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## **Rydberg atoms in ultracold gases - from electron to ion impurities (ONLINE presentation) NB!!! slides are truncated and youtube link temporarily removed to block access to unpublished data**

*mardi 14 septembre 2021 14:00 (1 heure)*

I will report on our endeavor to control single Rydberg atoms immersed in degenerate atomic gases. Such Rydberg impurities allow us to study a rich plethora of effects resulting from the interaction of the Rydberg electron with the surrounding gas such as the formation and structure of ultralong-range Rydberg molecules. More recently, we have demonstrated that a Rydberg impurity can also serve as a precursor to generate a single low-energy ion via tailored photo- or field-ionization schemes. I will discuss how we control the produced ion with small electric fields in the absence of any trapping potentials. This allowed us to observe Rydberg blockade effects induced by a single charge and recently also to study diffusive transport of a single ion through a Bose Einstein condensate [1]. While the dynamics we study here is well captured by semi-classical Langevin collisions, our approach offers intriguing means to enter the elusive quantum regime for ion-atom scattering. In that context, I will finally discuss first results obtained with a new apparatus equipped with a high-resolution ion microscope to study ionic quantum impurities [2].

[1] T. Dieterle, M. Berngruber, C. Hölzl, R. Löw, K. Jachymski, T. Pfau, and F. Meinert, Phys. Rev. Lett. 126, 033401 (2021).

[2] C. Veit, N. Zuber, O. A. Herrera-Sancho, V. S. V. Anasuri, T. Schmid, F. Meinert, R. Löw, and T. Pfau, Phys. Rev. X 11, 011036 (2021).

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