UNIWERSYTET SZCZECIŃSKI
INSTYTUT FIZYKI

Środowe seminarium w Instytucie Fizyki

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"Quantum superposition of thermodynamic evolutions with opposing time's arrows"

Microscopic physical laws are time-symmetric, hence, a priori there exists no preferential temporal direction. However, the second law of thermodynamics allows one to associate the "forward" temporal direction to a positive variation of the total entropy produced in a thermodynamic process, and a negative variation with its "time-reversal" counterpart. This definition of a temporal axis is normally considered to apply in both classical and quantum contexts. Yet, quantum physics admits also superpositions between forward and time-reversal processes, whereby the thermodynamic arrow of time becomes quantum-mechanically undefined. In this talk, I will show that a definite thermodynamic time's arrow can be restored by a quantum measurement of entropy production, which effectively projects such superpositions onto the forward (time-reversal) time-direction when large positive (negative) values are measured. Remarkably, for small values (of the order of plus or minus one), the amplitudes of forward and time-reversal processes can interfere, giving rise to entropy-production distributions featuring a more or less reversible process than either of the two components individually, or any classical mixture thereof.