Contribution ID: **130** Type: **Oral report**

Exploring Partonic Collinear Structure and Light-Cone Distribution Amplitudes by Quantum Computing

Wednesday, 10 August 2022 17:15 (15 minutes)

This talk contains two parts, the first part is Partonic Collinear Structure by Quantum Computing and the second part is Exploring Light-Cone Distribution Amplitudes from Quantum Computing.

In the first part, we present a systematic quantum algorithm, which integrates both the hadronic state preparation and the evaluation of the real-time light-front correlators, to study parton distribution functions (PDFs). As a proof of concept, we demonstrate the first direct simulation of the PDFs in the 1+1 dimensional Nambu-Jona-Lasinio model. We show the results obtained by numerical diagonalization and by quantum computation using classical hardware. The agreement between these two distinct methods and the qualitative consistency with QCD PDFs validate the proposed quantum algorithm. Our work suggests the encouraging prospects of calculating QCD PDFs on current and near-term quantum devices. The presented quantum algorithm is expected to have many applications in high energy particle and nuclear physics.

For the second part, light-cone distribution amplitudes (LCDAs) are essential nonperturbative quantities for theoretical predictions of exclusive high-energy QCD processes. We demonstrate the prospect of calculating LCDAs on a quantum computer by applying a recently proposed quantum algorithm, with Staggered fermions, to the simulation of the LCDA in the 1+1 dimensional Nambu-Jona-Lasinio model on classical hardware. The agreement between the quantum simulation and the numerical diagonalization justifies the proposed quantum algorithm. In addition, we find that the resulting LCDA exhibits features shared with the LCDAs in QCD.

Primary authors: ZHANG, Dan-bo (South China Normal University); WANG, Enke (South China Normal University); XING, Hongxi (South China Normal University); ZHU, Shi-Liang (South China Normal University); LI, Tianyin (South China Normal University); LAI, Wai Kin (South China Normal University); LIU, Xiaohui (Beijing Normal University); GUO, Xingyu (South China Normal University)

Presenter: LI, Tianyin (South China Normal University)

Session Classification: Parallel Session VI (2)：Hadron and Flavor Physics

Track Classification: 强子物理与味物理