

SEMINARIO
Departamentos de Física Teórica I y II
Universidad Complutense de Madrid

INVITADO: Philipp Hauke, ICFO, Barcelona

TITULO: "Devil's staircases, supersolids, and crystal-superfluid transitions with long-range interacting spins: A trapped ion quantum simulation"

LUGAR: FACULTAD DE CIENCIAS FÍSICAS UCM

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ABSTRACT

Long-range interactions lead to intriguing phenomena, such as supersolids, plethora of meta-stable crystal states, and even counterintuitive thermodynamic behavior. On the downside, this increased complexity hinders theoretical studies. In Ref. [1], we analyzed (based on [2]) the possibility to mimic (i.e., "quantum simulate") such behavior in a trapped-ion experiment.

In Ref. [1], we studied the system, which models spins with dipolar interaction and tunneling, in 1D, and found that the devil's staircase -- an infinite sequence of crystal states -- spreads to a succession of lobes similar to the Mott-lobes found in Bose-Hubbard models. Contrary to more standard models with nearest-neighbor tunneling, crystal phases become quasi-supersolids, i.e., phases with diagonal long-range order and off-diagonal quasi-long range order. Currently, we are analyzing supersolid phases and melting of crystals at finite temperature in a similar model on a 2D triangular lattice. Carrying out the proposed quantum simulation experiments could yield a wealth of new insights into the physics of long-range interactions.

[1] Hauke *\emph{et al.}*, New J. Phys. 12, 113037 (2010)

[2] Porras and Cirac, PRL 92, 207901 (2004)