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Relaxation Oscillations in Josephson STM Junctions at mK Temperatures[1] MICHAEL DREYER, ANITA ROYCHOWDHURRY, RAMI DANA, WANTING LI, SHU-CHU LIAO, University of Maryland — Small Josephson junctions can exhibit relaxation oscillations [1] between the superconducting and normal state. The switching time depends on the charging time of the junction capacitance and the R-L time constant of the electrical connections, usually in the μs range. We observed similar oscillations in the tunnel current between a Nb sample and a Nb tip in our STM operated at 30 mK. The oscillations occur in two forms, either of which is triggered by lowering the gap resistance. The first type occurs in voltage ranges where the I(V) curves show negative differential conductance, which in turn is caused by coupling to the electrical environment [4]. The oscillations span only a fraction of the superconducting gap and run at maximum frequencies below 10 kHz. The possible existence of "minor" loops was already mentioned in the original article [1], though thought to be a result of an applied in plane magnetic field. The second type appears at lower gap resistances and affects the whole bias range. The frequency was too high to be determined by our current setup, and thus could be due to a conventional relaxation oscillation.Our results will be discussed in detail.

[1] F. L. Vernon Jr. and R. J. Pedersen, J. Appl. Phys., **39** (6), 2661 (1968).

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