y. You	Field driven domain shift memory concept domain wall motion under the non-uniform transverse magnetic field
P-04	1	N. Kovaleva	Spin-and-orbital effects in mott-hubbard optical bands in two limits of Jahn-Teller instability: LaMnO ₃ vs. YTiO ₃
P-05	2	A. Thiaville	Electrical rectification effect in single domain magnetic microstrips: a micromagnetics-based analysis
P-06	2	K. Hosono	Perturbation theory of inverse spin Hall effect
P-07	2	D. Matsubayashi	Analysis of current-induced domain wall motion by time-dependent Schrödinger equation
P-08	2	J. Ohe	Numerical study on the spin motive electric field
P-09	3	H. Saarikoski	Spin accumulation with spin-orbit interaction
P-10	3	S. Teraoka	Spin Resonance of Two-dimensional Hole Gas
P-11	3	K. Taguchi	Anomalous Hall effect induced by the vector spin chirality and electron spin
P-12	3,4	T. Kontos	Shot noise in carbon nanotubes in the Kondo regime
P-13	3	T. Kubo	Kondo effect in a laterally coupled triple quantum dot
P-14	3	S. Amaha	Electronic charge and spin states in laterally coupled triple quantum dots
P-15	3	S. Kawabata	Theory of pi-junction using spin filtering barrier
P-16	3	Y. Avishai	Spin pumping in Rashba-Dresselhaus system
P-17	4,5	S. Smirnov	Spin Current Generation by the Ratchet Mechanism in a Dissipative System
P-18	4	M. Murata	The disappearance of the Dresselhaus field in GaAs-based quantum wells with microscopic inversion symmetry
P-19	4,5	A. Takeuchi	Current Pumping from Dynamical Spins in Spin-Orbit Interaction System
P-20	4	R. Yoshii	Scaling Analysis of the Kondo effect in a quantum dot embedded in an Aharonov-Bohm ring
P-21	4	Y. Ren	Spin correlated transport in quantum point contact
P-22	4	T. Yokoyama	Extrinsic spin Hall effect in semiconductor anti-dot structures
P-23	4	S. Onari	Intrinsic Spin Hall Effect in Graphene - Multi-orbital Model
P-24	4,5	T. Tanaka	Study of Intrinsic Spin Hall Effect and Orbital Hall Effect in 4d- and 5d- Transition Metals
P-25	(4),5	K.-I. Imura	Weak (anti-)localization in Z ₂ topological insulator
P-26	5	A. Shitade	Topological Phases in a Transition Metal Oxide Na ₂ IrO ₃
P-27	5	H. Obuse	Critical Properties at the Metal-Quantum Spin Hall Insulator Transition in Two-Dimensions
P-28	5	Y. Asano	Spin Josephson effect in spin-triplet superconductors
P-29	5	K. Uchida	Thermo-spin effects in ferromagnetic/paramagnetic metallic films
P-30	5	K. Sasage	Local Generation and Detection of Spin Currents in a Nanostructured NiFe Film
P-31	5	S. Souma	Computational Modeling of Spin-Dependent Transport in Graphene Nanoribbon Devices

P-32	5	S. Fujimoto	Anomalous spin Hall effect in frustrated magnets
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