Effect of Microwaves on the Current-Phase-Relation of diffusive SNS Junctions

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— We investigate the current-phase-relation (CPR) of long diffusive superconductor - normal metal - superconductor (SNS) Josephson junctions under microwave irradiation. The samples consist of narrow Ag bridges with a length between 300 and 500 nm inserted into a Nb loop by shadow evaporation on top of a mesoscopic Hall cross. Our Hall-sensors are based on high mobility GaAs/AlGaAs heterostructures. They directly detect the magnetic response of the loop to an external magnetic field, from which the full CPR can be reconstructed.

The measurements are done in the high-temperature regime $E_{Th} < k_B T$, where $E_{Th}$ is the Thouless energy of the junctions and $\hbar \omega \approx E_{Th}$.

We find that the CPR can be strongly affected by microwave radiation. A strong deviation of the CPR from the well-known sinusoidal $I(\Phi)$ relation is observed: depending on the applied frequency and amplitude, the supercurrent can be strongly suppressed for phase differences in the vicinity of $\phi = \pi$. At some frequencies, the $\sin(\Phi)$ term in the CPR can be completely suppressed, resulting in a dominant second harmonic.

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