NEW YORK CITY COLLEGE OF TECHNOLOGY
Physics Department
Center for Theoretical Physics

To Be Held on **Thursday, September 29 at 12 noon**
in
Namm, Room 823

Parity-Protected Josephson Qubits

Presented by:

Michael Gershenson
Department of Physics and Astronomy, Rutgers University

We have developed two novel Josephson circuits intended as prototypes of protected qubits whose logical states are decoupled from the environment by encoding them in a parity of a large number. The first type, the so-called charge-pairing qubit [1], represents a chain of two Josephson elements characterized by the π periodicity of the phase dependence of their Josephson energy (the so-called Josephson rhombi [2]). The second type, the flux-pairing qubit [3], consists of a 4π periodic Josephson element (a Cooper pair box with the e charge on the central island) shunted by a superinductor [3]. The lowest-energy quantum states of the charge-pairing qubit are encoded in the parity of Cooper pairs on a superconducting island flanked by the Josephson rhombi. The flux-pairing qubit encodes its quantum states in the parity of magnetic flux quanta inside a superconducting loop. In my talk, I will introduce the idea of parity protection and outline our recent work towards better flux-pairing qubits and superinductors as essential elements of protected qubits.

1. M.T. Bell, J. Paramanandam, L.B. Ioffe, and M.E. Gershenson. Protected Josephson Rhombus Chains. Phys. Rev. Lett. 112, 167001 1-5 (2014).

2. S. Gladchenko, D. Olaya, E. Dupont-Ferrier, B. Douçot, L.B. Ioffe, and M.E. Gershenson. Superconducting Nanocircuits for Topologically Protected Qubits. Nature Physics 5, 48-53 (2009).

3. M.T. Bell, W. Zhang, L. B. Ioffe, and M. E. Gershenson. Spectroscopic Evidence of the Aharonov-Casher Effect in a Cooper Pair Box. Phys. Rev. Lett. 116, 107002 (2016).

4. M.T. Bell, I.A. Sadovskyy, L.B. Ioffe, A.Yu. Kitaev, and M.E. Gershenson. Quantum Superinductor with Tunable Non-Linearity. Phys. Rev. Lett. 109, 137003 (2012).

Dark matter annihilation vs. astrophysics: the gamma-ray signal from the newly discovered dwarf galaxy Reticulum II

Presented by:

Alex Geringer-Sameth

Carnegie Mellon University

I will present results from a search for gamma-ray emission in many recently discovered Milky Way satellites. The Reticulum II dwarf, one of our nearest neighbors, shows evidence for a signal in Fermi data. The detected emission is consistent with annihilating dark matter with a particle mass less than a few hundred GeV. Different ways of treating the background yield different significances and I will discuss the caveats involved. Dynamical modeling, based on spectroscopic observations of member stars, is used to infer the dark matter density profile of Reticulum II, and shows that its annihilation signal should be among the largest of the known dwarfs. I will discuss current progress on determining whether a gamma-ray signal in dwarf galaxies can be explained by conventional astrophysical processes.