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Quantum behavior of a heavy impurity in a Bose gas (ONLINE presentation)

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The scenario of an infinitely heavy impurity in a quantum medium is a fundamental problem in physics, with relevance ranging from electron gases to open quantum systems. Here I will consider the case of a heavy impurity interacting with a dilute Bose gas at zero temperature –the so-called Bose polaron. When the impurity-boson interactions are short ranged, I will show that boson-boson interactions induce a quantum blockade effect, where a single boson can effectively block or screen the impurity potential. This behaviour depends on the quantum granular nature of the Bose gas and thus cannot be captured within a standard classical-field description. Using a combination of exact quantum Monte Carlo methods and a truncated basis approach, I will expose how the polaron ground-state energy is linked to the spatial structure of the quantum correlations, spanning the infrared to ultraviolet physics.

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