Theory and computation highlights in January, 2021
(Contribution to the Director's Monthly Report to JSABOD)
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Providing strong theory support to JLab's experimental program is one of the primary goals of the Theory Center. A new joint article by the CLAS collaboration and JPAC members for extracting the cross section of f2(1270) meson photoproduction from JLab data collected by the CLAS detector [arXiv:2010.16006] has been accepted for publication in Phys. Rev. Lett. They found that the comparison with theoretical models favors an interaction between the photon beam and the produced tensor meson driven by tensor-meson dominance.

An important feature of lattice gauge calculations is the ability to vary the underlying theory and its parameters as a means of revealing the emergence of the important physics. Theory's new postdoc fellow, Dr. Nikhil Karthik, who has recently joined the Theory Center, exploited this feature to study the valence PDF of the pion [arXiv:2101.11632]. In particular, he examined two-color QCD in 2 + 1 space-time dimensions, where by varying the number of flavors the transition from a strongly broken theory to a conformal, ie scale-independent, theory can be explored. The lattice study of the properties of the pion is an important activity of the lattice hadron structure effort, with both a graduate and undergraduate student joining the effort.

The JAM (Jefferson Lab Angular Momentum) Collaboration, led by theory joint staff, Dr. Ted Rogers and his PhD student Eric Moffat at ODU, together with Drs. Nobuo Sato and Wally Melnitchouk in the Theory Center, has performed a comprehensive new Monte Carlo analysis of high-energy lepton-lepton, lepton-hadron and hadron-hadron scattering data to simultaneously determine parton distribution functions (PDFs) in the proton and parton to hadron fragmentation functions (FFs) [arXiv:2101.04664]. Employing a new multi-step fitting strategy and more flexible parametrizations for both PDFs and FFs, the study assesses the impact of different data sets on sea quark densities and confirms the previously observed suppression of the strange quark distribution. The new fit will allow for improved studies of the universality of parton correlation functions, including transverse momentum dependent (TMD) distributions, across a wide variety of processes, as well as the matching of collinear to TMD factorization descriptions.