Speaker: Gonzalo MANZANO (IFISC, Spain)

Title: **Thermodynamics of Gambling Demons**

Abstract: The stochastic nature of games at the casino allows lucky players to make profit by means of gambling. Like games of chance and stocks, small physical systems are subject to fluctuations, thus their energy and entropy become stochastic, following an unpredictable evolution. In this context, information about the evolution of a thermodynamic system can be used by Maxwell's demons to extract work using feedback control. This is not always the case, and a challenging task is then to develop efficient thermodynamic protocols achieving work extraction in situations where feedback control cannot be realized, in the same spirit as it is done on a daily basis in casinos and financial markets. We introduce and realize gambling demons who, following a customary gambling strategy to stop a nonequilibrium process at stochastic times, are able to extract more average work than the free energy change. We derive second laws in the presence of gambling, and a set of universal stopping-time fluctuation relations for the work done in classical and quantum stochastic non-stationary processes. We test experimentally our results in a single-electron box, where an electrostatic potential is used to drive the dynamics of individual electrons tunneling into a metallic island.