**PREP Post-Bac 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.

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 High-Speed Waveform Metrology Group in the Communications Technology Lab and at Colorado School of Mines

**Project Title:** Researcher Support / PREP0003429 / Physics and Quantum Technologies

**Summary of Position:**

The research assistant will contribute to a team which is attempting to design, build, and operate the world’s first optical network of superconducting quantum computers. This interdisciplinary project entails the design and construction of nonlinear optical systems capable of generating quantum states of light, precision measurements of those states, and the distribution of this light as an entanglement resource. At the nodes of the network, novel microwave-optical transducers are operated in a cryogenic environment to establish the vital interconnect with the qubit states of superconducting quantum processors. Through a NIST cleanroom fabrication effort, the transducers are being engineered into reliable, modular, telecom-ready devices. The associate will have the opportunity to become involved with multiple aspects of this project which match their research interests while strengthening an array of skills through hands-on laboratory tasks, design challenges, data analysis, and theoretical considerations.

**Skills you may learn:**

* How to generate squeezed microwave states with the nonlinearity of a traveling-wave parametric amplifier operated at millikelvin temperatures.
* How to perform precision heterodyne measurements of squeezed microwave states to quantify their quantum characteristics and suitability for network operation.
* How to perform precision optical and electrical characterization of novel vibrating membrane quantum transducers in different operating modes and interpret results as a quantum information channel.
* How to upconvert squeezed microwave states to squeezed optical states in a quantum transducer limited by efficiency and added noise.
* How to operate and maintain a cryogenic dilution refrigerator.
* To provide technical input to research problems which have been recognized as critical obstacles to progress in quantum networking.
* To prepare journal manuscripts, attend research conferences, and present technical results.
* To work as a member of a collaborative, interdisciplinary team of graduate students, post-docs, and professionals.

**Required Qualifications:**

* Bachelor’s degree in a field of science, technology, engineering, or mathematics.

**Preferred Qualifications:**

* Knowledge of physics, electrical engineering, computer science, and/or quantum information theory.
* Experience with measurement equipment such as signal generators, oscilloscopes, spectrum analyzers, vector network analyzers, electrical amplifiers, photodetectors, power meters, Fabry-Perot cavities, and lock-in detectors and feedback circuits.
* Familiarity with precision optical, electrical, and microwave measurement techniques.
* Knowledge of cryogenics and dilution refrigerator operating principles is advantageous.
* Ability to write code with MATLAB, LabView, and Python is required.
* Familiarity with optical design software (e.g. Zemax, Code V, OSLO), mechanical design software (e.g. COMSOL), or microwave design software (e.g. HFSS, AWS) is desirable.
* Experience with electrical circuit design, soldering, and debugging is required.
* Familiarity with opto-mechanic design, computer-aided design, and machine shop skills is desirable.
* Familiarity with building materials, hardware, and basic construction and assembly methods.
* Comfortable working with hands doing manual tasks.
* 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)](https://www.nist.gov/iaao/academic-affairs-office/nist-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.