High Parametric Efficiency in Laser Cavity-Soliton Microcombs

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Laser cavity-soliton microcombs are robust optical pulsed sources, usually implemented with a microresonator-filtered fibre laser [1,2]. In such a configuration, a nonlinear microcavity converts the narrowband pulse resulting from bandwidth-limited amplification to a background-free broadband microcomb. We theoretically and experimentally study the soliton conversion efficiency between the narrowband input pulse and the two outputs of a four-port integrated microcavity, namely the 'Drop' and 'Through' ports. We simultaneously measure on-chip, single-soliton conversion efficiencies of 45% and 25% for the two broadband comb outputs at the 'Drop' and 'Through' ports of a 48.9 GHz free-spectral range micro-ring resonator, obtaining a total conversion efficiency of 72% [3].

References

[1] H Bao, A Cooper, M Rowley *et al.*, Nat. Photonics **13**, 384 (2019)

[2] M Rowley, P-H Hanzard, A Cutrona *et al.*, Nature **608**, 303 (2022)

[3] A Cutrona, M Rowley, D Das *et al.*, Opt. Express **30**, 39816 (2022)