CEA - Saclay 91191 Gif-sur-yvette Cedex

**Service de Physique de l'Etat Condensé**

**Jeudi 18 avril 14h15**

**Orme des Merisiers SPEC Salle Itzykson, Bât.774**

# Thermal Transportand Thermoelectric Coefficients Near the AndersonTransition, in Molecular Junctions and in short and long hopping chains.


## Yoseph Imry

Weizmann Institute of Science


We start by reviewing thermal and thermoelectric linear transport, including the various coefficients the symmetry relations among them (Onsager) and what determines their magnitudes. Applications will be briefly mentioned along with the requirements on the above coefficients Next, the Anderson localization transition will be considered at finite temperatures. This includes the electrical conductivity as well as the electronic thermal conductivity and the thermoelectric coefficients[1−3]. The latter becomes relatively large at low temperatures near the transition, its interesting critical behavior is found. A method for characterizing the conductivity critical exponent, an important signature of the transition, using both the conductivity and thermopower measurements, is outlined.
Then, the thermoelectric transport through a molecular bridge[4] a model nanosystem– will be discussed, with an emphasis on the effects of inelastic processes of the transport electrons caused by the coupling to the vibrational modes of the molecule. In particular it is found that when the molecule is coupled to a thermal bath of its own, which may be at a temperature different from those of the electronic reservoirs, a heat current between the molecule and the reservoir can be generated by the usual electric current. Expressions for the transport coefficients governing this conversion and similar ones are derived, and a possible scenario for increasing their magnitudes is outlined. This interesting case of three terminals (3t) with two types of carriers presents novel possibilities.
Finally, thermoelectric transport in a two site nano- or molecular system is considered 5 and then generalized to long chains. It is shown that this generalization of the Mahan-Sofo breakthrough to 3t and including a change of the transported energy, can produce large interesting thermoelectric figures of merit. For the long chain, we establish the surprising result that the (linear transport) thermopower is determined by the systems edges.


1. M. Cutler and N. F. Mott, Phys Rev. 181, 1336 (1969).
2. U. Sivan and Y. Imry, Phys Rev B33, 551 (1986).
3. Y. Imry and A. Amir, The localization transition at finite temperatures: electric and thermal transport, in 50 years of Anderson Localization, edited by E. Abrahams (World Scientific, Singapore, 2010) arXiv:1004.0966.
4. O. Entin-Wohlman, Y. Imry and A. Aharony, Three-terminal thermoelectric transport through a molecular junction, PRB 2010, arXiv:1005.3940.
5. J-H Jiang, O. Entin-Wohlman and Y. Imry, Thermoelectric three-terminal hopping transport through one-dimensional nanosystems, Phys. Rev. B85, 075412 (2012); arXiv:1201.4031