

CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé
SÉMINAIRE

Mercredi 24 avril 11h15

Orme des Merisiers SPEC Salle Itzykson, Bât.774

**Optimization of thermoelectric generator
operation with dissipative coupling to heat
baths**

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When a thermoelectric generator (TEG) is coupled to two heat baths with non-ideal heat exchangers, its performance crucially depends on the working conditions. From a thermodynamic viewpoint a TEG is a heat engine operating in a steady-state mode using the thermoelectric materials conduction electrons as a working fluid. An analysis of performance optimization thus must focus on the interplay between the constitutive laws of the device and those which govern its interaction with the environment. We start by giving an analytical form for the current-dependent thermal conductance of the TEG, which characterizes the coupling between the input and output of the device. This reflects the global displacement of the charge carriers in the system, which we associate to a convection process in opposition to conduction related to both phonon transport and heat transport by electrons under open circuit condition.

We thus define a thermoelectric analogue of the Prandtl number, which gives a quantitative measure of the performance of the TEG. Then, using a force-flux formalism we demonstrate that optimal performance may be reached if the conditions for both electrical and thermal impedance matching are met. We conclude our presentation with a discussion on the trade-off between efficiency and power.

A coffee break will be served at 11h00. The seminar will be given in English.

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