All-thermal transistor based on stochastic switching

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Fluctuations are strong in mesoscopic systems and have to be taken into account for the description of transport. We show that they can even be used as a resource for the operation of a system as a device. We use the physics of single-electron tunneling to propose a bipartite device [1,2] working as a thermal transistor [3]. Charge and heat currents in a two terminal conductor can be gated by thermal fluctuations from a third terminal to which it is capacitively coupled. The gate system can act as a switch that injects neither charge nor energy into the conductor hence achieving huge amplification factors. Non-thermal properties of the tunneling electrons can be exploited to operate the device with no energy consumption.

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