

COLLOQUE DE PHYSIQUE

Lundi 21 mars 2022, 12h30
École de Physique, Auditoire Stueckelberg

«From Quantum Many-Body Physics to Quantum Information with Rydberg Atom Arrays»

Prof. Hannes Pichler

University of Innsbruck

Individually trapped neutral atoms provide a promising platform to engineer quantum many-body systems in a controlled, bottom-up approach. They can be readily manipulated in large numbers and interact strongly when excited to Rydberg states. In this talk I will give an overview over the physics of these Rydberg atom arrays and discuss several phenomena that can be observed in these systems, as well as applications for quantum information processing. First, I will discuss many-body phenomena in and out of equilibrium. In equilibrium, Rydberg atom arrays allow to access quantum critical phenomena at transitions between disordered and ordered phases that break various spatial symmetries, and even topologically ordered states. Out of equilibrium, novel quantum many-body phenomena, such as quantum many-body scars can be observed in these systems. In the second part of this talk, I will show how these phenomena connect to quantum computation, specifically how quantum optimization algorithms can be implemented in current experiments with Rydberg atom arrays.