High-performance thermoelectric energy conversion by *engineered resonance hybridizations*

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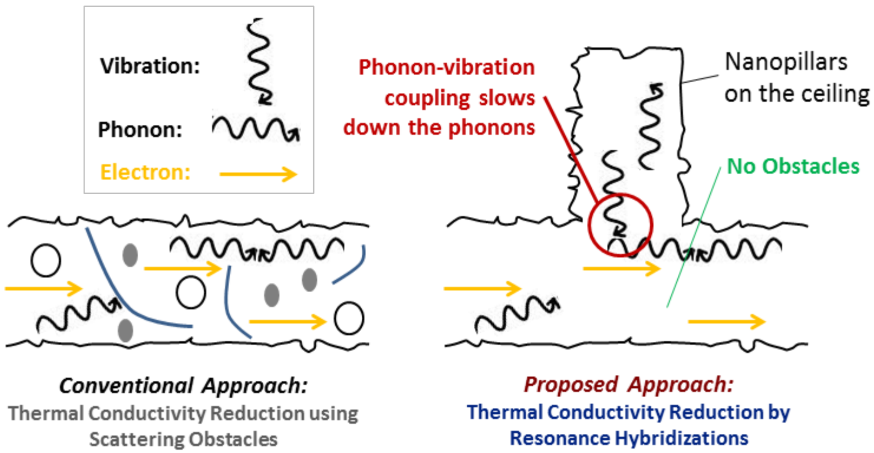
Concept



Davis and Hussein, *Phys. Rev. Lett.* (2014)

Approach

Thermal conductivity reduction by **local resonance hybridizations**

Concept realized in the form of a silicon **membrane with nanopillars** standing on the surface

Localized atomic vibrations in the nanopillars <u>slow down heat-carrying phonons</u> in the membrane and in doing so lead to strong reduction in the thermal conductivity along the membrane plane, with <u>minimum effect on electron transport</u>.

Performance

Unprecedented capability to lower the thermal conductivity:

With membrane/pillar optimization, the predicted thermoelectric conversion figure-of-merit is ***ZT* = 3.1** at room temperature. This is higher than any performance reported in the literature for any material and at any temperature.

Impact

Thermoelectric conversion at such high performance level will outperform conventional fluid-based technologies

Applications include *solid-state refrigeration* and recovery of waste heat in *power plants*, *computer data centers*, *cellphones*, *solar concentrators* and *car engines* to improve efficiency

Work was highlighted in APS *Physics*:
"Slowing Heat without Obstructions"
Physics **7**, 14, 2014
http://physics.aps.org/articles/v7/14

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