How To Optimize a Quantum Interferometer?

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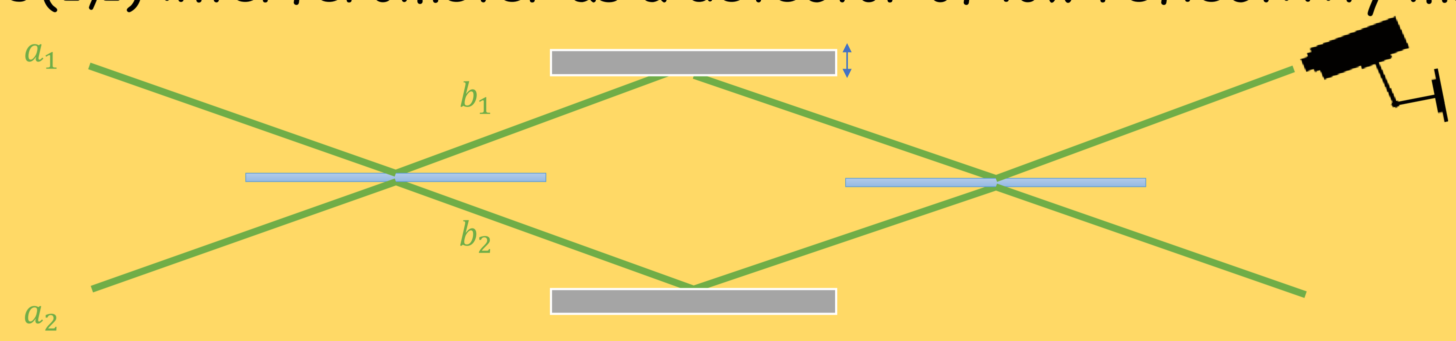
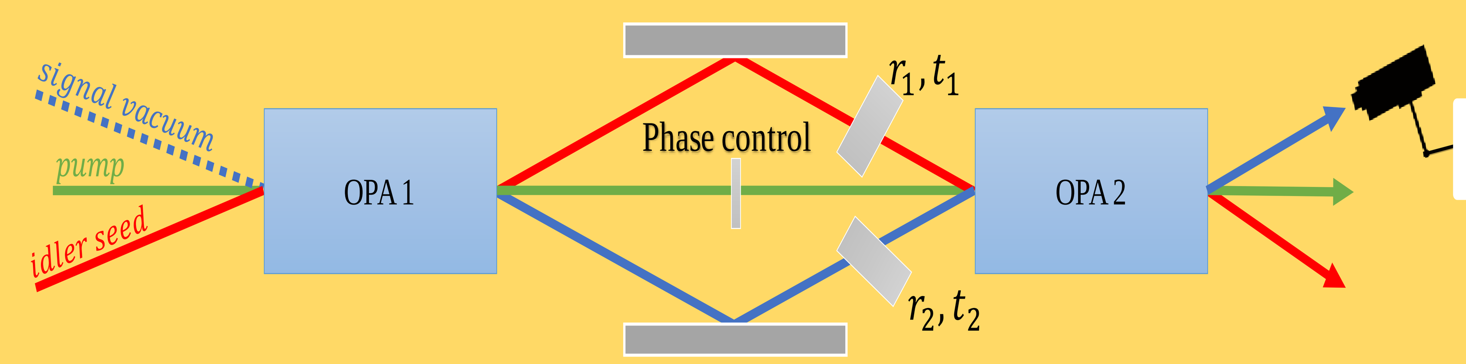
Abstract: We present the analysis of a seeded SU(1,1) interferometer in the high-losses regime. This configuration retains its quantum properties on top of the classical stimulation, rendering it practical in applications of quantum illumination and sensing.

Classical & Quantum Interferometry

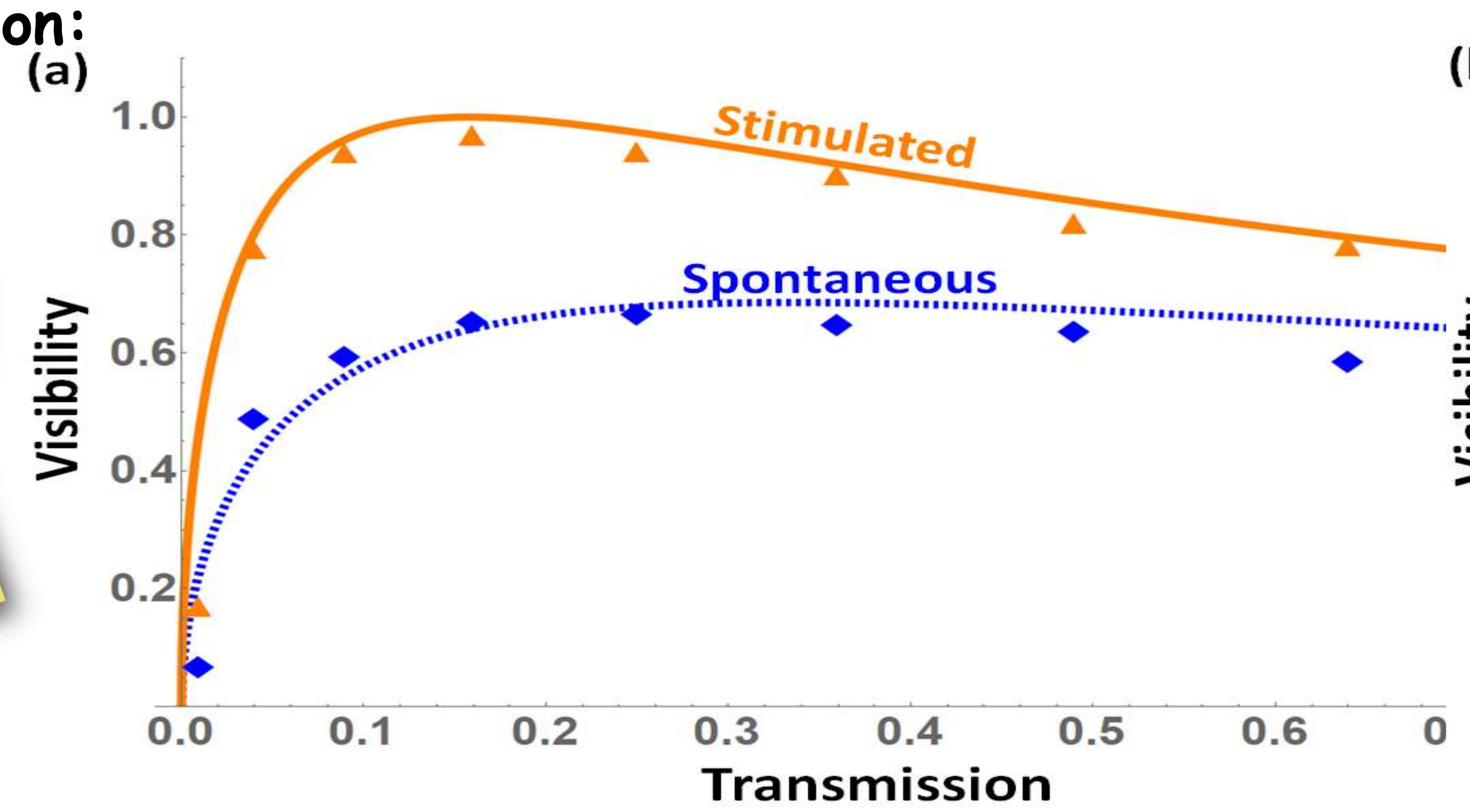
The Heisenberg limit relates to an infinite degree of squeezing, which is not physically attainable. In addition, any loss in an interferometer, acts like a beam splitter, where vacuum noise can creep in and degrade the phase sensitivity. Nevertheless, a quantum RADAR is inherently a lossy interferometer, and its goal is detection in the presence of high loss. We therefore aim to analyze the nonlinear SU(1,1) interferometer as a detector of low reflectivity mirrors.

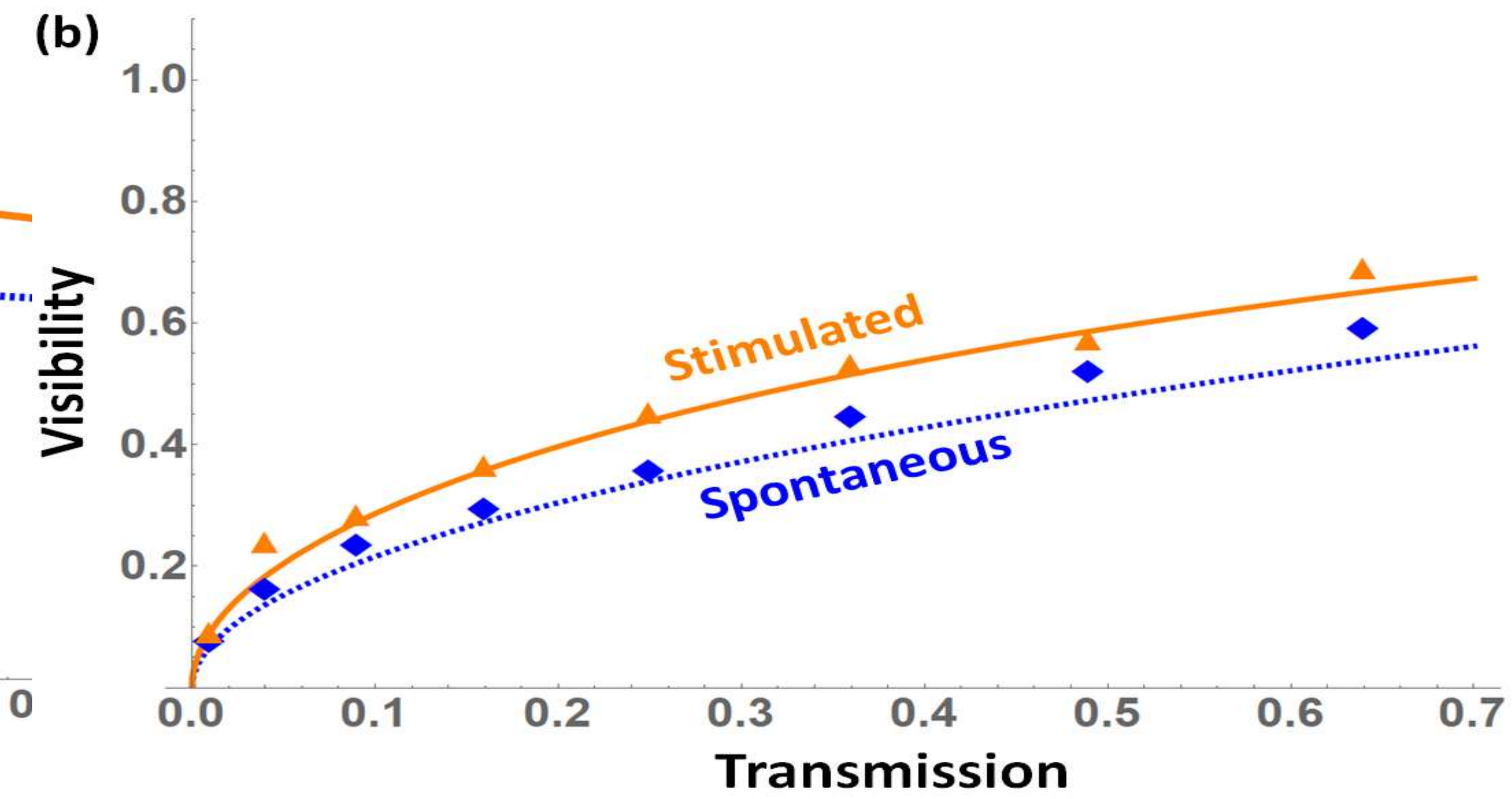




Results and Conclusion:

$$V = \frac{I_b - I_d}{I_b + I_d}$$





Experimental and theoretical visibility as function of the transmission ($T_{s,i}^2$) of the signal (a) and idler (b), for the spontaneous (ni = 0, blue, dashed) and strongly stimulated cases (ni = 10000, orange, solid), with G1 = 0:45;G2 = 0:2. The initial loss of the signal was lower than that of the idler. Each point in the graph is calculated by two consecutive measurements of constructive and destructive interference, with the triangle/diamond markers representing the experimental data. As shown here, the visibility can be twice as high when losses are applied on the signal than on the idler.