# Manipulation with Andreev states in spin active mesoscopic Josephson junctions

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We discuss the properties and manipulation with the Andreev bound states in Josephson quantum point contacts containing magnetic scatterers [1]. Two ways of manipulations are studied : (i) time-modulation of the phase difference applied to the contact, (ii) time-modulation of the direction of the magnetic moment of the scatterer. In both the cases, the contact response has the form of a slow time-oscillation of the Josephson current, and in the latter case, also spin polarization of the Andreev levels oscillates in time (electronic spin resonance). These oscillations manifest the Rabi dynamics in the Andreev bound level system of the contact. Although the Josephson effect in magnetic contacts is described by a four-component Nambu field, giving four Andreev bound levels per conducting mode, we find that the driven contact dynamics consists of rotations in the two-level subspaces. This is explained by the fundamental symmetry relation imposed on the four Nambu components by the singlet Cooper pairing, which puts constraints on all the properties of Andreev levels including energy spectrum, population numbers, eigen functions, and interlevel transition rates. The phase manipulation results in rotation in the spin-up electron - spin-down hole subspace, described by conventional two-component Nambu spinor. It results in a periodic inversion of the populations of the Andreev levels, while the total population of the level pair is preserved, similar to non-magnetic contacts. New feature in the magnetic contacts is a selection rule that forbid interlevel transitions in a certain interval of the biasing phases ; in particular, the transitions are completely forbidden for *pi*-junctions. The same physical results are obtained by considering conjugated Andreev level pair corresponding to a spin conjugated Nambu spinor. The magnetic manipulation results in rotations involving pairs of Andreev levels of both spin conjugated Nambu spinors. In terms of the levels of the same Nambu spinor, the corresponding dynamics consists of periodic oscillation of the total population of the level pair leaving unchanged the difference of the level populations. The phase manipulation selection rule also applies to the magnetic manipulation. The magnetic manipulation is only effective if the Andreev levels are initially spin polarized. 1. J. Michelsen, V.S. Shumeiko and G. Wendin, cond-mat. arXiv : 0710.0320.