Mariusz Gajda (IFPAN) – theory, squeezing and metrology
T. Roscilde (ENSL) – theory, entanglement and spin physics
M. Lewenstein (ICFO) – theory, Bell inequalities
G. Modugno (LENS) – Experiments, Dy atoms and molecules
F. Ferlaino, M. Baranov (IQOQI) – Exp/theory – lattices and mixtures
T. Pfau (Uni Stuttgart) – Experiments, Dy in lattices
B. Laburthe-Tolra (LPL) – Cr in lattices, coordination

http://www-lpl.univ-paris13.fr/gqm/
PROJECT PROGRESS (highlights)

CHALLENGE – endowing quantum simulators with long range interactions

SOLUTION – ultra-cold large-spin magnetic atoms in optical lattices

The only truly macroscopic (>10⁴ spins) stable long-range interacting AMO system (as compared to Rydbergs and molecules)

4 experiments, 4 theory groups

IMPLEMENTATION –

First characterization of two-body correlations in a MAQS (collective measurements)

2 new experiments being built with ultra-short lattices (boosts energy scales)

A novel data-based approach to characterize entanglement

HURDLES

– COVID → less meetings – slow hiring and purchase

Weak interactions → sensitivity to magnetic noise

(→ short period lattices, larger spin (molecules), improved magnetic field control)
IMPACT (RRI aspects)

**GENDER:** Only 1/7 Woman PI... However, our teams have hired a number of young female researchers: 6 at IFCO (including one post-doc hired by Quantera), 3 PhD at IQOQI, 1 Master at IFPAN.

**OPEN SCIENCE:** 15/62 papers published in open-access journals. One article in Physics Today. Announcements of ICFO papers on Twitter.

**SCIENCE EDUCATION:** M. Lewenstein donated the prize from his Medalla del Spanish Royal Physical Society (15,000 EU) for Catalan education; this is used to organize annual schools for teachers of physics.

**PUBLIC ENGAGEMENT:** - Radio program on the discovery of Pauli Crystals (in Polish). Disseminating quantum physics through art, and employing quantum physics for contemporary art: example concert at SONAR 2021 “Interpreting Quantum Randomness”. Participation at Fête de la Science (Bell Inequalities, using an IBM Q-computer)
This project has received funding from the European Union’s Horizon 2020 research and innovation programme under Grant Agreement No. 731473.