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Enhanced thermoelectric properties in silicon nanowires SLOBODAN MITROVIC, JEN-KAN YU, AKRAM BOUKAI, JAMIL TAHIR-KHELI, WILLIAM A. GODDARD III, JAMES R. HEATH, Division of Chemistry and Chemical Engineering, Caltech, Pasadena, CA 91125 — Recently, we demonstrated that silicon nanowires can be designed and fabricated to achieve an approximately 100-fold enhancement in thermoelectric efficiency compared to bulk silicon. Independent measurements of thermoelectric power, and thermal and electrical conductivities suggest that this improvement is due to phonon effects rather than quantum confinement. Here, we present the study of the scaling laws (i.e. nanowire length/width dependence) for the phonon dynamics and transport. We investigate the influence of the phonon drag, carrier mobility and doping on the thermoelectric properties, and the universality of these findings. This work is supported by the Office of Naval Research, the Department of Energy, the National Science Foundation, and the Defense Advanced Research Projects Agency.

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