

Theory and computation highlights in December, 2019  
(*Contribution to the Director's Monthly Report to JSABOD*)  
January 7, 2020

With the fast developing world effort to use lattice QCD approach to calculate and explore the 3D partonic structure of hadrons, A. Radyushkin, a Theory joint staff with ODU, completed a timely and comprehensive review article on this development [arXiv: 1912.04244], summarizing the recent progress made in the theory of parton pseudo-distributions and its applications to the extractions of parton distribution functions from lattice QCD calculations. This approach was recently developed at Jefferson Lab and has been used in calculations of the nucleon and pion valence quark distributions. It is also a basis for ongoing extractions of the pion distribution amplitude and generalized parton distributions.

J. Dudek, a Theory joint staff with William & Mary, co-organized an international workshop at the Hamilton Mathematics Institute in Dublin, Ireland, featuring talks discussing contemporary methods in lattice QCD [<https://indico.cern.ch/event/844656/overview>]. Most importantly, this meeting celebrated the ten-year anniversary of the publication of the “distillation” paper [<http://inspirehep.net/record/820396>] which presented a ground-breaking method to compute correlation functions in lattice QCD and has revolutionized calculations of hadron spectroscopy. The development of this technique was led by Prof. Michael Peardon of Trinity College, Dublin, while he was on sabbatical leave at JLab in 2008. At the same meeting, Theory staff, Robert Edwards presented an invited talk on “Lattice Methods for the 2020s” for the future direction and tasks of the field.

The JPAC had its collaboration meeting/workshop at the ECT\* in Trento, Italy from 18 to 20 December 2019 to exchange views on strong dynamics for physics at the frontier between theory and experiments. The program included discussions on ongoing amplitude analyses for CLAS, GlueX, BESIII and LHCb, and aimed at providing an informal environment to develop new ideas and to cross the boundaries between theory and experiment as needed to make further progress in the field. The workshop was attended by 16 physicists, from 5 European countries and from the US and represented a mix of young theorists and experimentalists involved in hadron spectroscopy analysis. The vast majority of attendants were students and postdocs at the early stages of the career. Additional ten participants from Germany, US and Taiwan joined the meeting through a remote connection. The atmosphere at the workshop was open and productive with active discussions on formal and practical aspects of the techniques to extract the physics on hadrons spectrum from data analysis.