

Abstract Submitted  
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**Sign problems and tensor renormalization group** YUZHILIU, University of Colorado Boulder, SHAILESH CHANDRASEKHARAN, Duke University, ALAN DENBLEYKER, YANNICK MEURICE, University of Iowa, MINGPU QIN, TAO XIANG, ZHIYUAN XIE, JI-FENG YU, Institute of Physics, Chinese Academy of Sciences, JUDAH UNMUTH-YOCKEY, HAIYUAN ZOU, University of Iowa — Sign problems appear generically in simulating a system with a high density of fermions, where the Boltzmann weight oscillates fast. Sign problems also occur in modes with complex couplings or temperature. It remains a challenging problem for Monte Carlo practitioners in condensed matter physics and particle physics. In this talk, I will present our latest results on calculating lattice spin models with complex coupling via numerical tensor renormalization group method. I will also present results on two dimensional XY (or  $O(2)$ ) model with a complex “chemical potential” term. Comparison with the world-line algorithm will be shown and a discussion on possible extension of the tensor renormalization group method to models in other gauge groups and higher dimensions will be followed.

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