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Abstract for an Invited Paper
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Hybrid Quantum Systems with Circuit Quantum Electrodynamics[1]

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Quantum Information Processing presents daunting challenges, with competing requirements of fast manipulation, long storage, and long distance transport of fragile quantum states. In aggregate, many of the challenges quantum computation have been met with nanosecond manipulations (quantum circuits), coherence times measured in seconds (atomic ions/nuclear spins), and entanglement transported over kilometers (linear optics), yet thus far no system has achieved all of the necessary components simultaneously. One promising direction is to leverage the best aspects of each system in a hybrid system, much as is done in a conventional computer, where transistors provide fast processing, magnetic memory provides massive long term storage, and information is transmitted via microwaves or fiber optics. A review of the constituent quantum systems, and the types of couplings between them will be presented. The coupling of a superconducting cavity/qubit system to electrons floating on helium will be discussed as an example of how to construct a hybrid system. Recent results on trapping and detection of electrons on helium using a superconducting cavity will be presented.

[1]Andreas Fragner, Yang Ge, Bing Li, Rob Schoelkopf