Contribution ID: **10** Type: **not specified**

Heavy quark thermalization using quantum search algorithm

Heavy quark thermalization in the quark-gluon plasma is one of the most promising phenomena for understanding the strong interaction, where their energy loss and momentum broadening at low momentum can be well described by a stochastic process with drag and diffusion terms. We propose an accelerated quantum circuit Monte-Carlo framework that utilizes the quantum amplitude estimation, the generalized Grover search algorithm, to simulate heavy quark thermalization with quadratically less resources compared to classical Monte-Carlo method. Specifically, we simulate the thermalization of a heavy quark in both 1D and 2D and in isotropic and anisotropic mediums using an ideal quantum simulator and compare that to analytical thermal expectations.

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