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Josephson waveguide: a new platform for quantum optics

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Josephson waveguides have recently emerged as very promising platform for superconducting quantum science and technologies. Their distinguishing potential resides in ability to engineer them at sub-wavelength scales, which allows complete control over wave dispersion and nonlinear interaction. In this talk I will discuss a Josephson waveguide with strong third order nonlinearity, which can be tuned from positive to negative values, and suppressed second order non-linearity. As first implementation of this versatile meta-material, we operate it to demonstrate a novel reversed Kerr phase-matching mechanism in traveling wave parametric amplification. In a second part, I will report on our observation of broadband vacuum two-mode squeezing in these Josephson waveguides. Besides such advances in amplification performance and the generation of broadband squeezing, Josephson meta-materials open up exciting experimental possibilities in the general framework of microwave quantum optics, single-photon detection and quantum limited amplification.

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