

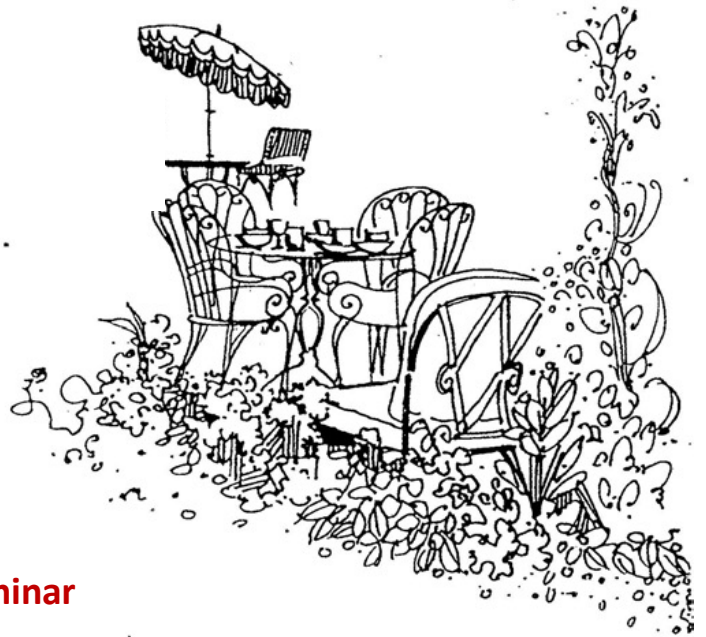
Chez Pierre

Presents ...

Monday, February 12, 2024

12:00 pm -1:00 pm

Duboc Room – 4-331



Chez Pierre Seminar

Andreas Heinrich, Ewha Womans University

“Quantum sensing with atomic-scale spatial resolution”

There is a strong international research effort in the area of quantum information science, where the concepts of quantum coherence, superposition and entanglement of quantum states are exploited [1]. One of the very prominent applications in this realm is Quantum Sensing, where a quantum system is used to measure some external fields with high energy resolution [2].

In this talk we will focus on quantum-coherent experiments in Scanning Tunneling Microscopy (STM) [3]. STM enables the study of surfaces with atomic-scale spatial resolution and offers the ability to study individual atoms and molecules on surfaces. To make a movable quantum sensor with atomic-scale spatial resolution, we attached a single molecule to the spin-polarized apex of an STM tip. In contrast to all other known molecules, its coupling to the tip is so weak that this molecule performs as an excellent electron spin resonance (ESR) sensor on a bare metallic surface. We show in unpublished results how this sensor can measure atomic-scale magnetic and electric fields and compare its performance to the well-established NV center in diamond [2].

1. Andreas J. Heinrich, William D. Oliver, Lieven M. K. Vandersypen, Arzhang Ardavan, Roberta Sessoli, Daniel Loss, Ania Bleszynski Jayich, Joaquin Fernandez-Rossier, Arne Laucht, Andrea Morello, “Quantum-coherent nanoscience”, *Nature Nanotechnology*, **16**, 1318-1329 (2021).

2. Christian L. Degen, F. Reinhard, and P. Cappellaro, “Quantum sensing”, *Rev. Mod. Phys.* **89**, 035002 (2017).

3. Yi Chen, Yujeong Bae, Andreas Heinrich, “Harnessing the Quantum Behavior of Spins on Surfaces”, *Advanced Materials* **2022**, 2107534 (2022).

Support from Institute for Basic Science (IBS-R027-D1) is gratefully acknowledged.