



# Ultra-low phase-noise microwave with optical frequency combs

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# PHOTONIC $\mu\text{W}$ GENERATION W/ FREQUENCY COMBS

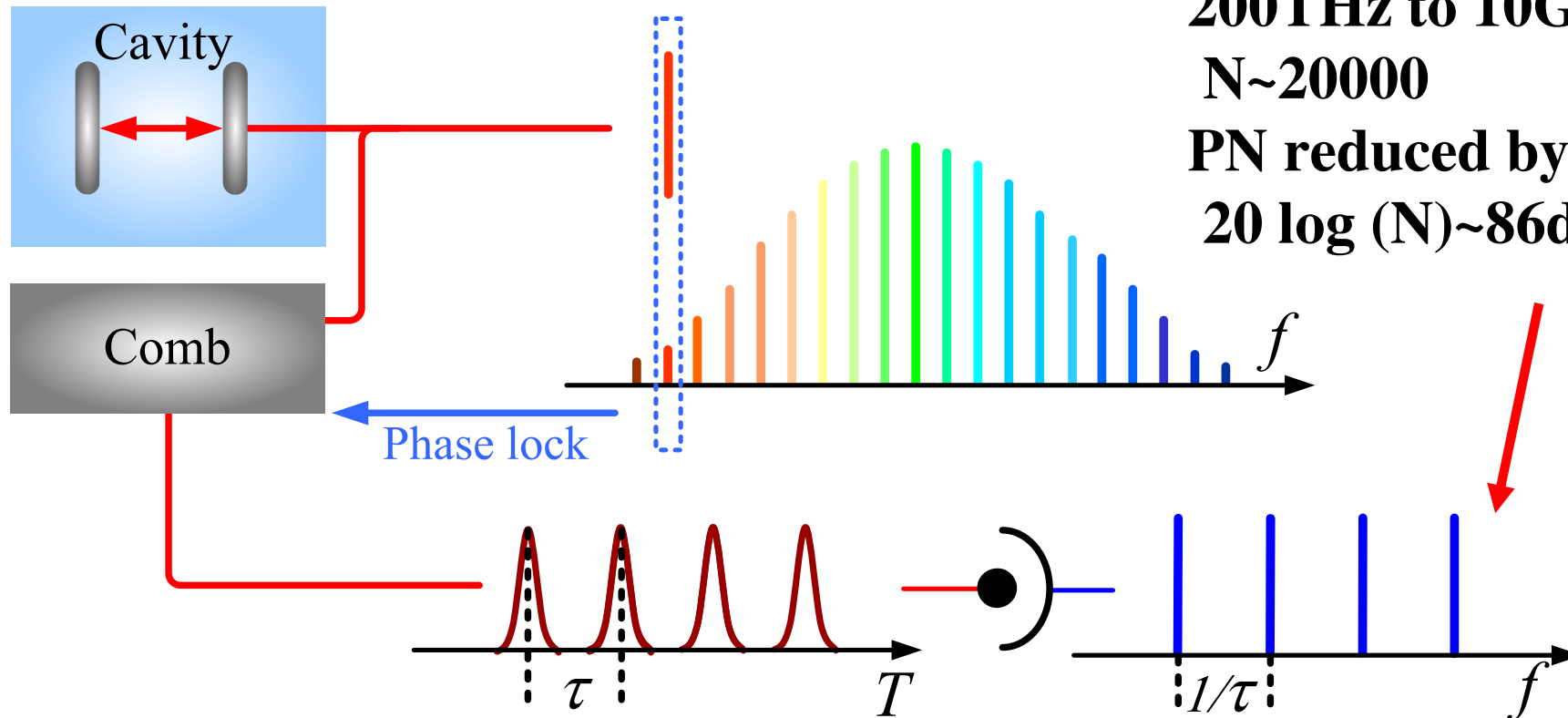
Frequency Combs is frequency divider from optics-to- $\mu\text{W}$

**200THz to 10GHz**

**$N \sim 20000$**

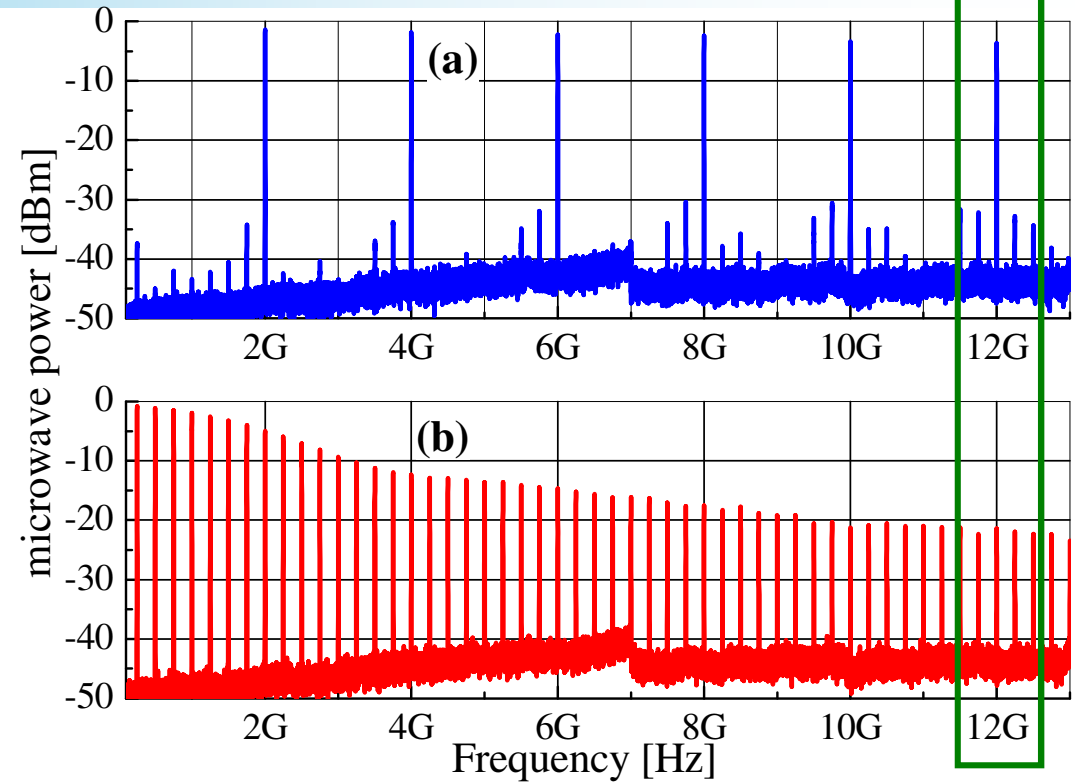
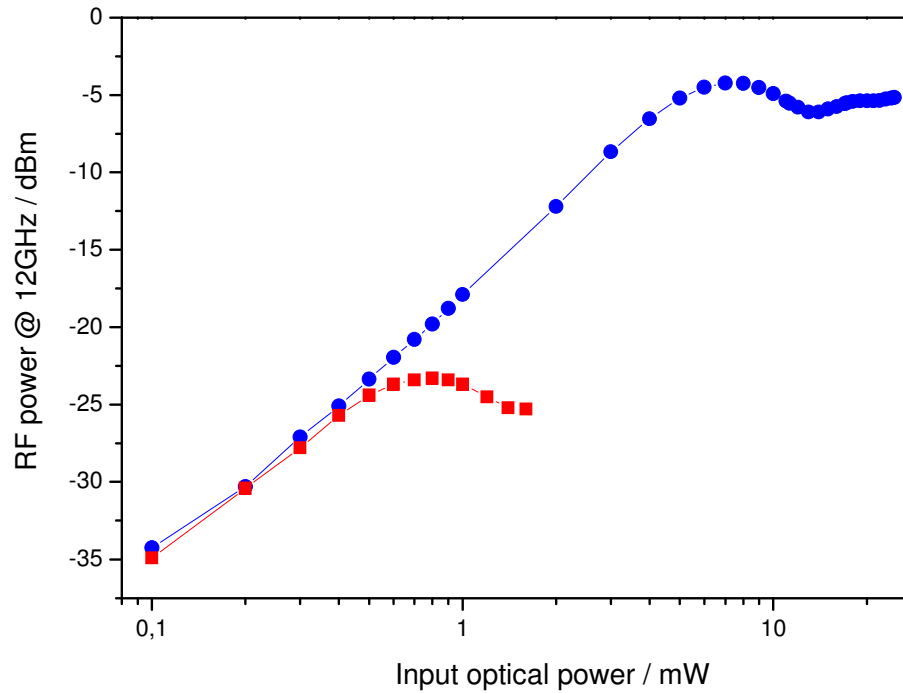
**PN reduced by  $N^2$**

**$20 \log(N) \sim 86\text{dB}$**

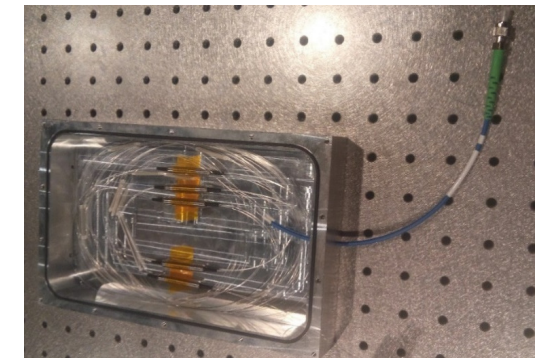
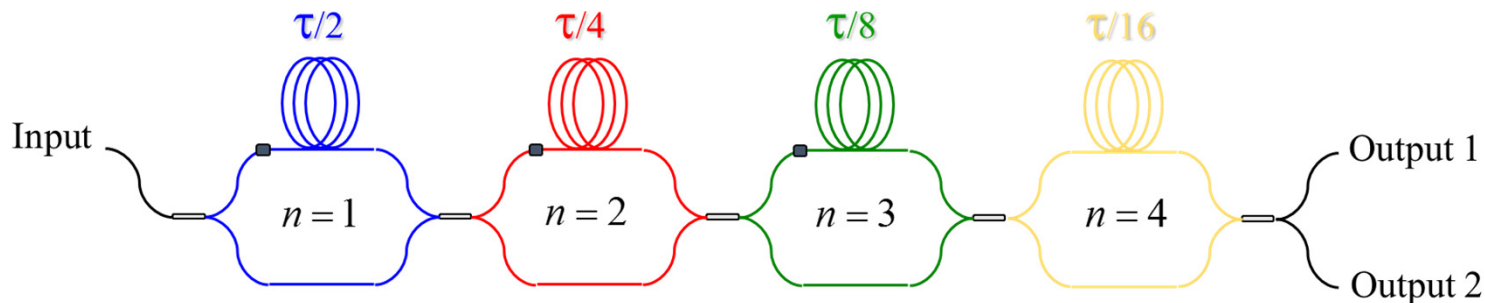


- ✓ no cryogenic, easy operation, potentially compact
- ✓ very phase low noise low&high Fourier frequencies
- ✓ multiple output microwave frequencies, tunable

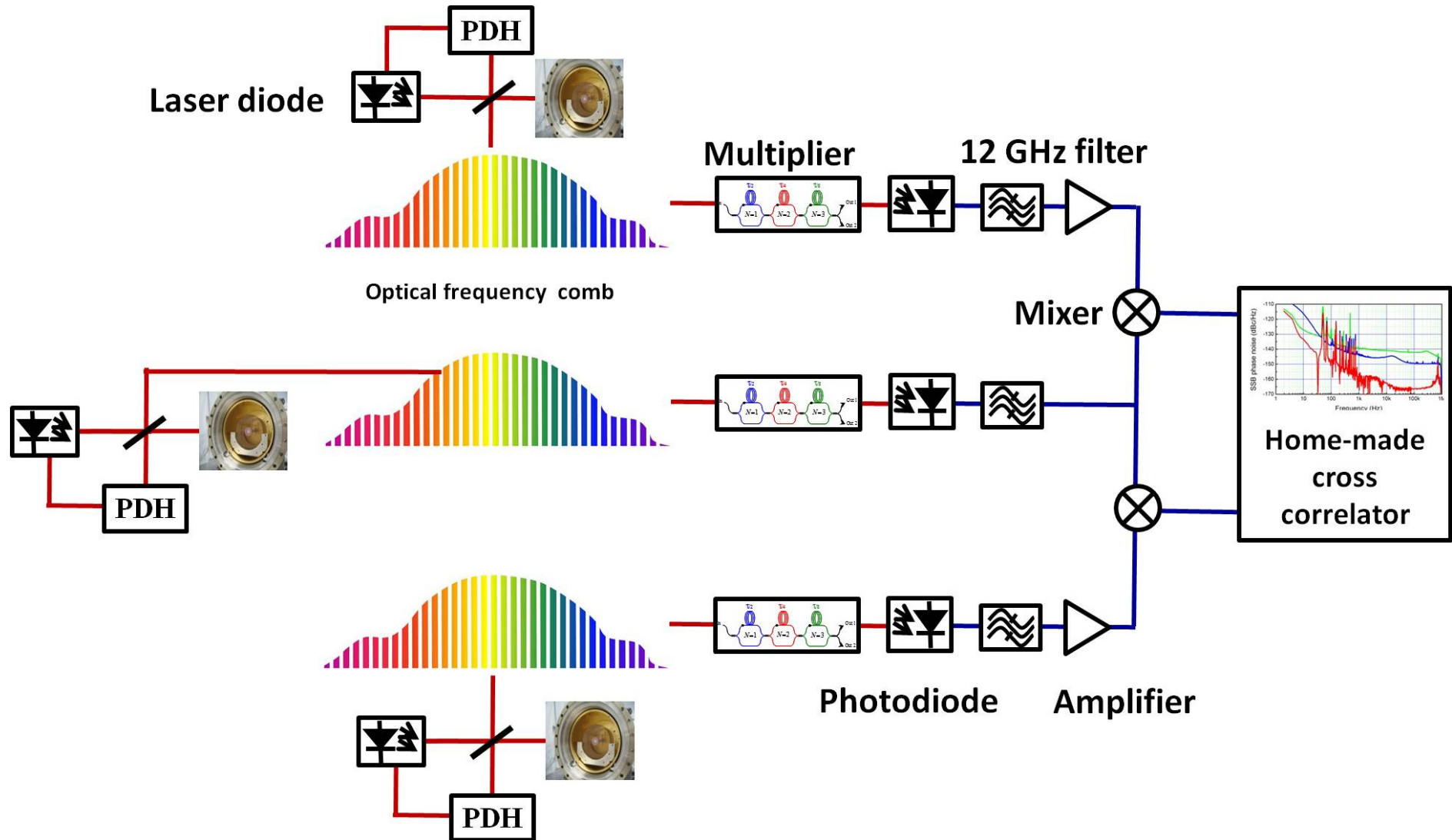
# REPETITION RATE MULTIPLICATION



- ✓ Suppression of unwanted harmonics
- ✓ Simpler microwave filtering



# PHASE NOISE PSD CROSS CORRELATION MEASUREMENTS



Up to 3 cw USL at 1.5 $\mu$ m loosely frequency locked  
 3 comb-based  $\mu$ wave generation

**We need to develop only one system**



# PHASE NOISE PSD@12GHz

