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Rydberg crystallization detection by statistical means

We investigate an ensemble of atoms which can be excited into a Rydberg state. Using a disordered quantum Ising model, we perform a numerical simulation of the experimental procedure and calculate the probability distribution function $P(M)$ to create a certain number of Rydberg atoms M, as well as their pair correlation function. Using the latter, we identify the critical interaction strength above which the system undergoes a phase transition to a Rydberg crystal. We then show that this phase transition can be detected using $P(M)$ alone. As a possible application in the solid state devices we show how to apply the findings to a system of an exciton condensate.

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