ST. FRANCIS XAVIER UNIVERSITY

Physics Colloquium

Friday, 5 April 2013, 4:00pm, PSC 3046

Honours talks

Zachary MacDonald

Finite temperature analytical results for a harmonically confined gas obeying exclusion statistics in d-dimensions

Closed form, analytical results for the finite-temperature one-body density matrix, and Wigner function of a *d*-dimensional, harmonically trapped gas of particles obeying exclusion statistics are presented. As an application of our general expressions, we consider the intermediate particle statistics arising from the Gentile statistics, and compare its thermodynamic properties to the Haldane fractional exclusion statistics. At low temperatures, the thermodynamic quantities derived from both distributions are shown to be in excellent agreement. As the temperature is increased, the Gentile distribution continues to provide a good description of the system, with deviations only arising well outside of the degenerate regime. Our results illustrate that the exceedingly simple functional form of the Gentile distribution is an excellent alternative to the generally only implicit form of the Haldane distribution at low temperatures.

Thomas Lee

Bell's Paradox in Quantum Mechanics

Bell's paradox was initially designed as a thought experiment to understand the nature of special relativity. The thought experiment considers two spaceships initially separated and connected by a taunt thread at rest in the lab frame. Both ships agree to undergo a constant acceleration for an equal period of time, effectively boosting the ships into a new inertial frame. Current literature yields the result that the connecting thread snaps due to a loss of simultaneity during the acceleration. We use the Dirac equation to extend this phenomenon to the framework of quantum mechanics. To analyze the paradox we consider the following interferometry experiment. We prepare an initial packet as a superposition of spin up and spin down solutions with a relative phase separation. Next, we separate the packet into two sections and accelerate them. Following this procedure we recombine the sections into a final packet. We then take a spin measurement of final packet and compare the result to the spin of the initial packet.