

## Rysq



## Rydberg Quantum Simulators

Quantum Simulators provide new levels of understanding of equilibrium and out-of-equilibrium properties of many-body quantum systems, one of the most challenging problems in physics. The main objective of the RYSQ proposal is to use Rydberg atoms for quantum simulations, because their outstanding versatility will allow us to perform a great variety of useful quantum simulations, by exploiting different aspects of the same experimental and theoretical tools. By implementing not only one but a whole family of Rydberg Quantum Simulators, the project will address both the coherent and incoherent dissipative dynamics of many-body quantum systems, with potential applications in the understanding and design of artificial light harvesting systems, large quantum systems with controlled decoherence, and novel materials. This will be achieved by building upon a novel generic approach to quantum simulation, where Rydberg atoms allow both digital (gate) and analog (interaction) simulations.

In addition to solving problems in fundamental and applied science, the project will build up core competences for quantum science and technologies in mainstream engineering, by using innovative methods for communication, dissemination and exploitation of results. In summary, RYSQ plans (A) to develop a collection of novel experimental and theoretical tools for Rydberg quantum simulators, and (B) to use them as a basis for implementing many important applications of quantum simulations. The project is structured in such a way to allow for efficient exchanges within the consortium, and to maximize the overall outcome of the work.

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