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Nonequilibrium "melting" of a charge density wave insulator via an ultrafast infrared laser pulse[1] WEN SHEN, YIZHI GE, AMY LIU, Georgetown University, H.R. KRISHNAMURTHY, India Institute of Science, TOM DEVEREAUX, Stanford University, JIM FREERICKS, Georgetown University — In equilibrium, electrons interacting with lattice vibrations have a transition either to a charge density wave phase (a static modulation of the electronic charge) or to a superconductor (electron pairs move without resistance). If the coupling is weak, the system orders in the Bardeen-Cooper-Schrieffer scenario, where the ordering occurs at some transition temperature Tc and a gap simultaneously forms in the density of states. In strong-coupling, preformed pairs bind at a high temperature (forming a gap in the density of states) and the ordering only occurs at a lower temperature. We employ an exact solution of a model for pump-probe time-resolved photoemission spectroscopy to show how, in nonequilibrium, a third scenario arises: the gap disappears in the presence of a nonzero order parameter, and then reforms well after the pulse has passed. This nonequilibrium "phase transition" scenario qualitatively describes all of the available experiments on the ultrafast melting of a charge density wave.

[1]National Science Foundation, Department of Energy, National Energy Research Scientific Computing Center

Wen Shen
Georgetown University

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