

Phononics: Why is it important for information technologies?

Clivia M. Sotomayor Torres

*Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC and BIST,
Campus UAB, Edifici ICN2, 08193 Bellaterra, Spain*

Phonons, the quanta of lattice vibrations, are ubiquitous in semiconductors and by extension, in optoelectronic and electronic components and systems. In particular, low frequency acoustic phonons carry heat and therefore play a crucial role not only in thermal management, but also in noise reduction strategies. I will provide an introduction to the state-of-the art in our understanding of acoustic phonons, based on our extensive experimental work in model systems consisting of free-standing silicon membranes, 2D Si phononic crystals, InP on silicon microstructures, and the classic MoS₂ 2D material [1–10].

I will discuss the major achievements so far and illustrate the trends in phononics research that are of relevance to information technologies. I will provide an insight on the potential of using phonons as state variables.

This work has been carried out with several collaborators in ICN2 and with J. Ahopelto (VTT), D. Donadio (UC–Davis), and many valuable others.

1. B. Graczykowski *et al.*, *Nano Lett.* **17**, 7647 (2017).
2. M. Sledzinska *et al.*, *ACS Appl. Mater. Interfaces* **9**, 37905 (2017).
3. B. Graczykowski *et al.*, *Nature Commun.* **8**, 415 (2017).
4. J. Jaramillo-Fernandez *et al.*, *Crystal Eng. Commun.* **19**, 1843 (2017).
5. M. R. Wagner *et al.*, *Nano Lett.* **16**, 5661 (2016).
6. M. Sledzinska *et al.*, *2D Mater.* **3**, 035016 (2016).
7. J. Cuffe *et al.*, *Phys. Rev. B* **91**, 245423 (2015).
8. B. Graczykowski *et al.*, *Phys. Rev. B* **91**, 075414 (2015).
9. S. Neogi *et al.*, *ACS Nano* **9**, 3820 (2015).
10. E. Chavez Angel *et al.*, *Appl. Phys. Lett. Mater.* **2**, 012113 (2014).