Seminar/Talk

Granular Aluminum Parametric Amplifier beyond the gain- bandwidth limit

Nicolas Zapata
Karlsruhe Institute for Technology (KIT) / DE

Host: Johannes Fink

Superconducting-based parametric amplifiers have become essentialcomponents for the detection and readout of microwave quantum circuits. Amongtheir different implementations, standing-wave amplifiers are particularlyattractive due to their ability to deliver high gain and quantum-limited noiseperformance with flexible engineering and fabrication. However, their operationnear an instability point imposes a fundamental constraint: the instantaneousbandwidth decreases with increasing amplifier gain, a trade-off commonly knownas the gainbandwidth limit. One approach to mitigate this limitation consists ofimpedance engineering, which enables a tenfold bandwidth increase at the 20dB gain levels typically required in quantum measurements [1]. In this work, weimplement a complementary approach based on two simultaneous parametricdrives that activate phase-preserving gain and frequency-conversion processes,enabling parametric amplification without instability [2]. Realized in a granularaluminum Bose-Hubbard dimer [3], this method achieves a fivefold bandwidthenhancement at 20 dB gain, surpasses the conventional gainbandwidth limit upto 25 dB, and maintains near-quantum-limited performance.[1] O. Naaman. & J. Aumentado, PRX Quantum 3, 020201 (2022).[2] A. Metelmann. et al., arXiv 2208.00024 (2022).[3] N. Zapata. et al., Phys. Rev. Lett. 133, 262604 (2024).

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Office Bldg West / Ground floor / Heinzel Seminar Room (I21.EG.101)

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