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Physical Sciences Seminar

Exploration of quantum states with cold atoms: Spin-orbit coupling in the presence of strong atomic correlations

Ayaka Usui (OIST Japan & IQOQI Vienna, Austria)

Host: Mikhail Lemeshko

I investigate ultracold gases theoretically and aim to create entanglement. In this talk, first I will introduce the basic properties of cold atoms and spin-orbit coupling. The spin-orbit coupling provides coupling between momentum and internal state degree. I will present work that considers two interacting bosons with synthetic spin-orbit coupling in one dimension [1]. The two bosons are described by two identical atoms with different hyperfine states, and therefore can be regarded as a two-level system with a pseudo-spin. The system is tractable since it is solvable exactly for some sets of parameters and allows to study what happens without any approximations. Even though the system we consider is bosonic, I will show that a regime exists in which the competition between the contact and spin-orbit interactions results in the emergence of a ground state that contains a significant contribution from the anti-symmetric spin state. This ground state is unique to few-particle systems and does not exist in the mean-field regime. Here I will discuss the static properties of the system such as the ground state and the energy spectrum. I will also talk about generating entanglement in real space as future work.

[1] A. Usui, Th. Fogarty, S. Campbell, S. A. Gardiner, Th. Busch, arXiv:1910.02399

Tuesday, November 26, 2019 11:00am - 12:00pm

IST Austria Campus Heinzel Seminar Room / Office Bldg West (I21.EG.101)

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