Postdoc Opportunity

We have recently succeeded in cooling a nanomechanical resonator to sub-mK temperatures purely by good thermal coupling to the refrigerator [1]. In contrast to the optomechanical cooling techniques used by many other groups, our technique cools the phonon bath of the vibrating structure as well as the low energy excitations arising from atomic-scale disorder in the structure. As a result, the 15 MHz mechanical mode reaches its quantum ground state.

Our research group is also making steady progress in the development of a continuous nuclear demagnetization refrigerator, which will allow us to maintain sub-mK temperatures indefinitely in a cryogen-free system. The dry system will provide a great deal of experimental space for microkelvin measurements.

We now intend to apply these technologies to study fundamental physics. Applications include probing individual low energy excitations in glass nanomechanical resonators, as proposed in [2]. According to a long-standing theory, these excitations are atomic-scale tunneling two level systems. It is essential to test this theory on the microscopic level, and the techniques we are developing will allow us to do so. In addition to fundamental concerns, the work may have practical applications considering the importance of tunneling two level systems to the damping of nanomechanical resonators and the decoherence of superconducting qubits.

We are seeking a postdoctoral researcher to work on this ERC-funded project at the Institut Néel/CNRS in Grenoble, France. Funding is available at least until February 2024.

Please contact andrew.fefferman@neel.cnrs.fr for more information.

[1] https://arxiv.org/abs/2104.09541, to appear in *Nature Comms.*

[2] L. Remus *et al.*, Phys. Rev. B, **80**, 174103 (2009); T. Ramos *et al.*, Phys. Rev. Lett., **110**, 193602 (2013).