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Creation of Rydberg Polarons in a Bose Gas

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In this talk we review the theory of various types of Bose polarons that can be realized in ultracold atomic systems. We then report the spectroscopic observation of Rydberg polarons in a Bose gas which is in excellent agreement with theoretical predictions [1]. This novel type of polaron is created by excitation of Rydberg atoms in a strontium Bose-Einstein condensate and it is distinguished by the occupation of a large number bound molecular states [2]. The cross-over from few-body bound molecular oligomers to many-body polaron features is described with a functional determinant theory that solves an extended Froehlich Hamiltonian for an impurity in a Bose gas. The detailed analysis of the red-detuned tail of the excitation spectrum describes the contribution from the region of highest density in the condensate and provides a clear signature of Rydberg polarons. This work [1] has been performed in collaboration with groups at Rice University, Harvard University, and the TU Vienna.

References:

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