Unveiling the limitations of energy conversion in quantum systems

Quantum energy conversion devices such as solar cells, photosynthetic systems, or molecular junctions exhibit a surprising effect known as the turnover effect: their power increases with the interaction strength with the energy source but drops to zero for very strong interactions (see figure). *As a consequence of the turnover effect, the performance of several non-equilibrium devices is limited by a bound on the electrical current, heat flow, power, or reaction rate*. **The potential technological applications of these devices call for devising strategies to prevent or minimize the consequences of the turnover effect.** In this project, we will develop numerical and/or analytical models to understand the turnover effect and identify strategies to mitigate it, thereby unleashing the full potential of these devices for multiple technological applications.

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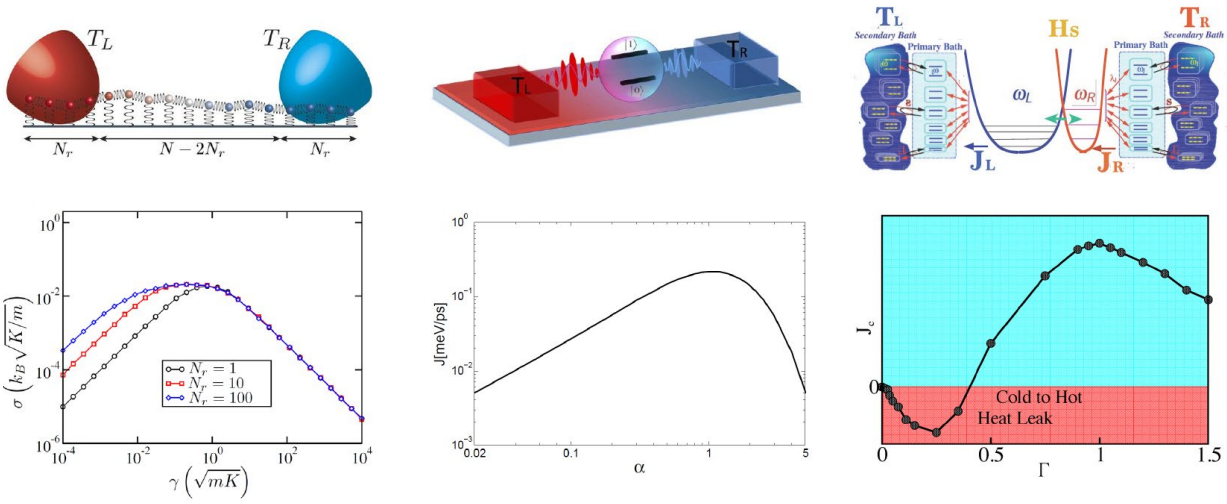

References:

- Turnover effect in different quantum devices. From left to right: Dubi, Y. et al. *Nano Lett.* **9**, 97–101 (2009);
- Wang, C., Ren, J. et al. *Sci Rep* **5**, 11787 (2015)
- Katz, G. et al. *Entropy* **18**, 186 (2016).

Prerequisites: Basic course on Quantum mechanics, basic programming skills in any language (python, Mathematica, Matlab, etc)