2023 IBS-CALDES Seminar

- ✓ **Date & Time:** Friday, August 18th,2023,10:30 AM
- ✓ **Venue :** Room#104-Auditorium, IBS POSTECH Campus
- ✓ **Speaker&Title**

  Prof. Wilson Ho(University of California, Irvine)

  A Qubit-Based Quantum Microscope for Space-Time Sensing

❖ **Organized by Dr. Ungdon Ham(uham@ibs.re.kr, 054-260-9015)**

A Qubit-Based Quantum Microscope for Space-Time Sensing

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In contrast to all other microscopes, a qubit-based quantum microscope (QM) combining coherent light with the scanning tunneling microscope (STM) is unique in incorporating the quantum superposition principle in its operation. This QM uses the superposition of two levels in a single hydrogen molecule as the sensor to probe the electric fields of a sample's surface. In a pilot study (*Science* 376, 401, 2022; *Phys. Rev. Lett.* 130, 096201, 2023) the QM demonstrates a 300-fold finer energy resolution and 0.1 angstrom spatial sensitivity of the sample's near-field electrostatics, compared to microscopes not based on this quantum principle. Furthermore, the wave-particle duality, nonlinear Stark effects, superposition of multiple quantum states, and entanglement among adjacent two levels illustrate the sensitivity of the QM to a set of basic phenomena underlying quantum mechanics. This qubit-based QM advances precision measurement with space-time resolution by irradiating the STM junction with femtosecond THz radiation and recording in the time domain coherent oscillations of the light-induced rectified tunneling current. The common occurrence of systems with two levels within a double-well potential suggests a broad application of the QM in probing the heterogeneous distribution of static and dynamic properties of electrons in functional materials.