Title: Quantum optical simulation for complex systems

The intrinsic nature of parallelism of quantum states is expected to give extraordinary computational power to quantum processors for certain problems. A linear optical network is one of the simplest quantum processors that it could reveal the (computational) quantum supremacy against classical machines. A photon-sampling problem in a linear optical network, so-called Boson Sampling, is a specially designed mathematical problem, which is expected to be intractable for any classical machine. In my talk, I will present what we can do with the photonic quantum simulator (non-universal quantum computer) practically. Particularly, boson sampling is generalized with Gaussian input states to simulate the molecular vibronic spectroscopy [1,2] and dynamical Casimir effect [3].

[1] J. Huh, G. G. Guerreschi, B. Peropadre, J. R. McClean, and A. Aspuru-Guzik. Boson Sampling for Molecular Vibronic Spectra. Nature Photon. 9 (2015): pp 615-620.
[2] J. Huh and M.-H, Yung, Hierarchy in Sampling Gaussian-correlated Bosons, Preprint: arXiv:1608.03731.
[3] B. Peropadre, J. Huh, C. Sabin, Dynamical Casimir effect for boson sampling. Preprint: arXiv:1610.07777