Theory and computation highlights in August, 2022
(Contribution to the Director's Monthly Report to JSABOD)

September 13, 2022

The discovery of so-called exotic states in the spectrum of heavy quark-antiquark systems challenges the understanding of quantum chromodynamics and has given rise to a new field of research in strong interaction physics, with experimental programs at LHC (LHCb, ATLAS, CMS), e+e- facilities (BELLE-II, BES-III), and fixed-target experiments (CERN COMPASS). A recent workshop explored the potential of exotic heavy quarkonium spectroscopy and structure studies with the future EIC (15-18 August 2022, Center for Frontiers of Nuclear Science, Stony Brook University, ~80 participants, https://indico.bnl.gov/event/14792/). It was organized by members of the JLab Theory Center (Astrid Hiller Blin, A. Szczepaniak, C. Weiss) and brought together researchers working in pp/e+e- collider experiments, fixed-target experiments, EIC physics and detector development, and theory. The workshop assessed the status and prospects of present experimental programs, open physics questions in exotic meson physics, and the possible
contributions of the EIC. Unique capabilities that the EIC will bring to this field are photoproduction/electroproduction processes for a clean environment, polarization for structure studies, and far-forward detection for exclusive processes. These capabilities will become particularly valuable as the field moves from spectroscopy to exploring the structure of the exotic states.

The lightest strange vector resonance, $K*(892)$ dominantly decays into $K \pi$, but has a much weaker radiative decay into $K \gamma$, the rate of which has been measured in Primakoff experiments. In a recent paper [arXiv:2208.13755], this decay is computed for the first time in first- principles QCD using the lattice approach, treating the $K*(892)$ as a unstable resonance. A careful consideration is made of the effect of the finite spatial volume of the lattice, including the impact of S-wave scattering of $K\pi$, even when we are considering the P-wave in which the $K*(892)$ appears.