Seminar/Talk

Effect of parasitic capacitances on Bloch oscillations measured via dual Shapiro steps

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Measurement of Bloch oscillations in a single Josephson junction in the phase slip regime is a crucial element of metrology that links the current to the frequency standard. Bloch oscillations can be measured by applying a periodic drive to a DC-biased Josephson junction. Phase-locking between the two oscillations then gives rise to dual Shapiro steps. Unlike the normal Shapiro steps, a measurement of these dual Shapiro steps is impeded by parasitic capacitances. These parasitic capacitances can be screened by an on-chip superinductance. However, as the system is constantly driven, the energy has to be dissipated. To that end, we propose to add an additional large off-chip resistance. We investigate the resulting system by a set of analytical and numerical methods. We show that even in the presence of parasitic capacitances, it is possible to observe Bloch oscillations with real- istic system parameters. In particular, we show that the leading effect of the parasitic capacitance is a reduction of the critical voltage of the phase slip junction by a factor of exp(-10kO/Z) where Z is the characteristic impedance formed by the parasitic capacitance and the superinductance.

Tuesday, December 5, 2017 11:00am - 12:30pm
Seminar Room, Lab Building East

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