PREP Research Associate

This position is part of the National Institute of Standards (NIST) Professional Research Experience (PREP) program. NIST recognizes that its research staff may wish to collaborate with researchers at academic institutions on specific projects of mutual interest, thus requires that such institutions must be the recipient of a PREP award. The PREP program requires staff from a wide range of backgrounds to work on scientific research in many areas. Employees in this position will perform technical work that underpins the scientific research of the collaboration.

Research Title:
Research Physicist – Quantum magnetometry using photoelectrically detected magnetic resonance of NV centers in diamond

U.S. Citizen Preferred

The work will entail:
Quantum sensing based on optically active spin defects in semiconductors (color center spins) is an emerging opportunity to deploy SI-traceable measurements in widespread application areas, including transportation, medicine, and resource exploration. The Nanoscale Spectroscopy Group seeks a research physicist to conduct optically and photoelectrically detected spin resonance sensing of magnetic fields for such applications. The successful candidate will study the physics and control of color center spins using a combination of metrologies, including optical and magnetic spectroscopies, advanced microscopies, and simulations to develop quantum sensing platforms. With limited supervision, the candidate will develop high-resolution spectral characterization of NV centers in diamond and other color center spins; investigate promising new color center spins in systems such as GaN, Si, and SiC, etc.; use judgment and literature precedents to research, interpret, and apply available guiding principles to characterize nanoscale optical and spin measurements of color centers, including single-defect emission, time-resolved detection, stroboscopic and spectroscopic methods, and nanoscale magnetometry using diverse readout schemes. The candidate will also integrate Bayesian algorithms for efficient measurements and develop automated measurement systems. The candidate will undertake numerical modelling of spin dynamics to understand device performance and improve on sensor design. The work impacts the goals of the nanoscale spectroscopy program to advance the development of engineered artificial atoms for nanoscale sensing and quantum applications. The candidate will interact with a broader team consisting of spectroscopy and materials chemistry expertise. The candidate will disseminate research results through open literature publication and technical talks at conferences.

Key responsibilities will include but are not limited to:

- Designing, integrating, testing, and operating instrumentation for performing optically detected and photoelectrically detected magnetic resonance sensing of diamond NV centers.
- Develop scanning confocal microscopy, widefield microscopy, and bulk sensor instrumentation incorporating optical excitation and readout, electrical biasing, and microwave spin control.
- Developing new and employing existing Bayesian algorithms for measurement efficiency and automation.

- Numerical modelling of spin resonance dynamics for sensor development.
- Presenting results at internal meetings, and occasional meetings with external stakeholders.
- Ensuring that results, protocols, software, and documentation have been archived or otherwise transmitted to the larger organization.

Qualifications

- Ph.D. in Physics, Electrical Engineering, Applied Physics, or a closely related field.
- At least 2 years of relevant experience.
- Experience in magnetic resonance/ODMR/EDMR of color center spins, including NV centers in diamond.
- Experience with confocal microscopy, lasers, optical alignment, single photon counting, microwave electronics, and experimental design.
- Familiarity with Bayesian experimental design and programming instrumental control.
- Team-oriented and goal-driven, with strong written and oral communication skills.
- Demonstrated ability to write and present research clearly and effectively.

Privacy Act Statement

Authority: 15 U.S.C. § 278g-1(e)(1) and (e)(3) and 15 U.S.C. § 272(b) and (c)

Purpose: The National Institute for Standards and Technology (NIST) hosts the Professional Research Experience Program (PREP) which is designed to provide valuable laboratory experience and financial assistance to undergraduates, post-bachelor's degree holders, graduate students, master's degree holders, postdocs, and faculty.

PREP is a 5-year cooperative agreement between NIST laboratories and participating PREP Universities to establish a collaborative research relationship between NIST and U.S. institutions of higher education in the following disciplines including (but may not be limited to) biochemistry, biological sciences, chemistry, computer science, engineering, electronics, materials science, mathematics, nanoscale science, neutron science, physical science, physics, and statistics. This collection of information is needed to facilitate administrative functions of the PREP Program.

Routine Uses: NIST will use the information collected to perform the requisite reviews of the applications to determine eligibility, and to meet programmatic requirements. Disclosure of this information is also subject to all the published routine uses as identified in the Privacy Act System of Records Notices: NIST-1: NIST Associates.

Disclosure: Furnishing this information is voluntary. When you submit the form, you are indicating your voluntary consent for NIST to use of the information you submit for the purpose stated.