Physics Colloquium

Tuesday, October 3rd at 3:30 pm in SC 234

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Materials for Harnessing Thermoelectric Flow

Thermoelectricity is an environmentally friendly method for energy conversion and power generation. Thermoelectricity relies completely on a solid-state scheme of operation, thus materials with desired properties are necessary to achieve efficient devices. A fruitful direction to achieve this has been to utilize systems whose atomic lattices promote anharmonic scattering for reduced thermal conductivity. In this context, inorganic clathrates hold promise since they can accommodate guest atoms ratting in the voids and giving rise to phonon scattering lowering the thermal conductivity. I will discuss some recent calculations based on first principles simulations showing interesting structure-property relation in the relatively unexplored class of type II Sn clathrates [1, 2]. Recently, a new direction based on the design of metamaterials for manipulating thermal and electric flow has been also proposed [3]. This is a unique and versatile approach, which takes advantage of transformation optics and it can achieve unusual outcomes, such as thermoelectric cloaking by using materials with highly anisotropic and inhomogeneous properties. These efforts constitute a significant step forward towards finding new ways (beyond electronic-phonon structure engineering) to control and manipulate thermoelectric transport at larger scale applications.

1. A.R. Khabibullin, T.D. Huan, G.S. Nolas, and L.M. Woods, Cage disorder and gas encapsulation as routes to tailor properties of inorganic clathrates, Acta Mater. 131, 475 (2017);
2. K. Wei, X. Zeng, T.M. Tritt, A.R. Khabibullin, L.M. Woods, and G.S. Nolas, Materials **9**, 732 (2016);
3. T. Stedman and L.M. Woods, *Cloaking of thermoelectric transport*, Sci. Rep. **7**, 6988 (2017).

Refreshments at 3:00 pm in SC 103