

## **Thermoelectric energy conversion in metal-semiconductor nanocomposites and multi layers**

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In this talk we will review the trade offs between the electrical conductivity, the Seebeck coefficient and the electronic contribution to thermal conductivity. We describe how these parameters are related to the bandstructure and how superlattices and hot electron filtering can improve the thermoelectric energy conversion. Novel metal-semiconductor nanocomposites are developed to modify the transport of both electrons and phonons. Theory and experiment are compared for a series of samples based on rare-earth ErAs nanoparticles in InGaAlAs semiconductor matrix as well ZrWN/ScN multilayer films. Potential to reach energy conversion efficiencies exceeding 15-20% is discussed. We also describe how similar principles can be used to make micro refrigerators on a chip and remove hot spots in integrated circuits. In this case the three dimensional heat and current spreading plays an important role.

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