Minicolloque n° PMQ31 **X Oral** **□ Poster**

Realizing artificial topological matter in arrays of Rydberg atoms

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In this talk I will show how Rydberg array platforms for quantum simulation allow for an original way of exploring topological phases of matter, by using the resonant dipole-dipole interaction between several Rydberg levels.

I will first describe how, in a Su-Schrieffer-Heeger chain, we not only observed the textbook properties of the SSH model in the single-particle regime, but also could realize a novel phase of matter induced by hard-core interactions between spin excitation and called a symmetry-protected topological phase, by reaching the many-body ground state at half-filling [1].

I will then report on the demonstration of a tool which is required to extend those studies to 2 dimensions, namely spin-orbit coupling. In [2], in a minimal instance of three atoms, we demonstrated the existence of a density-dependent spin-orbit coupling by observing the chiral motion spin excitations. I will conclude by explaining how we now plan to extend this to large two-dimensional arrays.

[1] S. de Léséleuc *et al.*, Science **365**, 775 (2019).

[2] V. Lienhard *et al.*, Phys. Rev. X **10**, 021031 (2020).