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EDUCATION

- Ph.D. in Physics, Ohio State University, Columbus, Ohio, USA, 2008.
  Thesis topic: "High Sensitivity Electron Spin Resonance by Magnetic Resonance Force Microsocpy at Low Temperature"
  Advisor: Prof. Chris Hammel
- B.S. in Physics, The Chinese Univerisity of Hong Kong, Hong Kong, 1998.

EMPLOYMENT

- *To begin on Dec 2009, Postdoctoral Researcher, Prof. Keith Schwab's group, California Institute of Technology, California, USA.*
- Aug 2009 – Nov 2009, Postdoctoral Researcher, Prof. Immanuel Bloch's group, Max Planck Institute of Quantum Optics, Germany.
- Jan 2009 – July 2009, Postdoctoral Researcher, Prof. Immanuel Bloch's group, Johannes Gutenburg University Mainz, Germany.
- Sept 2002 – Dec 2008, Graduate Research Assistant, Ohio State University, Ohio, USA.
- Sept 2000 – Sept 2002, Graduate Teaching Assistant, Ohio State University, Ohio, USA.
- Sept 1998 – Aug 2000, Physics Teacher, St. Paul's Convent School, Hong Kong.

HONORS

- *Ohio Eminent Scholar Fellowship in Experimental Materials*, 2007/08 academic year.
- *Graduate Student Poster Award*, Department of Physics, Ohio State University, 2006.
- *Hazel Brown Teaching Award* for excellent performance as teaching associate, Department of Physics, Ohio State University, 2002.
- Awarded the *Japan Airline (JAL) Scholarship* to represent Hong Kong in a cultural exchange, public forums and study program in Japan, 1997.

RESEARCH INTERESTS

- Hybrid atomic and condensed matter experiments.
- Many-body physics of ultracold Bose-Fermi mixture in optical lattice.
- Ultra-sensitive force detection techniques and applications.
- Magnetic resonance force microscopy.

RESEARCH ACCOMPLISHMENTS

1. **Measured and explained the spin correlation time of the statistical polarization of few electron spin ensembles.** We measure the correlation times of the spin fluctuation in the few electron spin ensembles of the γ-irradiated silica sample in various sample temperatures and identify the relaxation mechanism: the direct phonon process at low temperature and two-phonon local mode process at higher temperature.
2. **Observed the statistical polarization of few electron spin ensembles with two net electron spins sensitivity.** In the cryogenic Magnetic Resonance Force Microscopy I designed and constructed, we detect the real-time spin fluctuation by coupling electron spins to the IBM-style ultrasoft cantilever, which has about 6 $aN/\sqrt{Hz}$ force sensitivity. Our microscope opens opportunities to study spin moments in buried surfaces in mesoscopic scale.
3. **Designed, fabricated and characterized an impedance matched microwave resonator for the electron spin resonance by Magnetic Resonance Force Microscopy.** We simulate the single stub tuning by the 3 dimensional finite element analysis software – HFSS^{TM}– to optimize design dimension for efficient magnetic field generation. Besides the advantages of low cost and easy fabrication, our microwave resonators has bandwidth $\geq$ 40 MHz for spin manipulation through the microwave frequency modulation in MRFM.
4. **Conceived and demonstrated a novel spin manipulation protocol to detect magnetic resonance and to characterize the field gradient in Magnetic Resonance Force Microscopy experiments.** This new protocol allows spins imaging in various gradient, hence spatial resolution, by MRFM. It improves the utility of MRFM as a generally applicable imaging and characterization tool.
5. **Implemented negative feedback system on mechanical oscillator for measuring transient force signal due to magnetic resonance.** The analog negative feedback circuit I constructed reduces cantilever response by 250 times. We experimentally verified that applying negative feedback on the cantilever displacement shortens the cantilever response time without sacrificing the signal-to-noise ratio in force detection by directly comparing magnetic resonance signal from MRFM experiments.

PUBLICATIONS

1. "Spin Correlation Time of Few Electron Spins Ensemble in Magnetic Resonance Force Microscopy," K. C. Fong, M. R. Herman, P. Banerjee, D. V. Pelekhov and P. C. Hammel, manuscript in preparation.
2. "Impedance Matched Microwave Resonator for Low Temperature Magnetic Resonator Force Microscopy," K. C. Fong, P. Banerjee, I. H. Lee, D. B. Chait, Yu. Obukhov, D. V. Pelekhov and P. C. Hammel, manuscript in preparation.
3. "Experimental Verification of Signal-to-Noise Ratio Preservation with Negative Feedback System," K. C. Fong, D. R. Daughton and P. C. Hammel, manuscript in preparation.
4. "Manipulating Spins by Cantilever Synchronized Frequency Modulation: A Variable Resolution Magnetic Resonance Force Microscope," K. C. Fong, P. Banerjee, Yu. Obukhov, D. V. Pelekhov and P. C. Hammel, Appl. Phys. Lett. **93**, 012506 (2008).
5. "Detection of higher order modulation harmonics in magnetic resonance force microscopy," T. Mewes, C. K. A. Mewes, E. Nazaretski, J. Kim, K. C. Fong, Y. Obukhov, D. V. Pelekhov, P. E. Wigen and P. C. Hammel, J. Appl. Phys. **102**, 33911 (2007).
6. "Real time cantilever signal frequency determination using digital signal processing", Yu. Obukhov, K. C. Fong, D. Daughton and P. C. Hammel, J. Appl. Phys. **101**, 034315 (2007).
7. "Light-free magnetic resonance force microscopy for studies of electron spin polarized systems", D. V. Pelekhov, C. Selcu, P. Banerjee, K. C. Fong, P. C. Hammel, H. Bhaskaran and K. Schwab, J. Magn. Mag. Matls. **286**, 324 (2005).

CONFERENCES and PRESENTATIONS

1. "Observing Phonon-Induced Relaxation in a Small Electron Spin Ensemble," invited talk and poster presentation, Molecular Imaging 2009, Kavli Institute at Cornell for Nanoscale Science, Ithaca, New York, August 9-13, 2009.
2. "Listening to Spin Noise," seminar presentation, Prof. Wrachtrup's group, Universität Stuttgart, Germany, July 24, 2009.
3. "Spin Noise Imaging in Few Spin Ensembles by Magnetic Resonance Force Microscopy," poster presentation, International Conference on Nanoscience + Technology, Keystone, Colorado, July 21, 2008.
4. "Spin Noise Imaging in Few Spin Ensembles by Magnetic Resonance Force Microscopy," poster presentation, Ohio Nanotechnology Summit, Mason, Ohio, April 11, 2008.
5. "Detecting Few Electron Spins by Magnetic Resonance Force Microscopy with Potential Application for Donor Mapping in Semiconductor," contributed talk, American Physical Society March Meeting, New Orleans, Louisiana, March 12, 2008.
6. "Progress on Statistical Polarization Detection of Electron Spin Resonance by Magnetic Resonance Force Microscopy," contributed talk, American Physical Society March Meeting, Denver, Colorado, March 7, 2007.
7. Workshop on Quantum Electron Mechanical Systems (QEM-2), participant, Morro Bay, California, Dec 13-15, 2006.

8. "A Novel Spin Manipulation Protocol for Field Gradient Measurement and Sensitive Slice Scanning in Magnetic Resonance Force Microscopy," poster presentation, Kavli Institute at Cornell Summer School in MRFM, Ithaca, New York, June 21-24, 2006.
9. "New Spin Manipulation Protocol & Tip Gradient Measurement for Magnetic Resonance Force Microscopy," contributed talk, American Physical Society March Meeting, Baltimore, Massachusetts, March 16, 2006.
10. "Force-detected Electron Spin Resonance of Phosphorus Doped Silicon," group talk, Prof. Schwab's group, Laboratory of Physical Science, College Park, Maryland, January 18, 2005.

SKILLS

- Optics: Laser spectroscopy, laser cooling and trapping.
- Force Microscopy: esp. high sensitivity (atto-Newton) force detection.
- Magnetic Resonance: both nuclear magnetic resonance and electron paramagnetic resonance, both CW and pulse spectrometers
- Cryogenic Experiments: flow cryostat, liquid helium temperature and sub-Kelvin ^{3}He setups.
- Microwave: Impedance matching, filter design, low temperature microwave devices, microwave simulation and design by both the HFSS^{TM}and Agilent Advanced Design System (ADS).
- Programming: Labview®, Matlab®, Mathematica®, C/C++, Visual C++® and Digital Signal Processor (DSP) programming.
- Analog Feedback Control Electronics: Proportional-Integral-Differential (PID) control and Kalman filter.
- Languages: Fluency in both English and Chinese.