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Computational Design of New Topological Materials”

Abstract for an Invited Paper

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Rahman Prize Talk: Pushing the frontier in the simulation of correlated quantum many body systems

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Amazing progress in the simulation of correlated quantum many body systems has been achieved in the past two decades by combining significant advances in new algorithms with efficient implementations on ever faster supercomputers. This has enabled the accurate simulation of an increasing number of problems and helped settle many open questions. I will review a selection of results that my collaborators and I have worked on, from quantum phase transitions in quantum magnets, over supersolidity of bosons in lattice models and Helium-4 to recent simulations of correlated fermions and quantum gases. I will then provide an outlook to the future and discuss how in the short term analog quantum simulators can help tackle problems for which no efficient simulation algorithms exist and how in the longer term quantum computers can be used to solve many of the still open questions in the field. I will finally connect to the topic of the remainder of this symposium by touching on how the design of new topological materials will help in the construction of these quantum computers.