ADAM MICKIEWICZ UNIVERSITY POZNAŃ

Proposal for Master thesis and/or Erasmus placement project:

Mobile electronic devices use gigahertz (GHz) acoustic phonons to mediate signal-processing with microwave radiation [1]. Thus, it is valuable to know how GHz phonons are generated, how they propagate, and how their energy is dissipated into other microscopic excitations. Recently, we developed a technique termed pumped Brillouin Light Spectroscopy (pumped-BLS) to study photoexcited, coherent GHz phonons in semiconducting nanomembranes [2]. In pumped-BLS, the GHz phonons are pumped with femtosecond laser pulses, and probed with inelastic light scattering (**Fig. 1**).

During this Master thesis and/or Erasmus placement, the student will use the pumped-BLS setup to demonstrate interference between phonons. The femtosecond laser pulses will be split in two beams and one of them will be delayed in time (50/50 beam splitter & delay stage). The two beams will excite coherent, GHz acoustic phonons that will show constructive or destructive interference, depending on their relative phase. This experiment can provide information about: (i) the timescale for phonon-generation, (ii) the lifetime of phonons, and (iii) phonon dephasing. During this project, the Master student will receive hands-on training with Brillouin Light Spectroscopy, optical microscopes, tandem Fabry–Pérot interferometers, femtosecond laser systems, and various optics and optomechanical components. Moreover, they will increase their theoretical knowledge on condensed matter physics, semiconductors and lasers. Finally, they will receive training about scientific writing, preparation of figures and presentations. If the student wants, they will be welcomed to participate in an international collaboration with the Max Planck Institute for Polymer Research in Mainz. The Master student is expected to have: (i) a positive attitude for basic research and experimental work, (ii) basic knowledge of condensed matter physics and/or optics, and (iii) adequate knowledge of the English language.

References: [1] Progress and perspectives on phononic crystals. Vasileiadis *et al*. Journal of Applied Physics 129, 160901 (2021). [2] Frequency-domain study of nonthermal gigahertz phonons reveals Fano coupling to charge carriers. Vasileiadis *et al*. Science Advances 6, eabd4540 (2020).

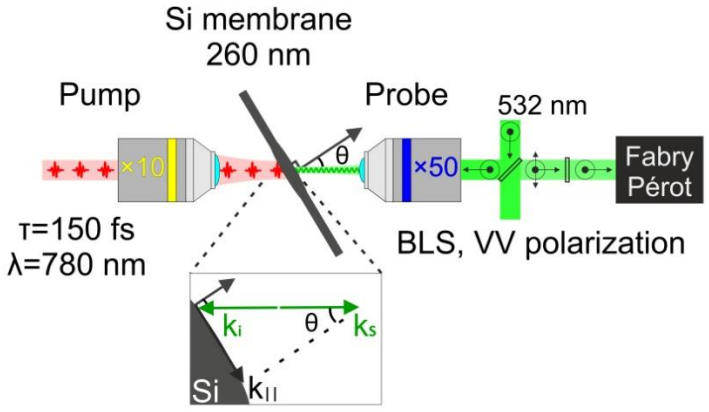

Fig. 1: The experimental setup of pumped-BLS.

For more information:

Where?	**Faculty of Physics, Adam Mickiewicz University, Poznan, Poland** (in collaboration with the group of Prof. G. Fytas in the Max Planck Institute for Polymer research in Mainz, Germany.)
With who?	Supervised by **T. Vasileiadis** & **B. Graczykowski** (Poland) and **K. Andrikopoulos** (Greece).
When?	October 2022 to January 2023 or March to June 2023 (flexible).

For more information contact: thovas@amu.edu.pl **or** kandriko@upatras.gr