Room temperature thermo-electric pumping in mid-infrared light-emitting diodes

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We present measurements of mid-infrared light-emitting diodes generating photons above the conventional limit of 100% electrical-to-optical power conversion efficiency. At low forward bias, lattice heat is absorbed via thermo-electric effects in the carrier injection process and released radiatively through recombination, so the diode acts as a thermodynamic heat pump. Experiments support an effective temperature model for electro-luminescence in the cooling regime and refute alternative interpretations of existing results. Although non-radiative recombination limits the power density available above unity efficiency, experiments confirm the phenomenon at room temperature.

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