ID de Contribution: **288** Type: **Poster**

Real time, non-perturbative quantum simulations in a strong coupling theory —phase structure, jet production, and charge transport in the Schwinger model

mardi 4 juin 2024 18:30 (1 minute)

Addressing QCD processes in a first principle manner requires a real-time, nonperturbative method. It is well known that the Schwinger model [QED in (1+1) dimensions] shares many common properties with QCD, including confinement, chiral symmetry breaking, and the existence of vacuum fermion condensate. As a step in developing such an approach, we report here on fully quantum simulations, using classical devices, of a massive Schwinger model.
In three separate but intrinsically connected works, we study three properties of the strong coupling Schwinger model: the phase structure at finite temperature and chemical potential [Phys.Rev.D 108 (2023) L091501], the chiral condensate modification and entanglement entropy caused by jet propagation [Phys.Rev.Lett. 131 (2023) 021902], and the propagation of vector and axial charge, i.e., non-linear Chiral Magnetic Wave [Phys.Rev.D 108 (2023) 074001].

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Classification de Session: Posters

Classification de thématique: Strangeness in Astrophysics, Other topics