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How bilayer excitons can greatly enhance thermoelectric efficiency KAI WU, Stanford Institute for Materials and Energy Sciences, SLAC National Accelerator Laboratory, LOUK RADEMAKER, Kavli Institute for Theoretical Physics, University of California Santa Barbara, JAN ZAANEN, Instituute-Lorentz for Theoretical Physics, Leiden University — Presently, a major nanotechnological challenge is to design thermoelectric devices that have a high figure of merit. To that end, we propose to use bilayer excitons in two-dimensional nanostructures. Bilayer exciton systems are shown to have an improved thermopower and an enhanced electric counterflow and thermal conductivity, with respect to regular semiconductor-based thermoelectrics. We suggest an experimental realization of a bilayer exciton thermocouple. Based on current experimental parameters, a bilayer exciton heterostructures of p- and n-doped Bi_2Te_3 can enhance the figure of merit an order of magnitude compared to bulk Bi_2Te_3. Another material suggestion is to make a bilayer out of electron-doped $SrTiO_3$ and hole-doped $Ca_3Co_4O_9$.

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