Invited talks

Exploring quantum magnetism with Rydberg atom arrays

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Rydberg atoms in arrays of optical tweezers open up new horizons for quantum simulation, computation, and metrology. In this talk, we will present an overview of this architecture. We will explore how individual atoms can be trapped and arranged into programmable arrays that serve as a versatile platform for various quantum applications. We will review the unique properties of Rydberg atoms and the methods to generate entanglement. We will describe ongoing efforts in the community to implement different spin models with hundreds of particles for simulating quantum many-body phenomena [1,2]. We will gain insight into the role of this platform in quantum computing, highlighting its ability to implement high-fidelity quantum gates and scalable quantum circuits [3]. Furthermore, we will illustrate how entanglement in the out-of-equilibrium dynamics of these systems can be harnessed to generate scalable spin squeezing for metrological applications [4]. Finally, we will provide perspectives on the future developments of Rydberg atoms arrays in the realm of quantum science and technology.

References:

[1] Scholl et al., Nature 595, 233 (2021).

[2] Chen et al., Nature 616, 691 (2023).

[3] Bluvstein et al., Nature 626, 58 (2024).

[4] Bornet et al., Nature 621, 728 (2023).