FNM 2016 Program Committee cordially invites people to submit abstracts for The International Workshop on Functional and Nanostructured Materials to be held in Tbilisi, Georgia 6th -10th September 2016.

Nonlinear nanophotonics with localized phonon polaritons

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Localized phonon polaritons are mid-infrared mixed light-matter excitations, naturally confined in microscopic dielectric structures. They were observed for the first time only few years ago in silicon carbide nanopillar resonators [1], similar to those shown in the left panel of Fig. 1. The extraordinary sub-wavelength confinement offered by those excitations, together with their long lifetimes and the relative facility to fabricate the samples

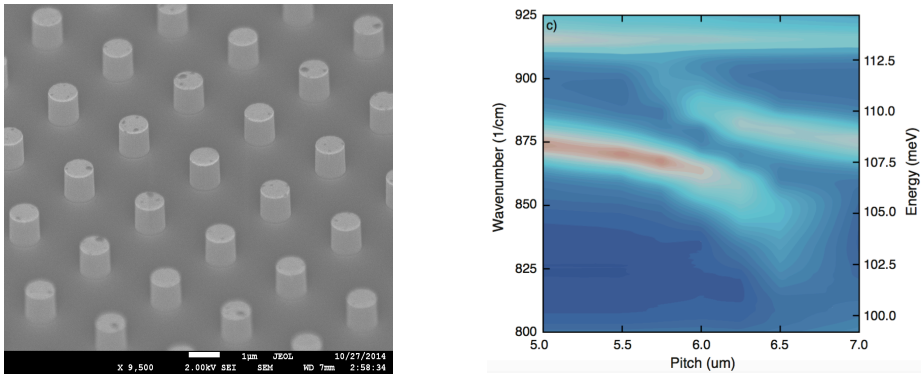

Figure 1. SEM image (left) of a silicon carbide sample patterned by micropillar resonators. Experimental reflectance map (right), highlighting the strong coupling (anticrossing) between the almost dispersionless localised phonon polaritons and the dispersive substrate surface modes as a function of the inter-pillar distance.

needed to observe and manipulate them, make of this novel technology a revolutionary platform for nonlinear mid-infrared quantum polaritonics. We were able to observe for the first time strong coupling in those systems [2], as shown in the right panel of Fig. 1, and we developed a comprehensive quantum theory capable to consistently describe localized phonon polaritons [3]. Building over those important, initial milestones, we recently started investigating nonlinear polariton-polariton scattering processes due to crystal anharmonicity [4], obtaining results consistent with the first nonlinear experiments performed using intense FEL-generated beams [5].

In this talk I will give an overview of this rapidly evolving domain, showing both our most recent results and highlighting future research directions that could allow us to translate in the mid-infrared range a number of the impressive results obtained in the near-infrared range using microcavity polaritons.

[1] J. D. Caldwell et. al., Nano Lett. **13**, 3690-3697 (2013)
[2] C. Gubbin, F. Martini, A. Politi, S. A. Maier, and S. De Liberato, Phys. Rev. Lett. **116**, 246402 (2016)
[3] C. Gubbin, S. A. Maier, and S. De Liberato, arXiv:1605.01975
[4] C. Gubbin and S. De Liberato, In preparation
[5] A. Paarmann, I. Razdolski, A. Melnikov, S. Gewinner, W. Schöllkopf, and M. Wolf, Appl. Phys. Lett. **107**, 081101 (2015)

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