THEORY LECTURE SERIES: Introduction to the physics of dipolar quantum gases

LUIS SANTOS

May 09, 2024 to May 23, 2024
10:00 to 12:00
Seminar Room and Blue Lecture Room

The new series of Theory Lecture **i¿½Introduction to the physics of dipolar quantum gasesi¿½** will be presented by **Prof. Luis Santos**, and it is scheduled to take place on:
May 9, 14, 21, 23 from **10:00** to **12:00** in the **SMR** (May 9 and 23) and in the **BLR** (May 14 and 21).

Abstract:
Inter-particle interactions play a crucial role in the physics of ultra-cold quantum gases. As a result, dipolar gases, formed by particles with a significant dipole moment, present a radically different physics compared to their more standard non-dipolar counterparts, both for weakly- and strongly-interacting systems, as well as in what concerns their ground-state properties and the non-equilibrium dynamics. This new physics is attracting a rapidly-growing attention in the community of quantum gases.

This lecture series will cover a broad range of topics related to the physics of dipolar gases from a theoretical perspective, although I will discuss key experimental results as well.

I will start the lecture series with a discussion of basic ideas on dipolar particles, experimental realizations, and the main properties of weakly-interacting Bose and Fermi dipolar gases. I will then discuss in more detail recent developments on dipolar quantum droplets, supersolidity, pattern formation, and dipolar mixtures. We will then move to the physics of dipolar gases in optical lattices, starting with the quantum simulation of extended Hubbard models. We will first discuss the possible ground-state phases, which offer a very rich variety of crystalline phases, lattice supersolids, Haldane insulator, and more. I will then comment on the non-equilibrium dynamics of dipolar Hubbard models, including the physics of dynamically-bound dimers and clusters, Hilbert-space shattering, disorder-free localization, and the role of dipole-assisted hopping. In the last part of the lecture series, I will discuss dipolar spin models, focusing especially on the interplay between dipole-induced spin exchange and positional or quenched disorder, which results in a rich non-equilibrium physics, characterized by algebraic localization of spin excitations and multifractality.?

Biography:
Luis Santos graduated from the University of Salamanca (Spain) in 1995. He received his Ph.D. in 1998, with a thesis on laser cooling, under the supervision of Luis Roso and Maciej Lewenstein. From 1999 to 2004, he worked as a postdoc in the group of Maciej Lewenstein at the University of Hanover (Germany). From 2004 to 2006, he was an associate professor at the University of Stuttgart. Since 2006, he has been a full professor at the University of Hanover. Since 2010, he has been the director of the Institute of Theoretical Physics at that university. His work deals generally with the theory of ultra-cold gases, particularly Bose-Einstein condensates and atoms in optical lattices. In recent years, his group has especially focused on dipolar gases, spinor gases, synthetic magnetism, and the dynamics of many-body quantum systems in optical lattices.?

Participation is open to all ICFOnians

If you are unable to attend the lecture in person, here is the link to follow it online. However, we strongly encourage you to attend in person.

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Zoom acces: 27687
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