Dynamics of Ferromagnetic Josephson Junctions

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Abstract. Ferromagnetic Josephson Junctions have shown negative coupling (π-coupling) and they have been used as a phase provider to generate macroscopic spontaneous current. However to implement more sophisticated quantum circuits it is necessary to understand the effect of the spin dynamics on the phase dynamics. We have performed two sets of experiments in mesoscopic and macroscopic junctions. First, we have found that while the escape rate is thermally activated, an excited state is revealed in underdamped π-junctions by a non-adiabatic phase transformation. This state is likely due to coexistence of 0 and π-coupling. Second, Sub-Gap-Structures (SGS) are measured in sub-micrometer overdamped junctions with a finite magnetization. These SGS are related to supercurrent and they duplicate at the Shapiro steps. We will discuss the coupling between the AC-Josephson effect and spin excitations. Finally, we will show that in mesoscopic ferromagnetic junctions time reversal symmetry is broken.