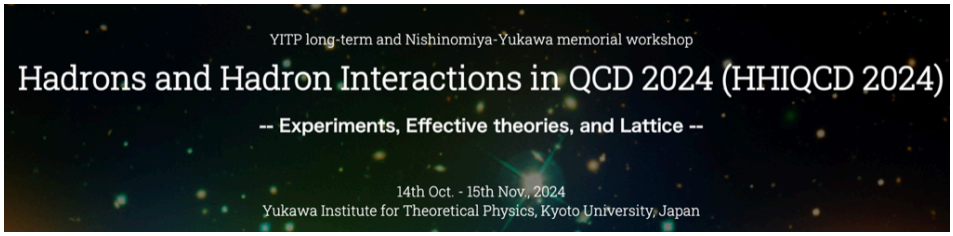

Contribution ID: **132** Type: **3rd week (Nishinomiya-Yukawa symposium)**

Toward Quantum Simulating the Strong Force

Friday, November 1, 2024 11:30 AM (1 hour)

What does the phase diagram of matter, such as matter in the interior of neutron stars, look like? How does matter evolve and thermalize after energetic processes such as after the Big Bang or in particle colliders? How do quarks and gluons and their interactions give rise to the complex structure of a proton or a nucleus, and their response to various probes? A successful lattice chromodynamics (QCD) program has enabled a first-principles look into some properties of matter with the aid of classical computing. At the same time, we have yet to come up with a more powerful computational tool to predict the complex dynamics of matter from the underlying interactions. Can a large reliable (digital or analog) quantum simulator eventually enable studies of the strong force? What does a quantum simulator have to offer to simulate QCD, and how far away are we from such a dream? In this talk, I will describe a vision for how we may go on a journey toward quantum simulating QCD, by taking insights from early developments of lattice QCD and its achievements, by motivating the need for novel theoretical, algorithmic, and hardware approaches to quantum-simulating this unique problem, and by providing examples of the early steps taken to date in establishing a quantum-computational lattice-QCD program.

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