# QTech2018

# China-Japan International Workshop on Quantum Technologies

## Aug 23rd-26th, 2018, Hefei

University of Science and Technology of China

QTech2018

# Workshop Schedule

***Thursday 23th of August 2018***

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| 8:00 – 8:30 **Opening remarks and welcome by sponsors** |
| 8:30 – 9:00 **Jiangfeng Du** ***University of Science and Technology of China*** <br> *Nanoscale Spectroscopy: Technology and Applications* |
| 9:00 – 9:30 **Hideo Kosaka** ***Yokohama National University*** <br> *Geometric spin qubits in an NV center in diamond for quantum repeaters* |
| 9:30 – 10:00 **Hongqi Xu** ***Peking University*** <br> *Progress in Making Quantum Devices from 2D Materials* |
| 10:00 – 10:15 ***Coffee break*** |
| 10:15 – 10:45 **Satoru Masubuchi** ***The University of Tokyo*** <br> *Autonomous robotic searching and assembly of two-dimensional crystals to build van der Waals superlattices* |
| 10:45 – 11:15 **Xiaosong Wu** ***Peking University*** <br> *Intercalation, a route towards introduction of magnetism and strong electronic correlation to two-dimensional materials* |
| 11:15 – 11:45 **Satoshi Iwamoto** ***University of Tokyo*** <br> *Topological edge states in semiconductor-based photonic crystals* |
| 12:00 – 13:00 ***Lunch*** |
| 13:00 – 13:30 **Yongqing Li** ***Institute of Physics, CAS*** <br> *Impurity effects on the quantum transport in 3D topological insulators* |
| 13:30 – 14:00 **Minoru Kawamura** ***RIKEN*** <br> *Quantum phase transition in magnetic topological insulator studied by transport measurement* |
| 14:00 – 14:30 **Ming Xiao** ***University of Science and Technology of China*** <br> *Semiconductor Charge Qubits* |
| 14:30 – 14:45 ***Coffee break*** |
| 14:45 – 15:15 **Takashi Nakajima** ***RIKEN*** <br> *Quantum control of spin qubits in different encodings in a triple quantum dot* |
| 15:15 – 15:45 **Gang Cao** ***University of Science and Technology of China*** <br> *Tunable Hybrid Qubit in multi-electron Quantum Dot System* |
| 15:45 – 16:15 **Peter Stano** ***RIKEN*** <br> *Effects of an in-plane magnetic field on a quasi-2D quantum dot* |
| 16:15 – 16:30 ***Coffee break*** |
| 16:30 – 17:00 **Jianjun Zhang** ***Institute of Physics, CAS*** <br> *Si-based quantum materials for spin qubits* |
| 17:00 – 17:30 **Zhimin Liao** ***Peking University*** <br> *Quantum transport in Dirac semimetal $Cd_3As_2$ nanowires* |
| 17:30 – 18:30 **Poster Pitches** |
| 18:30 – **Dinner Banquet** |

***Friday 24th of August 2018***

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| 8:00 – 8:30 **Shiro Saito** ***NTT Basic Research Laboratories***<br>*Quantum sensing using superconducting circuits* |
| 8:30 – 9:00 **Yasunobu Nakamura** ***University of Tokyo***<br>*Quantum magnonics in a ferromagnetic sphere* |
| 9:00 – 9:30 **Shaoyun Huang** ***Peking University***<br>*Anisotropic spin-orbit interaction effects of InAs and InSb nanowire quantum dots* |
| 9:30 – 10:00 **Mingtang Deng** ***State Key Laboratory of High Performance Computing***<br>*Majorana bound states in superconductor-semiconductor nanowires* |
| 10:00 – 10:15 ***Coffee break*** |
| 10:15 – 10:45 **Haiou Li** ***University of Science and Technology of China*** |
| 10:45 – 11:15 **Akira Fujiwara** ***NTT Basic Research Laboratories***<br>*Tunable-barrier electron pump for quantum current standards and information-to-energy converters* |
| 11:15 – 11:45 **Kai Chang** ***Institute of Semiconductors, CAS***<br>*Exciton insulator phase in two-dimensional semiconductors* |
| 12:00 – 13:00 ***Lunch*** |
| 13:00 – 13:30 **Masayuki Hashisaka** ***NTT Basic Research Laboratories***<br>*Tomonaga-Luttinger-liquid nature of quantum Hall edge excitations* |
| 13:30 – 14:00 **Jianing Chen** ***Institute of Physics, CAS***<br>*Progress on Plasmonics of low Dimension Materials* |
| 14:00 – 14:30 **Yoshiro Hirayama** ***Tohoku University***<br>*Resistively-detected nuclear resonance and its imaging* |
| 14:30 – 14:45 ***Coffee break*** |
| 14:45 – 15:15 **Xi Lin** ***Peking University***<br>*3/2 fractional quantum Hall plateau in a single layer two-dimensional electron gas* |
| 15:15 – 15:45 **Guangwei Deng** ***University of Electronic Science and Technology of China***<br>*Exploring quantum nano-mechanics using 1D/2D NEMS* |
| 15:45– 16:45 **Lab showing around and free talking** |
| 17:00 – **Departing to Yellow Mountain (partly)** |
| 18:30 – **Dinner Banquet (partly)** |

# Effects of an in-plane magnetic field on a quasi-2D quantum dot

P. Stano[1], C.-H. Hsu[1], L. Camenzind[2], L. Yu[2], D. Zumbuhl[2], D. Loss[1,2]

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The topic falls under the research on spin qubits in gate-defined semiconductor nanostructures. They are among the leading candidates for quantum information processing and are favorable for scaling to a large number of qubits. Yet, so far there is no tool to characterize the quantum dot hosting the spin qubit at the level of its orbitals, despite two decades of research and despite being a key factor for the qubit performance. Here, **I present, explain, and demonstrate a new spectroscopy tool** which we have developed. Using magnetic fields with various strengths and directions in the 2D plane, **we can extract the shape, size, and orientation of quantum-mechanical orbitals of a quasi-2D quantum dot.**

The method exploits a renormalization of the mass tensor of the electron upon applying a strong in-plane magnetic field. The arising spectral response reveals the information on the quantum dot properties. I illustrate the method on the data measured in Ref. [3] (see the figure). It allows to, for example, to find the spin-orbit lengths solely from the measured dot spectra. I will also discuss the implications for the g-factor of quantum dots, currently studied vigorously for various Si quantum dots.

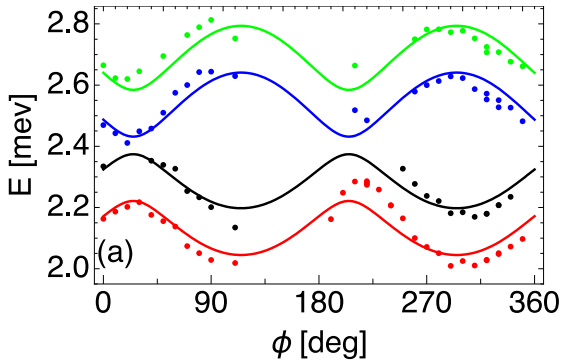


Figure: Spectral response of a quantum dot upon applying in-plane magnetic field. Points: measured data, Lines: analytical fit. It allows to quantify the quantum-dot orientation, size, dimensionality, the width of the 2DEG, and the strength

[1] P. Stano, Ch-H. Hsu, L. C. Camenzind, L. Yu, D. Zumbühl, D. Loss, arxiv:1804.00128.

[2] L. C. Camenzind, L. Yu, P. Stano, J. Zimmerman, A. C. Gossard, D. Zumbühl, D. Loss, arxiv:1804.00162.

[3] L. C. Camenzind, L. Yu, P. Stano, J. Zimmerman, A. C. Gossard, D. Loss, D. M. Zumbühl, Hyperfine-phonon spin relaxation in a single-electron GaAs quantum dot, arxiv:1711.01474, to appear in Nat. Commun.