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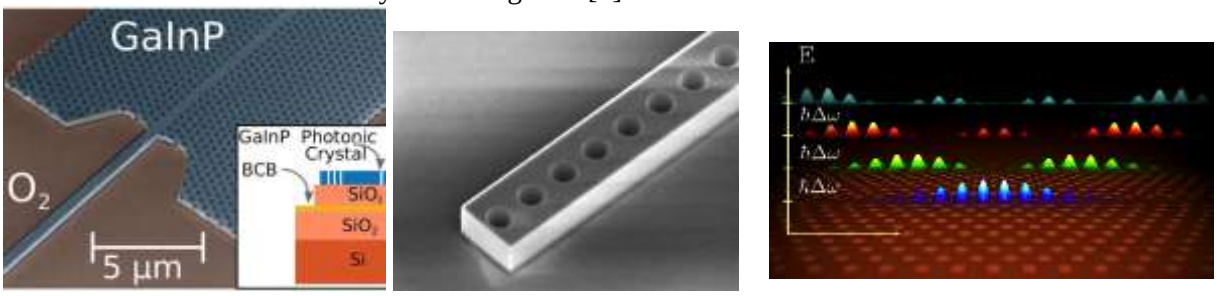
The control of light propagation at the nanoscale is one of the major subjects of present research. By enabling the confinement of the light in volumes as small as few cubic half-wavelength, photonic nanostructures enable revolutionary devices for quantum photonics (single photon sources), optical interconnects in high-performance computing (energy-efficient nanolasers) and analogic photonic computing and neural networks (ultra-fast nanosized nonlinear activation function).
In the last years, academic (C2N) and industrial (TRT) research laboratories are collaborating to miniaturize a critical element of future integrated photonic circuits, namely an optical parametric source[1,2]. This is used for the coherent manipulation of light, in particular in the context of quantum technologies. The revolutionary objective here is to make these effects extremely efficient, to that the could be integrated in a photonic circuit. To this purpose, novel concepts of nonlinear cavities have been developed [3] and are being implemented on a hybrid Silicon nanophotonic technology [1,4] where also ultra efficient lasers have already been integrated [5].



Nonlinear Photonic Crystal technology for ultimate miniaturized non-classical light sources

More generally, the nonlinear effects under study, such as Kerr effect or second harmonic generation, enable a range of possibilities such as the control of light by light, light amplification or the generation of new frequencies.
Within an European Consortium [MOCCA], other partners (a photonic integration SME: AMO), III-V labs, and world- leading theoreticians from university of Rome and Aston) have joined our efforts towards this goal.
We will recruit motivated candidates who will focus on this groundbreaking research where second and third order nonlinear processes will be made ultra-strong owing to semiconductor nanostructures. Here, novel concepts will meet advanced fabrication and suitably developed materials.
The candidate will have the opportunity to develop skills in theory, modelling, cleanroom fabrication and advanced optical measurements through this network of international collaborations.

[1] A. Martin, S. Combrié, A. De Rossi,G. Beaudoin, I. Sagnes, F. Raineri, Phot. Res. 6, B43-B49 (2018)
[2] A. Martin, R. D. Sanchez, S. Combrie, A. De Rossi, F. Raineri, **Opt. Lett. 42**, 599 (2017)
[3] S. Combrié,G.Lehoucq, G.Moille,A. Martin,A. De Rossi, Laser Phot. Rev., 11, 1700099 (2017).
[4] G. Marty …., submitted APL Photonics
[5] G. Crosnier,D. Sanchez,S. Bouchoule,P. Monnier,G. Beaudoin,I. Sagnes,R. Raj,F. Raineri, Nat. Phot. **11**,297(2017)