ÉCOLE DE PHYSIQUE des HOUCHES

UNIVERSITE JOSEPH FOURIER SCIENCES TECHNOLOGIE MEDECINE

Contribution ID: **7** Type: **not specified**

Quasiparticle engineering and entanglement propagation in a quantum many-body system

The key to explaining and controlling a range of quantum phenomena is to study how information propagates around many-body systems. Quantum dynamics can be described by particle-like carriers of information that emerge in the collective behaviour of the underlying system, so called quasiparticles. These elementary excitations are predicted to distribute quantum information in a fashion determined by the underlying system' s interactions.
On my poster I report on quasiparticle dynamics observed in a quantum many-body system of trapped atomic ions [1]. In detail I present the implementation of the Ising Hamiltonian and the performed experiments on the system: We investigated how entanglement is distributed by quasiparticles, as they trace out lightcone-like wavefronts, and observed the predicted non-local transport of information and breakdown of the light-cone picture.
Furthermore we artificially constructed approximate Eigenstates of the system, to perform spectroscopy on low lying energy levels and observe signatures of quasiparticle interactions.

[1] P. Jurcevic et al., Nature, 511, 202-205 (2014).

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