LUND INSTITUTE OF TECHNOLOGY
Lund University

Mini-Symposium on

Many-Body Effects in Finite Fermion and Boson Systems

Wednesday, May 7, Mathematical Physics, Sem. Room F

13:15 Morten Hjort-Jensen: ***Trends in nuclear structure theory***

Major advances are occurring in theoretical studies of nuclear systems. Algorithmic and computational advances hold promise for breakthroughs in predictive power, enhancing the strong links between theory and experiment. I will try to a give a kind of snapshot on the status of nuclear many-body theory, with links to several new and coming experimental results. In particular I will focus on recent experiments on the chains of helium, carbon, oxygen and nickel isotopes. These experiments pose several challenges on our understanding of nuclear stability. I will use these isotopes to demonstrate the challenges nuclear theory faces, from stable nuclei to weakly bound nuclei.

14:15 Henri Saarikoski: ***Many-body physics in two-dimensional quantum droplets***

Modern technology makes it possible to fabricate quantum systems where the movement of particles is restricted into a two-dimensional plane. Examples of such systems include nanostructures in semiconductors and rapidly rotating atomic condensates. Special features emerge in the physics of such (pseudo) two-dimensional systems which make them also useful for potential applications. In this talk I give an introduction to basic properties of finite size two-dimensional quantum systems and to some of the most useful computational methods which are used to solve the many-particle problem.

15:00 **Coffee**

15.30 Vladimir Zelevinsky: ***Many-body quantum chaos as a computational tool***

All realistic many-body quantum systems with strong interactions between the particles exhibit chaotic properties starting from a certain level density or excitation energy. In practice we are usually interested in detailed properties of low-lying states while the rest can be described by general statistical features which are close to those predicted by random matrix theory. Exact diagonalization of huge matrices becomes impossible with the dramatic growth of dimensions. The idea is to solve exactly the problem in a properly selected subspace and take into account the rest as a chaotic reservoir. This approach is still in its infancy. I illustrate the emerging possibilities by the proof of exponential convergence of large Hamiltonian matrices under successive truncation.

16:30 Jonas Christensson: ***Effective interaction-approach to the many-body boson problem***

We show that the convergence behavior of the many-body numerical diagonalization scheme for strongly interacting bosons in a trap can be significantly improved by the Lee-Suzuki method adapted from nuclear physics: One can construct an effective interaction that acts in a space much smaller than the original Hilbert space. In particular for short-ranged forces and strong correlations, the method offers a good estimate of the energy and the excitation spectrum, at a computational cost several orders of magnitude smaller than that required by the standard method.

WELCOME!

S.M. Reimann, S. Åberg and J. Cederkall