

Flux tunable entanglement generation in Josephson Traveling Wave Parametric Amplifiers

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ABSTRACT

Josephson Traveling Wave Parametric Amplifiers (JTWPAs) have recently emerged as sources of non-classical microwave radiation, both in three wave mixing (3WM) [1] and four wave mixing (4WM) [2, 3] regime. However, the flux tunability of entanglement generation in JTWPA devices has not yet been systematically investigated.

Here, we report an experimental study of multimode entanglement generation in a prototypical flux tunable JTWPA based on Superconducting Nonlinear Asymmetric Inductive Element (SNAIL) unit cells with alternated flux polarity. Such a device was first introduced in the literature as 4WM amplifier [4] and squeezer [3]. Subsequent investigations have shown that flux tunability can be used to activate residual 3WM, allowing second harmonic generation [5].

Here, we demonstrate for the first time that residual 3WM can also be used for entanglement generation, provided that an appropriate flux operating point is selected. This study provides valuable insights into flux-controlled squeezing generation with TWPAs, possibly extending the range of applications in the framework of microwave photonics.

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