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Spectroscopy by Tensor Renormalization Group Method

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We present a spectroscopy scheme for lattice field theory by using tensor renormalization group method combining with transfer matrix formalism. By using this scheme, we can not only compute the energy spectrum for the lattice theory but also determine the quantum number of the energy eigenstate. Unlike spectroscopy by Monte Carlo algorithm, this scheme can extract the energy spectrum with relatively small error without considering large time extent in the lattice. Furthermore, the wave function of one-particle state energy can also be obtained, and its momentum can be classified. Additionally, this scheme can also identify the momentum of two-particle state energy. Lastly, we use Lüscher formula to obtain the scattering phase shift from the two-particle state energy whose total momentum is zero. As a demonstration, we apply this scheme to (1+1)d Ising Model.

Primary authors: Mrs ZAHRA, Fathiyya Izzatun Az (Kanazawa University); TAKEDA, Shinji (Kanazawa University)

Co-author: YAMAZAKI, Takeshi (Univ. of Tsukuba)

Presenter: Mrs ZAHRA, Fathiyya Izzatun Az (Kanazawa University)

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