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Ultrafast transient response and electron-phonon coupling in the iron-pnictide superconductor Ba(Fe1-xCox)2As2

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The real-time study of out-of-equilibrium states give access to the dynamical excitation and relaxation of electrons close to the Fermi level, tightly related to the structural and electronic properties of the material. We carried out femtosecond pump-probe reflectivity measurements on a novel pnictide high-Tc superconductor, namely Ba(Fe1-xCox)2As2, studying the relaxation dynamics and especially the role of coherent optical lattice oscillations observed for the first time in an iron-pnictide material [1]. After ultrafast photoexcitation, hot electrons were found to relax with two different characteristic times, indicating the presence of two distinct decay channels. Our analysis indicates that the fast relaxation should be attributed to preferential scattering of the electrons with only a subset of the lattice-vibration modes with a second moment of the Eliashberg function lambda<w2>˜64 meV. The simultaneous excitation of a strong fully symmetric A1g optical phonon corroborates this conclusion and makes it possible to deduce the value of lambda˜0.12. This small value for the electron-phonon coupling confirms that a phonon-mediated process cannot be the only mechanism leading to the formation of superconducting pairs in this family of pnictides [2].

[1] B. Mansart et al., Phys. Rev. B 80, 172504 (2009)
[2] B. Mansart et al., Phys. Rev. B 82, 024513 (2010)

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