PREP Research Associate
CHIPS Funded Project

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 and thus requires that such institutions be the recipients 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.

The Professional Research Experience Program (PREP) is a cooperative partnership between the National Institute of Standards and Technology (NIST) and the Colorado School of Mines (Mines). PREP provides research opportunities to Mines undergraduate and graduate students, as well as researchers with a Bachelor's, Master's, or PhD in NIST labs to gain research experience alongside NIST scientists. All hires made through the NIST PREP program at Mines are employees of Colorado School of Mines.

Research Location: Physically at NIST with their Quantum Calorimeters Group in the Physical Measurements Lab (Boulder, CO) and in Golden, CO at Colorado School of Mines

Research Title:
Post-Doctoral Researcher in x-ray spectrometry using low-temperature sensors / PREP0003555

The work will entail:
The Quantum Calorimeters Group at NIST seeks a scientist to join a team of several researchers optimizing, calibrating, and using cryogenic sensors to perform x-ray emission and absorption spectroscopy with metrological accuracy and precision. The microcalorimeter sensors take advantage of superconducting materials, cryogenic (sub-Kelvin) temperatures, and quantum mechanical effects. They achieve energy-resolving power for individual x-ray photons far greater than that offered by traditional calorimeters, opening many new lines of inquiry. These devices, fabricated in NIST's state-of-the-art clean room, consist of superconducting transition-edge sensors on micromachined structures. They are read out using unique high-speed, low-noise SQUID preamplifier systems also designed and fabricated here. The successful candidate will use these complex systems to perform x-ray spectral measurements of unprecedented quality. The candidate will focus primarily on characterizing the x-ray emission spectra of elements used in the semiconductor industry, especially emission at longer wavelengths and lower photon energies (3 keV and below) where standard reference data do not yet exist. The work will require precision measurement with research-grade (non-commercial) sensors operated at cryogenic temperatures. It will involve calibration of the measured energy scale by use of a pulsed optical-band laser or other means, and extreme control over and understanding of systematic uncertainties and measurement noise. It will require computer-based analysis of large data sets. The Quantum Calorimeters Group as a whole develops microcalorimeter spectrometers for x rays and gamma rays to perform a wide range of research, including applications in: analysis of materials and catalysts; nuclear non-proliferation and nuclear reactor optimization; x-ray nano-tomography; fundamental nuclear and particle physics; and high-energy astrophysics.

Key responsibilities will include but are not limited to:

- Operate arrays of custom, non-commercial cryogenic sensors, including superconducting transition-edge sensors, along with readout systems for such arrays.

- Operate and optimize microcalorimeter spectrometers built from cryogenic sensor arrays, using them in measurement applications in the basic and applied sciences.
- Metrologically characterize the x-ray emission spectra of several chemical elements, especially those used in the semiconductor industry.
- Plan and undertake additional x-ray precision measurements of industrial interest, such as x-ray transmission through relevant materials.
- Characterize the performance of new cryogenic x-ray sensor technologies developed at NIST.
- Develop new applications for cryogenic sensors and pursue both internal and external funding.
- Work with other NIST scientists on the operation and application of cryogenic sensor instruments.
- Communicate work status to team members and supervisors regularly.
- Disseminate research results through publications and presentations.

Qualifications

- A doctoral degree in Physics, Applied Physics, Astrophysics, Materials Science, Mechanical Engineering, Electrical Engineering, or a related field.
- Previous experience with precision measurements in a laboratory setting.
- Prefer experience with any or all of: spectroscopic x-ray measurements; cryogenic measurements; use of computer-controlled instrumentation; measurements with novel sensors.
- Ability to develop data analysis procedures and software.
- Ability to work with peers in a collaborative environment.
- Strong oral and written communication skills.

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 the 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. By applying to a

CHIPS-funded PREP opportunity, you also acknowledge that participation in the project requires signing a Non-Disclosure Agreement (NDA) prior to beginning any work.