UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI

INSPEM WEEKLY SEMINAR

46/2019

#UNSDG

Date & Time

Friday, 13th December 2019 @ 3.15 pm

Venue

al-Farabi Seminar Room, Second Floor, INSPEM

Presenter

Mr. Kalai Kumar Rajagopal
Dept. of Mathematics, Faculty of Science

Topic

Equilibrium Properties of the Two-Dimensional Bose-Einstein Condensate

Abstract

My presentation will cover the microscopic theory of Bose-Einstein condensate (BEC) in a two-dimensional harmonic confinement at zero and finite temperatures. I will illustrate how many-body scattering process effects the equilibrium properties of the condensate. Later I will also show how atom-atom scattering in the system can be manipulated and controlled as we magnetically sweep the scattering parameter across the Feshbach resonance. Here condensate stability plays a vital role. Then I will explain my result when the two-dimensional Bose condensate is rotated at finite temperature for the creation of a single vortex. The effect of atom/boson scattering within the fluid are crucial in finding the critical velocity for this vortex formation. The second part of my talk will cover the strongly correlated fluid model when large number of vortices present in the system (similar to fractional Quantum hall effect). The vortices will be treated as fundamental building block of the fluid and they interacts with Yukawa Potential (logarithmic soft-core potential in contrast to the hard-core boson-boson repulsive ones). Hence our system now is a Yukawa Bose fluid confined within the radial harmonic trap. The calculation for this system is carried out using the Density functional theory (DFT) formalism within the Kohn-Sham scheme. Comparison of this model is made with the Gross-Pitaevskii model which is conventionally used in the description of dilute Bose condensate (fluid) valid within the mean-field or Bogoliubov regimes. The final section of the talk will cover the system of dense two-dimensional Bose condensate when the consequences of higher order interactions becomes more prominent. Here the Gross-Pitaevskii model is not appropriate for the description of the model and we resort to Slave-Boson model (Field theoretical approach). These works were done during my stay at ITP Augsburg, Germany and Scoula Normale Superiore, Pisa Italy.