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### **Hybrid Circuit QED with Electrons on Helium**

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Electrons on helium (eHe) is a 2-dimensional system that forms naturally at the interface between superfluid helium and vacuum. It has the highest measured electron mobility [1], and long predicted spin coherence time [2]. In this talk, we will first review various quantum computer architecture proposals that take advantage of these exceptional properties [3]. In particular, we describe how electrons on helium can be combined with superconducting microwave circuits to take advantage of the recent progress in the field of circuit quantum electrodynamics (cQED). We will then demonstrate how to reliably trap electrons on these devices hours at a time, at millikelvin temperatures inside a dilution refrigerator. The coupling between the electrons and the microwave resonator exceeds 1 MHz, and can be reproduced from the design geometry using our numerical simulation [4]. Finally, we will present our progress on isolating individual electrons in such circuits, to build single-electron quantum dots with electrons on helium. [1] K. Shirahama et al., *Low Temp. Phys.* 101, 439 (1995). [2] S. A. Lyon, *Phys. Rev. A* 74, 052338 (2006). [3] D. I. Schuster et al., *Phys. Rev. Lett.* 105, 040503 (2010). [4] Ge Yang et al., *Phys. Rev. X* 6, 011031 (2016).