

Lattice Hadron Structure Journal Club

March 7, 2021

The 3D structure of the proton is one of the most important problems in hadron physics in the current and following decades. The JLab 12 GeV program and COMPASS experiment are currently pushing the limits to measure the 3D proton structure. The Electron-Ion Collider (EIC), which is expected to be commissioned in 2030, will be the world's most advanced machine for this study. The observables of interest include but are not limited to the parton distribution functions (PDFs), generalized parton distributions (GPDs), transverse-momentum-dependent (TMD) PDFs, Wigner distributions, light-front wave functions (LFWFs) and the spin decomposition. Since the proton structures are intrinsically nonperturbative, the most promising first-principles method to calculate them is through lattice QCD. In addition to the experimental efforts, lattice QCD with high-performance computing facilities will play a pivotal role in making predictions for the relevant physical observables. Thanks to the inspiring development over the past years, we are now advancing to the stage of precision lattice calculations of the PDFs, GPDs and TMDs.

To facilitate the above goal, we propose to organize a journal club at the Physics Division of Argonne National Laboratory, focusing on the lattice QCD calculations of the 3D proton structure. The journal club is open to all interested physicists, and will cover the most recent developments in both theory and numerical implementations. Unlike seminars, this journal club is more focused on the discussions to ensure the most hardcore questions be asked and answered. Through the discussions, we hope to strengthen the communication of ideas, to sharpen the theoretical tools for precision calculation, and to set milestones for the current and following decades.

Organization

- **Schedule.** Currently we propose to have the journal club once every month. We will decide the day of a month to have the meeting to avoid conflict with other conferences. To accommodate different time zones, the meeting time will switch between 11 AM EDT or 4 PM EDT intermittently.
- **Format.** The meeting will be conducted virtually, and it includes a presentation which is followed by extensive discussions. The length of presen-

tation is about 30 minutes, and is not limited to one speaker. We expect to have an extensive discussion session, which is to be moderated by at least two panelists. Despite how long the discussion is, the total duration of the meeting is expected to be no more than 90 minutes.

- Speakers and panelists. We welcome suggestions of speakers and panelists from the attendants. The panelists are supposed to prepare for their own questions and lead the discussions.
- Topics. The topics of the journal club include, but are not limited to, the lattice calculations of PDFs, GPDs, TMDs, Wigner distributions, LFWFs and proton spin decomposition. It is encouraged to talk about recent publications on both theory and numerical implementations. The organizer is supposed to send out the topic and references at least one week before the meeting, and anyone interested in joining the discussion is encouraged to prepare some auxiliary materials that can be displayed during the meeting.
- Shared resources. We will create an indico page for the journal club. Slides, recorded meetings (if permitted by all the attendance) and notes will be shared on the indico page. We will also create a mailing list for all the attendees. If needed, we may also create a Slack or Microsoft Teams channel for the journal club.