UT AUSTIN PORTUGAL 2019 ANNUAL CONFERENCE

MASTERCLASS I
QUANTUM COMPUTING: PRINCIPLES, ALGORITHMS AND APPLICATIONS

Lecture 2: "Application: Using quantum computing to model matter"
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The quantum theory that govern matter around us, from nuclei, to atoms, molecules, biomolecules all the way up are well defined and would give us almost infinite prediction power if we could solve the resulting equations.

However, the quantum nature of matter poses a formidable challenge: the amount classical computational resources needed to model a given system scales exponentially with size. This problem is known as the exponential wall.

Thus, except for the case of very small systems, we need to use approximations that in many instances are a barrier for the solution of important problems. This lecture will discuss how the use of quantum computers provides an exponential ladder to climb the exponential wall, in the so-called quantum digital simulation. Some simple examples will be presents, together with a discussion on the current state of the art with noisy intermediate scale quantum computers.