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Computing Correlated Electrons: Roadmap and Roadblocks[1]

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Starting with a reminder of the motivations and key concepts, I will present an overview of computational strongly correlated electron research, its challenges and its current applications and directions. I will explain methods to obtain information from the theory, given the roadblocks one encounters due to strong quantum correlation. The focus will be on the density matrix renormalization group, one of the preferred methods to extract information from the low dimensional theories. A roadmap to study time evolution, temperature dependence, and spectral functions will be discussed. These three topics are of interest for experiments at Oak Ridge National Laboratory's CNMS nanocenter and elsewhere. The talk will conclude with a summary of our efforts to program and make available free and open source codes to compute correlated electrons in models for functional materials.

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