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Spectral Linewidth of Josephson Flux Flow Oscillators; influence from bias and geometry

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Abstract

Presently the Josephson Flux Flow Oscillator (FFO) is the best on-chip integrated local oscillator in all-superconducting sub-millimeter wavelength receivers based on SIS mixers. Potential applications are spectral investigations in astronomy, atmospheric pollution, biophysics, etc. Theoretically, the linewidth of the emitted radiation from the FFO - as for all other Josephson oscillators - should be given by the well-known lumped junction expression containing only internal noise and quantities measured from the DC I-V characteristic. The FFO, however, differs from the other members of the Josephson oscillator family in needing also an external magnetic field bias. Several theoretical models have been proposed adding also external noise. Experimentally the linewidth may be fitted by a simple extension of the lumped junction expression including also the measured dynamic resistance of the magnetic bias current. We suggest a simple solution to this based on the assumption that the DC bias current e.g. due to geometrical asymmetries creates an additional contribution to the magnetic field in the junction.

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