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**Recommendation letter for Mr. Zhite Yu's application**

Dear Colleagues,

I am writing to provide my strongest support to Mr. Zhite Yu's application for attending the 2023 Quantum Computing Boot Camp, to be held at the Jefferson Lab (JLab) on June 20-20, 2023.

Zhite is now a graduate student in the Department of Physics and Astronomy at Michigan State University (MSU), under the supervision of my friend, Prof. C. P. Yuan, and is expected to receive his Ph.D. in Theoretical Physics in May of 2023. Zhite is going to join JLab Theory Center as a postdoc in this fall.

Zhite focuses his research on QCD and its applications in both high energy particle and nuclear physics. I met Zhite about three years ago when he came to visit JLab, and have been collaborating with him to study exclusive QCD processes for extracting the generalized parton distributions (GPDs), $F(x, \xi, t)$, which provide rich information on the confined spatial distributions of quarks and gluons inside a bound hadron. The Fourier transform of their $t$-dependence at the limit $\xi \to 0$ provides tomographic quark/gluon images of the hadron transverse position $\mathbf{b_T}$ as functions of the active parton momentum fraction $x$. The $x$-moments of GPDs are responsible for many emergent hadronic properties such as the hadron's mass and spin, as well as its internal pressure and shear force.

However, the $x$-dependence of hadron's GPDs is the most difficult to extract from the existing known physical processes for studying GPDs, while the $\xi$ and $t$ dependence are uniquely determined by the kinematics of the scattered hadron. Zhite and I focused our study to search for new physical processes that could provide much more sensitive information on the $x$-dependence of GPDs. We introduced a new class of $2 \to 3$ exclusive processes for extracting GPDs, referred as single diffractive hard exclusive process (SDHEP) [JHEP 08 (2022) 103; Phys. Rev. D107 (2023) 014007]. We identified both the necessary and sufficient conditions for SDHEPs to be factorized into GPDs. We also demonstrated that the SDHEP is not only sufficiently generic to cover all known processes for extracting GPDs, but also well-motivated for the search of new processes for the study of GPDs. Phenomenologically, we focused on SDHEP in photoproduction, and demonstrated quantitatively the enhanced sensitivity on extracting the $x$-dependence of various GPDs from the photoproduction cross sections, as well as the asymmetries constructed from photon polarization and hadron spin that could be measured at JLab Hall D by GlueX Collaboration and future facilities. In addition, we also studied exclusive production of two back-to-back high transverse momentum photons in pion-nucleon collisions and demonstrated the sensitivities of this process for extracting $x$-dependence of GPDs from experimental facility, like J-PARC in Japan and COMPASS++/AMBER at CERN.

It has been a pleasure for me to know and work with Zhite. He is not only a good student to learn and grasp the knowledge of QCD factorization, but also a better student to apply what

he learned to justify the factorization of a new class of exclusive processes that enables us to have better sensitivities for extracting the $x$-dependence of GPDs. He is always prepared for all meetings and discussions, explains his idea clearly, and is open minded for listening to different opinions. His good ability to collaborate makes him an excellent collaborator and a good student for the Quantum Computing boot camp. Having Zhite to attend the upcoming Quantum Computing Boot Camp at JLab will provide him a good opportunity to experience a pedagogical introduction to the QIS, coding tools and hands-on interactive lectures delivered by NP/HEP experts, and to be mentored by the experts with explicit QIS implementations of their physics problems. Such experience might allow him to get involved in projects on quantum computing for nuclear physics, enhancing his knowledge and approaches to his current research on QCD and hadron physics. On the other hand, his knowledge and experience on QCD factorization and its applications to real physical observables can be a valuable addition to the discussions and conversations during the Boot Camp.

In summary, I give my strongest support to Zhite's application to attend the Quantum Computing Boot Camp to be held at Jefferson Lab on June 20-30, 2023 with enthusiasm. Please let me know if you need any more information.

Sincerely,

Jianwei Qiu
Associate Director for Theoretical and Computational Physics, and Theory Center Director, Jefferson Lab;
The Governor's Distinguished CEBAF Professor,
The College of William & Mary