Tuesday
Feb. 20th
At 3:45pm

Fermi Superfluids: From Cold Atoms to Neutron Stars and Back

Abstract:

Neutron stars are fascinating, comprising matter in its densest form where a teaspoon weighs as much as a small mountain. Direct observation, however, provides only a few clues about their intriguing properties, and experiments are out of the question. Surprisingly, one can simulate many properties of neutron star matter on earth in cold atoms cooled to some of the lowest temperatures on earth under vacuum conditions significantly better than in space.

In this talk I will discuss how the same universal physics describes hot dense neutron matter in neutron stars and dilute cold atoms on earth. Both systems are superfluid, and demonstrate a bewildering array of phenomena such as quantum turbulence which arrises despite the frictionless flow. In particular, I will show how we use some of the largest computers in the world to study superfluid dynamics.

From cold atoms experiments, we validate our techniques, then use them to study vortex pinning in neutron stars, the underlying mechanism behind pulsar glitches - a sudden increase in the rate of rapidly spinning neutron stars.

From neutron stars, we have a unique opportunity to learn about the properties of nuclear interactions at high density. The recent detection of a neutron star merger through gravitational waves heralds a new era of observational data, and I shall end the talk with a brief discussion about how gravitational waves can help constrain the properties of nuclear matter.

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CYCLOTRON COLLOQUIUM

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Refreshments will be served at 3:30pm