

Noise of Semiconductor Ring Lasers in a Bidirectional Regime

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Semiconductor Ring Lasers (SRLs) are widely investigated due to their peculiar two-mode dynamic properties. In particular, bistable operation has been demonstrated in several ring structures, and recently the study of bistability in a tandem of two SRLs [1] unveiled highly appealing features for applications in all-optical switching and optical memories. Unavoidable fluctuations, ultimately related to spontaneous emission processes, are likely to represent the quantum limit for the noise performance of SRLs as optical switch. In this work, we show how spontaneous emission noise sources shape the fluctuations in the two counter-propagating fields intensities. We performed this study by means of a two-mode model for the slowly varying complex amplitudes of the two counter-propagating components of the electric field ($E_{1,2}$) in a SRLs [2].

The results - represented by the Relative Intensity Noise (RIN) for the two counterpropagating intensities $I_{1,2} = |E_{1,2}|^2$ - are compared with recent experimental results [3].

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