School on Critical Stability of Few-Body Quantum Systems

Name	Nationality	Institute	Presentation Title	Presentation Abstract
Dérick dos Santos Rosa	Brazil	O Instituto Tecnológico de Aeronáutica - ITA	Dimensional Aspects of the Efimov Effect	The existence of the Efimov effect is drastically affected by the dimensionality of the space in which the system is embedded. The effective spatial dimension containing an atomic cloud can be continuously modified by compressing it in one or two directions. In the present abstract we determine for a general AAB system formed by two identical bosons A and a third particle B in the two-body unitary limit, the dimensionsality D for which the Efimov effect can exist for different values of the mass ratio $\mathpzc{A}=m_B/m_A$. In addition, we provide a prediction for the Efimov discrete scaling factor, exp(π/s), as a function of a wide range of values of $\mathpzc{A}$ and D, which can be tested in experiments that can be realized with currently available technology. We contrast the results with three different approaches the Skorniakov and Ter-Martirosyan equations, the idea of Bethe-Peierls boundary condition and the Well known Born-Oppenheimer approximation.
Eloisa Cuestas	Argentina	National University of Córdoba	Strongly bound fermion pairs on a ring: a composite-boson approach	Strongly bound fermion pairs on a ring: a composite-boson approach E. Cuestas and C. Cormick Particles made of two fermions can in many cases be treated as elementary bosons, but the conditions for this treatment to be valid are nontrivial. The so-called \coboson formalism" is a powerful tool to tackle compositeness eects relevant for instance for exciton physics and ultracold atomic dimers. A key element of this theory is an ansatz for the ground state of N pairs, built from the single-pair ground state combined with the exclusion principle. We show that this ansatz can fail in one-dimensional systems which fulll the conditions expected to make the ansatz valid. Nevertheless, we also explain how coboson theory can recover the correct ground state. Thus, our work highlights limitations and strengths of the formalism and leads to a better treatment of composite bosons. (see https://arxiv.org/abs/2108.13806)
Kamyar Mohseni	Iran	Instituto Tecnológico de Aeronáutica	Three-boson stability for boosted interactions towards the zero-range limit	We study the mass and wave functions of three-boson ground and excited bound states within a three-body relativistic framework with Kamada and Glocke boosted potentials in the limit of a zero-range interaction. We adopt a nonrelativistic short-range separable potential, with Yamaguchi and Gaussian form factors, and drive them towards the zero-range limit by letting the form factors' momentum scales go to large values while keeping the two-body binding fixed. We show that the three-boson relativistic masses and wave functions are model-independent towards the zero-range limit, and the Thomas collapse is avoided, while the nonrelativistic limit kept the Efimov effect. Furthermore, the stability in the zero-range limit is a result of the reduction of boosted potential with the increase of the virtual pair center of mass momentum within the three-boson system. Finally, we compare the present results with Light-Front and Euclidean calculations.
Pavel Belov	Russia	St.Petersburg State University	Linewidth broadenings of the electron impurity resonant states in semiconductor quantum wells	The linewidth broadenings of the resonant states of impurity electrons in semiconductor quantum wells with infinite barriers are calculated by the complex-scaling technique. An advantage in the accuracy of calculations using the smooth complex scaling is demonstrated. A dependence of the linewidth broadenings on the quantum well width is studied. The calculated results extend previous analytical and numerical estimations of the linewidth broadening in the similar system.
Rodrigo Alves Dias	Brazil	Universidade Federal de Juiz de Fora	Google TensorFlow in Wave Packets Time Evolutions	In this apresentation I will show a way to use Google TensorFlow to evolute in time Quantum Wave Functions in the real space.
Roy Yaron	Israel	Hebrew University of Jerusalem	Optimizing SVM For Systems With Periodic Boundary Conditions	SVM is a powerful tool to solve few body problems. In the last years these tool has been used in periodic boundary conditions to estimate there effect on a system. Including the periodic boundary conditions requires a lot of computation time and therefore these method was mainly used for 2,3 body systems, and for 4 body system the runtime was extremely long and the results were not very accurate. In the last year I developed few optimizations for this method under the supervision of Professor Nir Barnea which make 4 body system problem to be up to 100 time faster and more accurate and therefore feasible.
Samir Das	India	University of Hyderabad, India	Particle scattering by harmonically trapped quantum gases in an artificial magnetic field	In the present article, we study the particle scattering that occurs by harmonically trapped quantum gases in an artificial magnetic field with the short-ranged Fermi -Huang interactions among the incident particle and the scatterers. Both elastic and inelastic differential scattering cross-sections are obtained in analogy with the potential scattering. We have shown that the differential scattering cross-sections which depend on finite temperature and the magnetic field strength. Coherent scattering by harmonically trapped Bose and Fermi scatterers in an artificial magnetic field gives rise to a tool for probing its quantum statistical properties. We have shown that the scattered particle intensity can exhibit oscillatory at zero Kelvin temperature which depends on the strength of the magnetic field and the geometric shapes of the atomic cloud. At the limit of zero magnetic field strength, we have investigated the importance of the shell structure on the cross-section of scattering.