

Post-Doc Position in **ESR-STM Lab**

The ESR-STM lab at QNS is looking for several postdoctoral candidates. One opening is focused on revealing the spin structures of molecules and nanostructures with sub-nm resolution using the recently developed ESR-STM technique based on a Unisoku 3-He STM. QNS is one of the few labs around the world that have demonstrated ESR STM at the single atom level. In this project we want to utilize ESR-active atoms on surfaces as quantum sensors to detect the magnetic properties of nearby 'unknown' species.

A second and possibly third postdoctoral position is available utilizing home-built ESR STM systems. One system is built inside a dilution fridge which operates below 10 mK and a second one in a closed-cycle Joule-Thomson system. These two systems will offer temperatures from 10 mK to 40 K as well as magnetic fields in several vector geometries. Candidates for these positions should have some experience and a strong interest in developing home-built instrumentation. The research goals include ESR STM as well as quantum-coherent manipulation of spins on surfaces for possible quantum computing applications.

Requirement

- Ph.D. in Physics, Chemistry, or Material Science or related areas
- Excellent experimental skills
- Strong communication and interpersonal skills for interacting with a diverse group of researchers and technical staff
- Experience with SPM (STM, AFM)

Preferred experience

- Experience with programming languages such as MATLAB or Python
- Experience with high frequency measurements
- Surface science sample preparation and characterization
- Interest in living in the Sinchon area in Seoul, an amazing metropolis at the heart of Asia

Post-Doc Position in **Optics-STM Lab**

The Optics-STM lab at QNS is looking for a postdoctoral candidate. One opening is focused on controlling the spin states of atoms and molecules using the home-built Optics-STM. This system is built in a home-built closed-cycle Joule-Thomson system which operates at 1 K and is equipped with the optical fiber to induce photon into the tunneling junction.

This system is in the construction phase, expected to be completed in 2023 and will be in the testing and debugging phase at the beginning of 2024. We plan to be fully operational by summer of 2024. Candidates for this position should have some experience of optics experiments and a strong interest in developing home-built instrumentation. The research goals include quantum-coherent manipulation of spins on surfaces for possible quantum computing applications.

Requirement

- Ph.D. in Physics, Chemistry, or Material Science or related areas
- Excellent experimental skills
- Strong communication and interpersonal skills for interacting with a diverse group of researchers and technical staff

Preferred experience

- Experience with Optics experiments
- Experience with SPM (STM, AFM)
- Surface science sample preparation and characterization
- Interest in living in the Sinchon area in Seoul, an amazing metropolis at the heart of Asia

Post-doc Position in **Theory Team**

The Theory Team at QNS is currently seeking two postdoctoral candidates to join our research efforts. One of the positions is focusing on Quantum-coherence of surface spins studied by non-equilibrium transport, where the primary research involves studying individual electron spins localized in atoms or molecules on surfaces, recently recognized as promising solid-state quantum bits (qubits). In this role, you will primarily engage in computational studies to deepen our understanding of the decoherence behavior of these systems, extending existing models, and refining quantum control techniques. Collaboration with experimentalists is a key aspect, as you'll work together to implement fundamental quantum algorithms in customized spin systems.

The second position deals with ab initio based design of spins-on-surfaces quantum systems. In this project, we explore the potential of individual electron spins in atoms or molecules on surfaces as solid-state quantum bits (qubits). The research objective centers on utilizing ab initio calculations to uncover new material systems with favorable properties and enhancing existing systems to establish long-lived coherent surface spin states. This role offers a distinctive opportunity to optimize current systems, and actively contribute to the exploration of novel materials, ultimately advancing the field of quantum technologies.

Requirement

- Ph.D. in Physics, Chemistry, or related areas
- English at professional work level
- Interest in working closely with colleagues from theory and experiment in a dynamic environment

Preferred experience for:

- A) Computational studies of quantum spins on surfaces
 - Confidence with Fortran or another programming language with focus on implementing physical models in code
 - Familiar with open quantum systems
- B) Ab initio based design of spins-on-surfaces quantum systems
 - Confidence with density functional theory codes (Quantum Espresso, VASP, etc.)
 - Experience in the study of localized magnetism and strongly correlated electron systems
 - Knowledge in workflow tools (e.g. ASE, Aiida) and data analysis in python are of advantage

Post-doc Position in **NV Center Lab**

The Quantum Sensing lab at QNS is looking for a postdoctoral candidate. Scanning magnetometry at the nanometer scale has garnered world-wide attention since enhanced spatial resolution in magnetic resonance technique will enable the investigation of chemical structures of bio-molecules and materials at the atomic level.

In this Nitrogen Vacancy (NV) center project, we are developing novel scanning probe microscopes based on diamond NV centers. These centers are nanoscale spin qubits possessing long spin coherence time and high magnetic field sensitivity even at ambient conditions. We are utilizing the NV center as a probe tip of SPM, enabling three dimensional mapping of magnetic samples and molecules with nanoscale resolution. In 2023, we are integrating this scanning NV magnetometry with a low temperature cryostat. Although the NV centers exhibit excellent quantum properties at ambient condition, the quantum properties of the NV centers could be greatly enhanced at low temperatures. For instance, low temperature experiments will reduce thermal and mechanical drift, minimize phonon background, and lengthen spin coherence time, enabling sub-nanometer spatial resolution with greater magnetic field sensitivity.

Requirement

- Ph.D. in Physics, Chemistry, or Material Science or related areas
- Excellent experimental skills
- Strong communication and interpersonal skills for interacting with a diverse group of researchers and technical staff

Preferred experience for:

- Optical measurement techniques
- Low temperature experiments
- Programming in Labview, MATLAB or Python
- High frequency measurements
- Interest in living in the Sinchon area in Seoul, an amazing metropolis at the heart of Asia

Open Position as **Quantum Chemistry Engineer**

We are seeking candidates with progressed chemistry laboratory experience and a master's degree in chemistry or chemical engineering. Candidates should have experience managing small chemical research projects and have a good working knowledge of organic chemistry and chemical analysis. Candidates would be assisting the chemistry team of QNS with chemical synthesis and analysis, instrument operation, and materials preparation.

Requirements

- Master Degree in Chemistry or related fields
- Experiences in organic synthesis
- Strong communication and interpersonal skills for interacting with a diverse group of researchers and technical staff

Preferred Experience

- Experiences with laboratory equipment (UV-Vis, HPLC, Glovebox, ESI-MS, Centrifuges)
- Surface science sample preparation and characterization
- Interest in living in Seoul, an amazing metropolis at the heart of Asia