

International Workshop: Quantum Nanostructures and Electron-Nuclear Spin Interactions

October 19, 2015 – October 21, 2015

3F Lecture Theater, TOKYO ELECTRON House of Creativity, Katahira Campus, Tohoku University

Program

October 19 (Monday)

Opening

Session1: Keynote Session

K-1 10:00-10:45 Electron Spin in GaAs/AlGaAs Heterostructures
Klaus von Klitzing
Max-Planck-Institut für Festkörperforschung

Coffee Break

K-2 11:00-11:45 Unconventional Quantum Hall Effect in New Materials
Masashi Kawasaki^{1,2}
¹ Department of Applied Physics and Quantum Phase Electronics Center (QPEC),
University of Tokyo
² RIKEN Center for Emergent Matter Science (CEMS)

K-3 11:45-12:30 Coherent control of electron spin in a dynamical nuclear spin bath
Seigo Tarucha
¹ Graduate School of Engineering, The University of Tokyo
² Riken Center for Emergent Matter Science

Lunch (90min)

Session2: Topological Insulator

O-1 14:00-14:30 Hyperfine coupling and spin polarization in the bulk of the topological insulator
(Invited) Bi₂Se₃
Benjamin Piot
LNCMI-CNRS Grenoble

- O-2** 14:30-14:50 Large – area synthesis and nondestructive transfer process of high – quality Bi₂-x Sb_xTe_{3-y}Se_y film grown by catalyst – free physical vapor deposition
Ngoc Han Tu^A, Yoichi Tanabe^A, Yosuke Satake^A, Khuong Kim Huynh^B,
 Kastumi Tanigaki^{A, B}
^ADepartment of Physics, Graduate School of Science, Tohoku University
^BWPI-Advanced institute of materials research, Tohoku University
- O-3** 14:50-15:10 Single-Edge Transport in an InAs/GaSb Two-Dimensional Topological Insulator
F. Couedo, H. Irie, K. Suzuki, K. Onomitsu, and K. Muraki
 NTT Basic Research Laboratories, NTT Corporation

Coffee Break

Session3: Graphene

- O-4** 15:40-16:10 Quantum transport in van der Waals junctions of graphene and 2D materials
 (Invited) Tomoki Machida
 Institute of Industrial Science, University of Tokyo
- O-5** 16:10-16:40 Negative refractive transport of electrons in ballistic graphene
 (Invited) Gil-Ho Lee^{*}, Geon-Hyoung Park, and Hu-Jong Lee
 Department of Physics, Pohang University of Science and Technology
- O-6** 16:40-17:00 Energy distribution in graphene p-n junction in quantum Hall regime
N. Kumada¹, F. D. Parmentier², H. Hibino¹, D. C. Glatli², and P. Roulleau²
¹NTT Basic Research Laboratories
²CEA Saclay

Poster Session & Discussions (17:00-20:00)

- P-1** NMR in a triple-gate quantum point contact
M. H. Fauzi¹, M. F. Sahdan¹, and Y. Hirayama^{1,2}
¹Department of Physics, Tohoku University
²WPI-AIMR, Tohoku University
- P-2** Comparison of nuclear electric resonance and nuclear magnetic resonance
 in integer and fractional quantum Hall states
 Toru Tomimatsu^{1*}, Shota Shirai¹, Katsushi Hashimoto¹, Ken Sato¹,
Rei Higashida¹, and Yoshiro Hirayama^{1, 2}
¹Department of Physics, Tohoku University
²WPI-Advanced Institute for Materials Research, Tohoku University

P-3

Scanning gate microscopy of electron transport in the quantum Hall effect
breakdown regime

S. Taninaka¹, K. Hashimoto¹, S. Shirai¹, K. Sato¹, K. Nagase³, and Y. Hirayama^{1,2,3}

¹Graduate School of Science and faculty of Science, Tohoku University

²WPI Research Center, Advanced Institute for Material Research, Tohoku
University

P-4

Properties of Triple-gate Type Quantum Point Contacts: Disorder and Gate-
geometrical Effects

S. Maeda¹, S. Miyamoto^{1*}, M. F. Sahdan¹, M. H. Fauzi¹, K. Nagase¹,

K. Sato¹, and Y. Hirayama^{1,2}

¹Department of Physics, Tohoku University

²WPI-AIMR, Tohoku University

October 20 (Tuesday)

Session4: Superconductor and hybrid systems

O-7 9:30-10:00 Spin transport in mesoscopic superconductors with strong spin-orbit interactions

(Invited)

Yasuhiro Niimi

Department of Physics, Osaka University

O-8 10:00-10:30 Non-local spin entangled states in double quantum dot Josephson Junctions

(Invited)

Russell Stewart Deacon^{1,2}

¹Advanced Device Laboratory, RIKEN

²Center for Emergent Matter Science, RIKEN

O-9 10:30-10:50 Spin polarization detection and electron paramagnetic resonance spectroscopy using a dc-SQUID magnetometer

Hiraku Toida¹, Yuichiro Matsuzaki¹, Kosuke Kakuyanagi¹, Xiaobo Zhu¹,
Kae Nemoto², William J. Munro¹, Hiroshi Yamaguchi¹, and Shiro Saito¹

¹NTT Basic Research Laboratories, NTT Corporation

²National Institute of Informatics

Coffee Break

Session5: Quantum wires and point contacts

O-10 11:25-11:55 Evidence for Helical Nuclear Spin Order in GaAs Quantum Wires

(Invited)

D. M. Zumbühl

Department of Physics, University of Basel

O-11 11:55-12:15 Electronic magnetization of a quantum point contact studied by resistively-detected NMR

Minoru Kawamura¹, Keiji Ono¹, Peter Stano¹, Kimitoshi Kono¹,
Tomosuke Aono²

¹RIKEN

²Ibaraki University

Lunch (90min)

Session6: Quantum dots

- O-12** 13:45-14:15 Exchange-induced spin blockade in a double quantum dot
(Invited) T. Fujisawa¹, D. Imanaka¹, S. Sharmin¹, M. Hashisaka¹, and
 K. Muraki²
 ¹Department of Physics, Tokyo Institute of Technology.
 ²NTT Basic Research Laboratories, NTT Corporation.
- O-13** 14:15-14:45 Generation of locally and non-locally entangled electron spin pairs in a triple
(Invited) quantum dot
 Takashi Nakajima
 Center for Emergent Matter Science, RIKEN
- O-14** 14:45-15:05 Tunnel barrier fabrication in multi-walled carbon nanotubes by irradiation
 technique
 Tomohiro Yamaguchi¹, Hiroshi Tomizawa^{1,2}, Seiji Akita³,
 Koji Ishibashi^{1,2,4}
 ¹ Advanced Device Laboratory, RIKEN, 2-1 Hirosawa,
 ² Department of Applied Physics, Tokyo University of Science,
 ³Department of Physics and Electronics, Osaka Prefecture University,
 ⁴RIKEN Center for Emergent Matter Science (CEMS)
- O-15** 15:05-15:25 Valley coupling in finite-length single-wall carbon nanotubes and effective one-
 dimensional lattice model
 Wataru Izumida, Rin Okuyama, Riichiro Saito

Coffee break

Session7: Quantum Hall systems and real space imaging

- O-16** 15:50-16:20 Optically induced nuclear spin polarization in the quantum Hall regime
(Invited) K. Akiba¹, S. Kanasugi², T. Yuge³, K. Nagase², and Y. Hirayama²
 ¹Tokyo University of Agriculture and Technology
 ²Tohoku University
 ³Shizuoka University
- O-17** 16:20-16:40 Real-Space Observation of Nuclear Spin Resonance in a
 Quantum Hall System
 K. Hashimoto¹, S. Taninaka¹, S. Shirai¹, T. Tomimatsu^{1*},
 K. Nagase¹, K. Sato¹, and Y. Hirayama^{1,2}

¹Graduate School of Science, Tohoku University,

²WPI-AIMR

O-18 16:40-17:00 Nuclear polarization in a topological excited state of the fractional quantum Hall effect

J. Nicholas Moore¹, J. Hayakawa¹, T. Mano², T. Noda²,

G. Yusa¹

¹Department of Physics, Tohoku University

²National Institute for Materials Science

O-19 17:00-17:15 Current pumping time dependence on nuclear spin relaxation in bilayer total filling factor 2 quantum Hall effect

M. H. Fauzi¹, Y. Hama², and Y. Hirayama^{1,3}

¹Department of Physics, Tohoku University

²RIKEN-CEMS

³WRI-AIMR, Tohoku University

O-20 17:15-17:30 Hybrid Quantum Hall Systems

Y. Hama¹, M. H. Fauzi², K. Nemoto³, Y. Hirayama^{2,4}, and

Z. F. Ezawa⁵

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Tohoku University

⁵Advanced Meson Science Laboratory, Nishina Center, RIKEN

October 21(Wednesday)

Session8: Spin-orbit interactions

- O-21** 9:30-10:00 Spin orbit interaction in semiconductor nanostructures
(Invited) Makoto Kohda
Department of Materials Science
- O-22** 10:00-10:30 Electrical control of drifting spin coherence
(Invited) Yoji Kunihashi, Haruki Sanada, Hideki Gotoh, Koji Onomitsu, and Tetsuomi Sogawa
NTT Basic Research Laboratories
- O-23** 10:30-10:45 Transport Characteristics of Trench-gate Type Quantum Point Contact in Asymmetric Bias Voltage

T.Masuda¹, K. Sekine¹, K. Nagase¹, K. S. Wickramasinghe²,
T. D. Mishima², M. B. Santos², Y. Hirayama^{1,2}
¹Department of Physics, Tohoku University
²Homer L. Dodge Department of Physics and Astronomy, University of Oklahoma
³WPI-AIMR, Tohoku University

Coffee Break

Session9: Resistively detected NMR

- O-24** 11:15-11:45 NMR probing of the spin and charge ordering in the quantum Hall regime
(Invited) Benedikt Friess¹, Vladimir Umansky², Klaus von Klitzing¹,
Jurgen Smet¹
¹Max Planck Institute for Solid State Research
²Weizmann Institute of Science
- O-25** 11:45-12:05 NMR as a microscopic probe of order and disorder in quantum Hall systems
K. Muraki¹, T. D. Rhone¹, K. Yonaga², and N. Shibata²
¹NTT Basic Research Laboratories, NTT Corporation
²Department of Physics, Tohoku University

O-26 12:05-12:25 Gate control and resistively detected NMR of InSb
two-dimensional systems
M.M. Uddin^{1,a}, H. W. Liu^{1,2,b}, K. F. Yang^{1,b}, K. Nagase¹,
K. Sekine¹, K. S. Wickramasinghe³, T. D. Mishima³, M. B. Santos³,
Y. Hirayama^{1,4}

¹Graduate School of Science, Tohoku University

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Molecular Physics, Jilin University

³Homer L. Dodge Department of Physics and Astronomy, University of
Oklahoma

⁴WPI-AIMR, Tohoku University

Closing