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What carries heat in novel 2D semiconductors? ANDREA CEPELLOTTI, Ecole Polytechnique Federale de Lausanne, Switzerland, GIORGIA FUGALLO, Ecole Polytechnique, Paris, France, LORENZO PAULATTO, FRANCESCO MAURI, Sorbonne Universites, Paris, France, NICOLA MARZARI, Ecole Polytechnique Federale de Lausanne, Switzerland — When materials are scaled down to the microscopic scale, or when dimensionality is reduced, thermal transport exhibits new intriguing behaviors that are not present in conventional bulk crystals. While phonons are typically considered to be the excitations responsible for carrying heat through a crystal, as dimensionality is reduced, the motion of phonons driven by a temperature perturbation becomes correlated, and collective excitations of many phonons arise [1]. This leads to a wealth of complex phenomena, such as very high thermal conductivity (the highest known conductivities are indeed found in 2D materials), or wave-like heat diffusion, with second sound, hitherto found only in a few exotic materials at cryogenic temperatures, routinely present at room temperature [2]. In this contribution, we show that heat transport in crystals can be described exactly with the kinetic theory of a gas of collective phonon excitations, termed relaxons. In this way, it is possible to recover a microscopic interpretation based on mean free paths and relaxation times without any simplification of the linearised phonon Boltzmann equation. [1] G. Fugallo, A. Cepellotti, et al., Nano Lett. 14, 6109 (2014) [2] A. Cepellotti, et al., Nat. Commun. 6, 6400 (2015)

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