Nanomechanical systems in the quantum limit. **(Mentor: Lin Tian)** Nanomechanical resonators in the quantum limit can be explored to study both fundamental issues such as the classical-to-quantum boundary in macroscopic systems and applications such as precision measurement with ultra-high sensitivity. It was shown that the integration between a nanomechanical resonator and other solid-state electronic devices provides a powerful interface to manipulate and detect the quantum state of the mechanical mode. In this project, the REU student will study effective generation of quantum entanglement between two mechanical modes both coupling to a common superconducting qubit, which is a natural extension of our previous projects and is a key component for demonstrating the quantum nature of the mechanical modes. The model of this coupled system includes two harmonic oscillators and one quantum bit (spin ½ particle). During the project, the student will first survey recent literature on this topic. Then the student will use basic quantum mechanics to describe the dynamics of the coupled system and use Matlab to simulate the system evolution.