Field: *Physics/Astrophysics*

Introductory Speakers:

Shin Inouye, The University of Tokyo

Session Topic:

Cold quantum gases

Imagine what is happening in the air in this room. Although you cannot see it with your own eyes, you know there are nitrogen and oxygen molecules flying around with reasonably high speed (around hundreds of meters per second) colliding each other quite frequently (more than 10^9 times per second).

What I am presenting in this session is what happens if we cool the gas to ridiculously low temperature, near a millionth of a degree above absolute zero (i.e. one "micro-" Kelvin). We call gases at such a low temperature "quantum gases", since they show the quantum nature of matter in one of its most pure forms. Depending on the symmetry, some particles (bosons) experience a phase transition and become superfluid. Others (fermions) start to behave like electrons in a solid and eventually show equivalence to superconductivity. Recently, all of these phenomena have become experimentally accessible using laser cooled gases. Since often one can perform calculations from first principles, they became one of the best testing grounds for theoretical predictions.

In this talk, I will present a couple of experimental results and explain basic techniques that enable researchers to do such experiments.