

Contribution ID: 43

Type: Oral

Laser-initiated electron and heat transport in gold-skutterudite CoSb3 bilayers resolved by pulsed x-ray scattering

Tuesday, 16 July 2024 17:10 (20 minutes)

Transport phenomena at interfaces include amongst others the transport of heat or charges, which are of eminent importance in electronic or energy harvesting devices [1]. By using pulsed x-ray scattering with 80 ps time resolution following laser excitation of thin films [2] we were able to resolve the caloric balance in layered structures of gold and a skutterudite, CoSb₃. From the dynamics of heat distribution we conclude on the importance of energy transport across the gold-CoSb₃ interface, which is to a large part carried not by phonons, but by the heated electron gas. Gold is known as a good source for injecting electrons in coupled subsystems due to its weak electron-phonon coupling. The amount of heat transfer across the interface suggests additional transport by ballistic electrons [3].

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[2] A. Plech, B. Krause, T. Baumbach, M. Zakharova, S. Eon, C. Girmen, G. Buth and H. Bracht, nanomaterials 9, 501 (2019).

[3] A. Plech, P. Gaal, D. Schmidt, M. Levantino, M. Daniel, S. Stankov, G. Buth and M. Albrecht, New J. Phys. (2024) submitted.

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Dynamics of surfaces, interfaces, and nanostructures

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Session Classification: Dynamics of surfaces, interfaces, and nanostructures