



GP-Spin Seminar

Bussei colloquium Seminar

スピントロニクス国際共同大学院・物性コロキウム共催セミナー

Seminar title:

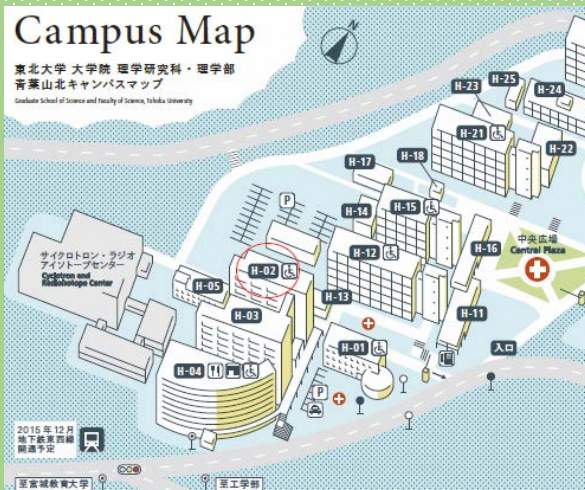
Hole and nuclear spins in gallium-arsenide quantum point contacts

Venue:

2:00 pm – 3:30 pm Tuesday, 4 August, 2015

Room **721** at Science Complex B

Graduate School of Science, Aobayama Campus
東北大学 理学研究科合同 B棟721号室 (青葉山キャンパス)



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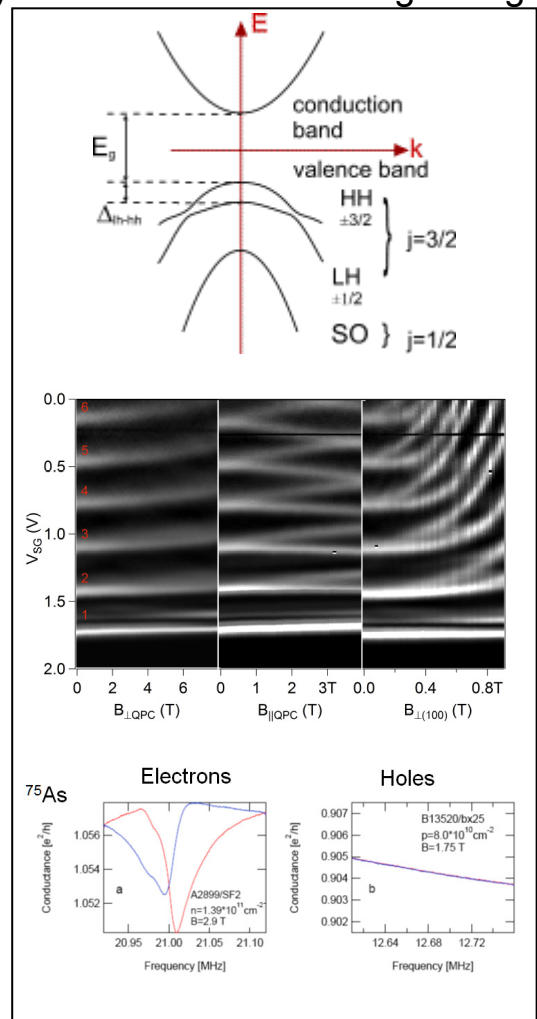
Hole and nuclear spins in gallium-arsenide quantum point contacts

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Valence band holes are spin-3/2 particles, and this gives them very different properties to spin-1/2 electrons. In recent years there has been growing interest in the possibility of using holes in semiconductor nanostructures for applications ranging from ultra-fast spin transistors through to quantum information and communication. This talk will describe where holes come from, why they are so different to electrons, and what one can do with holes that can't be done with electrons.

The differences between electron and holes are most striking when they are confined to low dimensional nanostructures. In quantum wires the interplay of spin-orbit interaction and electrostatic confinement leads to an extreme anisotropy of the Zeeman spin-splitting that is completely unlike electrons, and still not fully understood. [1]

The p-wave nature of spin-3/2 holes means that the hyperfine coupling is much weaker for holes than electrons. I will present measurements of resistively detected nuclear magnetic resonance in electron and hole quantum point contacts in the quantum Hall regime, where we find a strong signal for electrons but no response for holes [2,3].



- [1] J.C.H Chen *et al*, *Observation of orientation- and k-dependent Zeeman spin-splitting in hole quantum wires on (100)-oriented AlGaAs/GaAs heterostructures*, New Journal of Physics 12, 033043 (2010).
- [2] Z. K. Keane, *et al*, *Resistively Detected Nuclear Magnetic Resonance in n- and p-Type GaAs Quantum Point Contacts*, Nano Letters 11, 3147 (2011).
- [3] O. Klochan *et al*, *Landau level spin diode in a GaAs two dimensional hole system*, New Journal of Physics 17, 033035 (2015).