



Seminar/Talk

Improving superconducting quantum circuits: transmon charge stability, fluxonium readout and a new protected qubit

Adria Rospars

ENS de Lyon | FR

Host: Johannes Fink

To preserve quantum information, a qubit must be isolated from its environment. To be useful, it must remain accessible to control and measurement. In this talk, I will present three projects from my PhD at ENS de Lyon. Each addresses this tension for a different circuit. The transmon is a circuit whose lowest levels are charge-insensitive, but whose readout is not: the photon number at which it stops being quantum non-demolition depends on offset charge, and reported offset charges drift over minutes to hours. On two devices, we observed transmons whose offset charges were pinned at zero for more than ten days and up to nearly three months. This stability is fragile and disappeared in later cooldowns. I will show how materials characterization points to a thin superconducting layer that shunts the Josephson junction and pins the offset charge. The fluxonium shunts the junction deliberately, with a superinductance, which makes all its levels insensitive to offset charge. However, fluxonium readout remains slower than transmon readout, even at lower target fidelity. Here, I will present a cross-resonance readout, in which the fluxonium, driven at the resonator frequency, transmits the drive to the resonator with an amplitude that scales with the dispersive shift of each state. With appropriate circuit parameters, the resonator can then either stay close to vacuum for one state while being populated for the other, even when the dispersive shift is smaller than the resonator linewidth, or be displaced in opposite directions for two states. I will show both regimes experimentally, using the three lowest levels of the fluxonium. Finally, I will present the xiqubit, a protected qubit in which only pairs of Cooper pairs can tunnel. It addresses two obstacles faced by existing protected designs: sensitivity to junction asymmetry, and the conflict between protection against relaxation and protection against dephasing. The first devices are fabricated and will be measured in the coming months.

Wednesday, November 18, 2026 11:00am - 12:00pm

Office Bldg West / Ground floor / Heinzl Seminar Room (I21.EG.101)



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