INSIGHT SEMINAR: Scalable quantum computing and few-body physics with neutral atoms

SERVAAS KOKKELMANS

March 05, 2024
12:00 to 13:00
Seminar Room

BIO:

Servaas Kokkelmans is full Professor and leader of the Coherence and Quantum Technology group in the Department of Applied Physics at Eindhoven University of Technology and scientific director of the Center for Quantum Materials and Technology Eindhoven QT/e. His research focuses on strongly-interacting quantum gases and neutral atom quantum computing. He is an expert on the manipulation of interatomic interactions. Kokkelmans research impacts on the development of quantum materials and quantum computers, and on the fundamental understanding of superfluidity.
Kokkelmans has expertise in the many-body properties of strongly interacting Fermi and Bose gases, ultracold collisions, Feshbach resonances as tool for few-body physics including

ultracold molecules and Efimov trimers, ultracold plasmas and Rydberg atoms.
Servaas Kokkelmans studied Physics at Eindhoven University of Technology (TU/e), obtaining his MSc in 1996 and his PhD on interacting atoms in clocks and condensates in 2000. After this he went abroad for two two-year postdoctoral research positions. The first at JILA, University of Colorado (USA) and the second at Laboratoire Kastler Brossel, ENS (France). In 2004, he returned to TU/e to take on the position of Assistant Professor in the Department of Applied Physics at TU/e. In 2017, Kokkelmans became Associate Professor at TU/e. In 2018, he founded the Center for Quantum Materials and Technology Eindhoven QT/e. He is also a co-founder of the Eindhoven Hendrik Casimir institute, that started in 2021. In 2023, he became full professor at TU/e.

ABSTRACT:

Quantum processors are the base of the quantum stack. Neutral atom arrays have recently emerged as a highly promising quantum computing platform. These atoms can be well isolated from the environment and prepared in large systems of hundreds or thousands o particles with different geometries using laser cooling and trapping techniques. The mos well-established approach is atom-by-atom assembly where single atoms are trapped an individually positioned in desired geometries using optical tweezers. Quantum information i encoded in the internal states of atoms with interactions mediated via their highl electronically excited Rydberg states.

? The colloquium will attribute different aspects of the computing stack, where we start a the bottom with the ultracold atoms and discuss fundamental few-body physics a d how to account for the interparticle interaction in a computational tractable way; then v a optimal control and hybrid quantum-classical algorithms, quantum error correction, we en with the integration of the neutral atom platform in a high-performance computing cluster.

Hosted by: Prof. Dr. Maciej Lewenstein