# Design and Simulation of GeSbS-Based Microcavities for Advanced Nonlinear Photonics

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Microcavities are fundamental elements in the development of advanced photonic technologies. For more than a decade, they have been used as key devices for emerging technologies with a high prospect that has the potential to solve key challenges in the design of optical sensors, as well as in the development of nanophotonic and quantum devices [1, 2]. In this context, our work explores the use of the chalcogenide material GeSbS [3] as a medium for the fabrication of micro cavities, highlighting its potential for scalability and providing an arsenic (As) free glass to produce high-performance waveguides [4]. Considering the inherent advantages of this material for photonic applications and taking into account that it has a nonlinear refractive index comparable to silicon [4], we performed numerical simulations of various ring-resonators and one-dimensional (1D) micro-cavities, composed of periodic structures of equidistributed holes or also called Bragg reflector distribution [5] (Fig. 1.a). The objective of this paper is to evaluate and compare the optical performance of chalcogenide micro-cavities with respect their silicon-based counterparts, considering different geometries and to identify those structures with the best figures-of-merit, i.e. low nonlinear losses, high quality factors, resource efficiency in manufacturing, stimulated four-wave mixing (StFWM) (Fig. 1.b), in order to establish optimal design criteria for future experimental implementations on frequency comb generation and entangled pair generation via spontaneous parametric down conversion (SPDC).

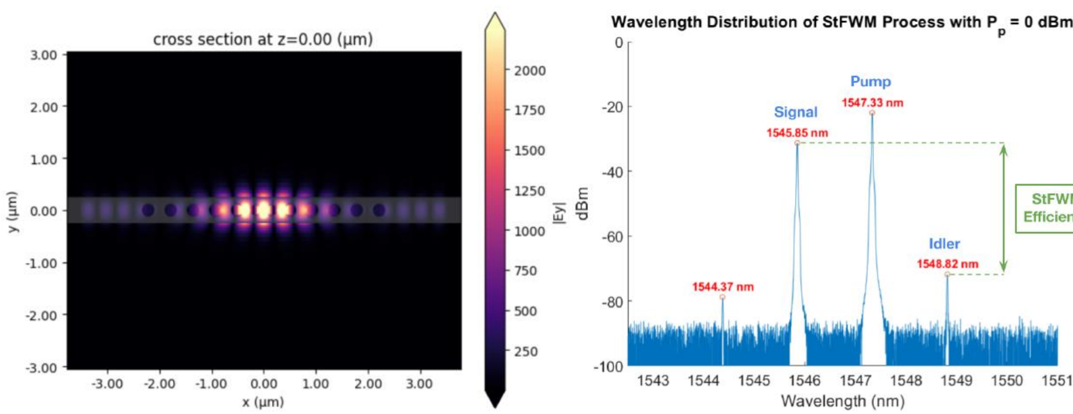


**Figure 1. a) Simulation of a silicon-based Bragg micro-cavity with circular geometry perforations, showing the electric field profile and evidence of a strongly confined optical mode (image on the left). b) Spectral response of the StFWM process within a silicon ring resonator generating an idler signal, this graphic was taken from [6] (image of the right).**

## References

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