Theory and computation highlights in October, 2020
(Contribution to the Director's Monthly Report to JSABOD)
November 10, 2020

Nuclear theorists in collaboration with lattice QCD practitioners presented the first Monte Carlo-based global QCD analysis of spin-averaged and spin-dependent parton distribution functions [arXiv:2010.00548]. They treated lattice QCD calculated data on nucleon matrix elements in coordinate space and experimental data under the same conditions. For the unpolarized sector, this new study reveals difficulties in describing the lattice matrix elements at large spatial distances simultaneously with the experimental results. In contrast, good agreement is found in the polarized case between experiment and lattice data, with the latter providing significant constraints on the spin-dependent isovector quark and antiquark distributions.

Strong interactions between quarks and gluons give rise to a rich spectrum of resonances, many of which decay into three or more hadrons. JPAC theorists considered a model of relativistic three-body scattering with a bound state in the two-body sub-channel. They showed [arXiv:2010.08084] that the naive K-matrix type parametrization has nonphysical singularities near the physical region, and demonstrated how to eliminate such singularities by using dispersion relations and also showed how to reproduce unitarity relations by taking into account all relevant open channels.

The search for the existence of "Hybrid Baryons" is a focus of a current CLAS12 experiment. At this month's 2020 DNP meeting, Theory Center's R. Edwards delivered an invited presentation on the subject: "N^* and Hybrid Baryons".