Universität Basel

Research Project

Phonon-ART / Uncovering Phonon Dynamics by Advanced Raman Techniques

Third-party funded project

Project title Phonon-ART / Uncovering Phonon Dynamics by Advanced Raman Techniques
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Organisation / Research unit
Departement Physik / Experimental Material Physics (Zardo)
Department
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In many technologies, heat management becomes the bottleneck for the next generation development. Phonons are mechanical vibrations of the atomic lattice that are responsible for the transmission of heat in many relevant materials, like semiconductors, thus controlling them analogously to photons and electrons is indispensable. Advanced time-resolved Raman spectroscopies enable the extraction of relevant information such as phonon spectra, lifetimes, and relaxation times, all critical to understanding thermal transport through advanced materials. In this project we aim to apply these techniques to solve two important open questions: (i) how to engineer the temperature sensors of the future based on diamond-based materials; and (ii) understanding the underlying physical mechanism responsible for deviations from the macroscopic predictions for nanoscale system, such as hypersonic surface phononic crystals, critical to technological applications. For this purpose, I propose four main objectives to the project. First, implementing an ultrafast time-resolved spontaneous Raman method to access the timescale of the absolute phonon mode population. Second, implementing a time-resolved stimulated Raman spectroscopy technique to explore the coherence of selectively excited phonons. Third, extending this technique to a time-resolved coherent anti-Stokes Raman (CARS) spectroscopy to probe the population dephasing lifetime of the system and energy relaxation time. This project will significantly advance the field of ultrafast, nano, materials and thermal science and will extend European knowledge in two different directions: advancing the current metrology tools by means of a fully developed time-resolved CARS setup at University of Basel, and studying energy flow dynamics in novel materials that will impact both fundamental understanding and technological applications.ă

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Add publication

Published results

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4662929, Abad, Begoña; Alberi, Kirstin; Ayers, Katherine E.; Badhulika, Sushmee; Ban, Chunmei; Béa, Hélène; Béron, Fanny; Cairney, Julie; Chang, Jane P.; Charles, Christine; Creatore, Mariadriana; Dong, Hui; Du, Jia; Egan, Renate; Everschor-Sitte, Karin; Foley, Cathy; Fontcuberta i Morral, Anna; Jung, Myung-Hwa; Kim, Hyunjung; Kurtz, Sarah; Lee, Jieun; Leitao, Diana C.; Lemmer, Kristina; Marschilok, Amy C.; Mitu, Bogdana; Newman, Bonna K.; Owens, Roisin; Pappa, Anna-Maria; Park, Youngah; Peckham, Michelle; Rossi, Liane M.; Shim, Sang-Hee; Siddiqui, Saima Afroz; Son, Ji-Won; Spiga, Sabina; Tsikata, Sedina; Vianello, Elisa; Wilson, Karen; Yuasa, Hiromi; Zardo, Ilaria; Zenyuk, Iryna; Zhang, Yanfeng; Zhao, Yudi, The 2022 applied physics by pioneering women: a roadmap, 0022-3727 ; 1361-6463, Journal of Physics D: Applied Physics, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

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