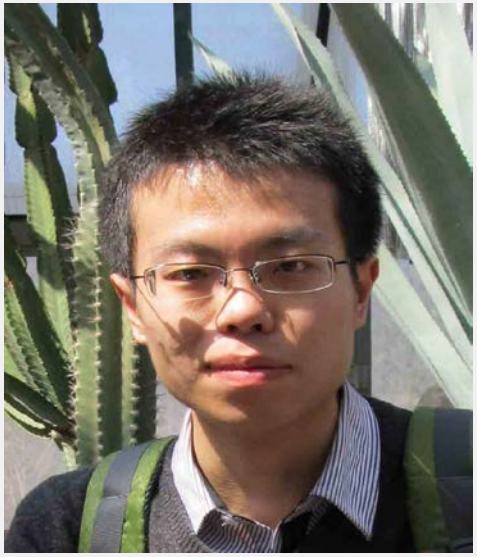
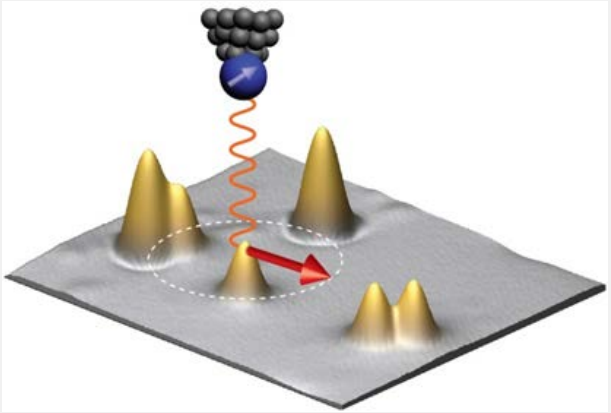
UCLA STROBE Seminar Series

Atomic-scale magnetic resonance of quantum spins on a surface

Kai Yang, *IBM Almaden Research Center*



Recently, the ability to drive electron spin resonance (ESR) of individual atoms using a scanning tunneling microscope (STM) provided a major step forward in sensing and manipulating magnetism at the atomic scale. In the first part, I will describe the implementation of continuous-wave ESR in STM [1]. The ultrahigh energy resolution of ESR has allowed the measurement of the magnetic interaction between two atoms [2–4], the detection of nuclear spins [5, 6], as well as the exploration of quantum fluctuations in designed spin arrays. Next, I will talk about coherent spin control using all-electric pulsed ESR [7]. By modulating the atomically-confined magnetic interaction between the STM tip and surface atoms, we drive quantum Rabi oscillations of single spins in as little as ~20 nanoseconds. Ramsey fringes and spin echo signals allow us to improve quantum coherence. I will also show the coherent operations on engineered atomic dimers. Coherent control of spins arranged with atomic precision thus provides a solid-state platform for quantum simulation of many-body systems.



Kai Yang is a postdoc researcher at the IBM Almaden Research Center in California. He uses scanning tunneling microscopy to study quantum magnetism at the atomic scale. Before joining IBM, Kai was a PhD candidate in the Institute of Physics, Chinese Academy of Sciences, where he studied the magnetic properties of single molecules. Currently, his research focuses on the application of the magnetic resonance technique in STM, which can be used for quantum sensing and quantum control of individual atoms.

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Location: PAB 4-330
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