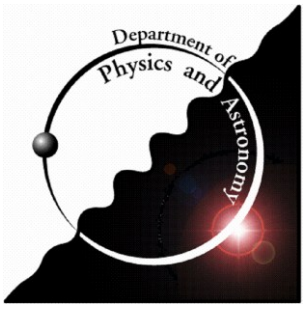

PHYSICS AND ASTRONOMY
COLLOQUIUM

Dr. Joseph Thywissen

University of Toronto

"Transport Dynamics of Ultracold Atoms in a Double-Well Potential"

Abstract

Ultracold atoms are ideal systems in which to study many-body quantum dynamics: these neutral gases are held in completely conservative potentials and isolated from dissipative interaction with the environment. In this talk, I present our observations of population dynamics of a Bose-Einstein condensate in a double-well potential. Oscillatory dynamics span three octaves, as we tune the healing length from 0.3d to 2d, where d is the separation between the wells. At barriers higher than the chemical potential, we observe slow oscillations that agree with the Josephson model, which was first developed for superconductor junctions. In the limit of low barriers, the fundamental mode is well described by superfluid hydrodynamics, which were first observed in liquid helium below its lambda point. Remarkably, in this single experiment, we observe both the limit in which quantum transport is driven by tunneling, and the other extreme, where hydrodynamic flow dominates over quantum pressure. The relative diluteness of gases makes a satisfying ab initio description possible throughout the crossover.

Wednesday, January 25, 2012
3:30 p.m.
Bob Wright Centre
Room A104