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Harnessing fundamental interactions between light and atoms

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There is a growing research community that attempts to create new paradigms for the strong coupling of light and matter by way of individual atoms interacting with photons in nano-scale dielectric lattices.

Combining the exquisite level of control of atomic systems, their non-linearity, and quantum functionality with the guiding and trapping of light in linear nano-dielectric waveguides holds promise for creating novel quantum matter built from atoms and photons one particle at a time.

I will discuss nascent work conducted at the Niels Bohr Institute and present the most recent efforts of our new team towards the integration of neutral atom-based quantum simulators with nano-photonic crystal waveguides.

Our research platform has many advantages for many-body physics studies, such as reconfiguration on-the-fly, scalability with many identical atoms, and operation at room temperature. It offers opportunities to explore and engineer strong and tunable atom-atom interactions mediated by light, with a variety of applications in quantum optics including, for example, quantum simulation, synthetic molecules of light, and atom mirrors.

This is a highly multidisciplinary research field and poses a formidable challenge in the laboratory.
I will present some of our tools and methods to overcome many of these challenges.

Presenter: BEGUIN, Jean-Baptiste