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Atomic-Scale Thermoelectric Refrigerator YU-CHANG CHEN, Department of Electrophysics, National Chiao Tung University, Taiwan, YU-SHEN LIU, Department of Electrophysics, National Chiao Tung University — We propose a thermoelectric cooling device based on an atomic-sized junction. Using first-principles approaches, we investigate the working conditions and the coefficient of performance (COP) of an atomic junction as an electronic refrigerator. Our research reveals that the absence of local heating and the suppression of the tunneling barrier by the bridging atoms are favorable for the operation of atomistic refrigerators. From the self-consistent DFT calculations, we show that the atomistic refrigerator may operate at temperatures below 100 K. This is a great improvement in comparison with the vacuum diode. We also investigate the impact of the phononic heat current on the capability of refrigeration in the nano-refrigerator. To minimize the adverse effects of the phononic heat current, we suggest creating a poor mechanical link between the nano-structured object and the electrodes while still allowing electrons to tunnel.

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