

Quantum Transport and Thermodynamics: New Avenues in Quantum Materials QuTTNAQMa

1 Proyectos I+D+i» 2020 Retos Investigación» y «Generación de Conocimiento PID2020-117347GB-I00

2 IPs: Rosa López and Llorenç Serra. Members: David Sánchez, Sungguen Ryu, Misha Moskalets, Nassima Benchtaber. External: Kaveh Delfanazari (University of Glasgow), Hongqi Xu (University of Beijing)

3 Area: Ciencia y tecnologías de materiales
Sub-area: Materiales con funcionalidad eléctrica, magnética, óptica o térmica

4 Budget: 72.000 €. Starting date: 01-09-2021. Finishing date: 31-08-2024



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QuTTNAQMa

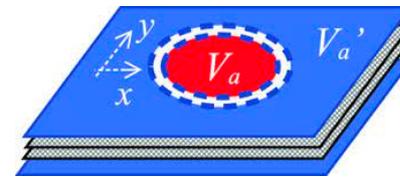
WP1: TOPOLOGICAL SYSTEMS

WP2: QUANTUM THERMODYNAMICS

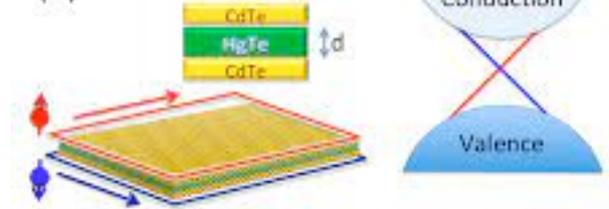
WP3: THERMOELECTRICITY

WP4: COMPLEX CORRELATED SYSTEMS

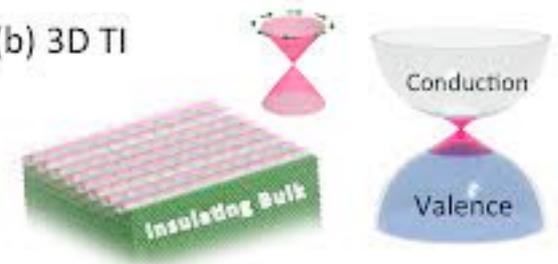
Bilayer graphene



(a) 2D TI



(b) 3D TI



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QuTTNAQM_a

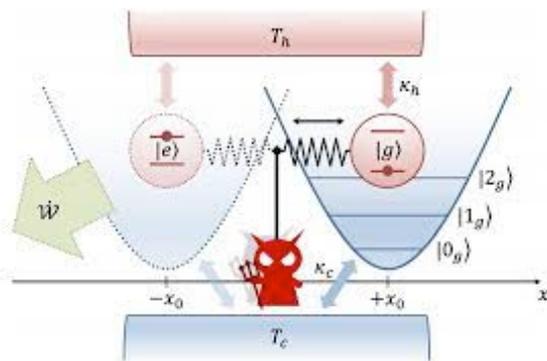
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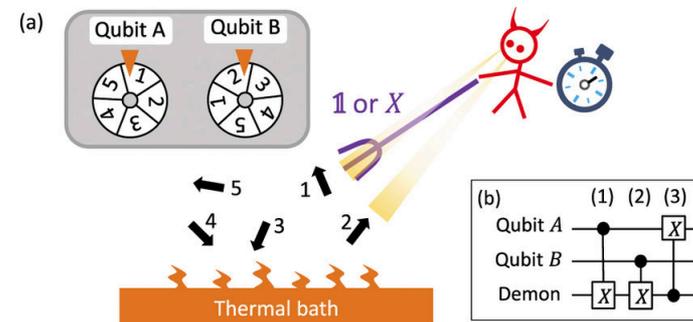
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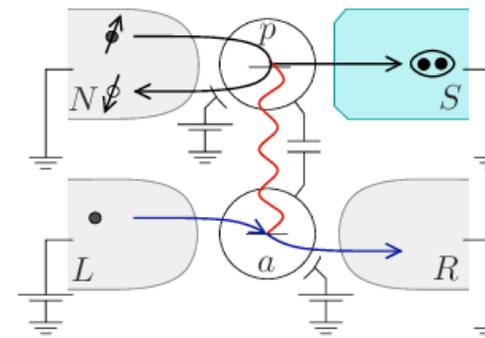
Maxwell demon
and coherence



Quantum Consensus



Quantum thermal machines



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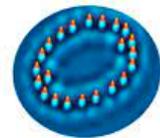
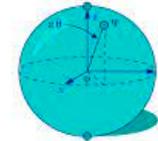
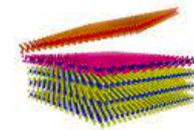
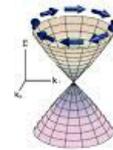
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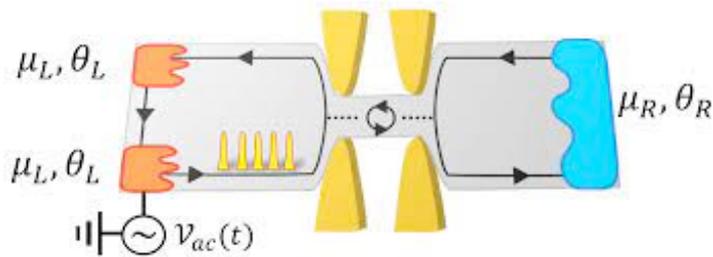
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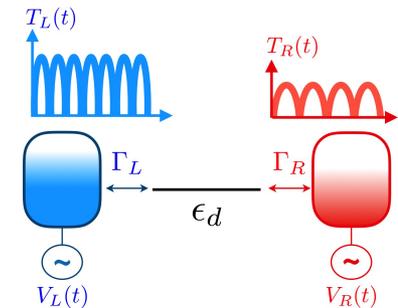
IA applied to search good thermoelectrical materials (quantum)



Time dependent thermal machines



Time dependent Temperature



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QuTTNAQMa: Rich complexity in quantum materials

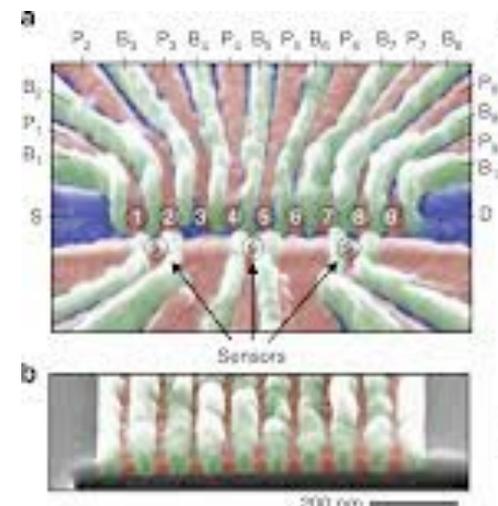
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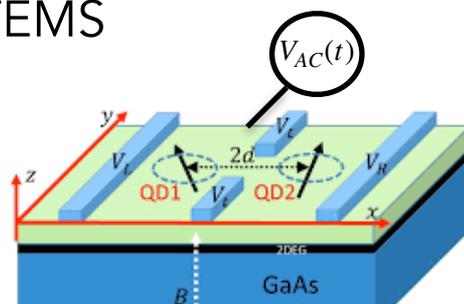
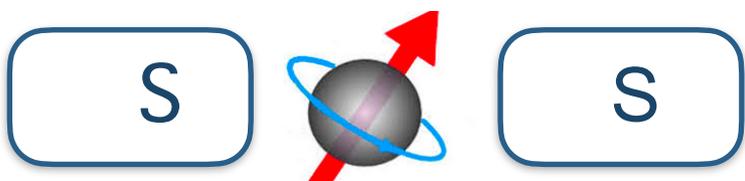
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Long range interactions in a 1D quantum dot array



Kondo effect with superconductivity



Correlations driven by AC field



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1

PROYECTE DE RECERCA CIENTÍFICA I TECNOLÒGICA GOVERN BALEAR.
Materia Cuántica Topológica: Precisión y Energía (MaCToPE)

2

IP: Rosa López. Members: Llorenç Serra, Michael Moskalets, Sungguen Ryu,
Nassima Benchtaber

3

PDR2020/12. Budget: 37.200 €. Starting date: 01-12-2021. Finishing date: 30-11-2024



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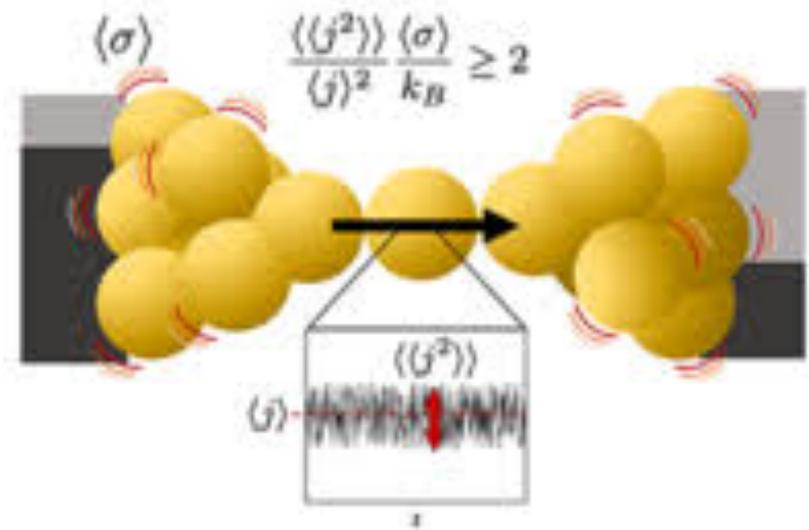
Dissipation versus Precision

Quantum Thermodynamics

$$\sigma \frac{\langle \delta X \rangle^2}{\langle X \rangle^2} \geq 2$$

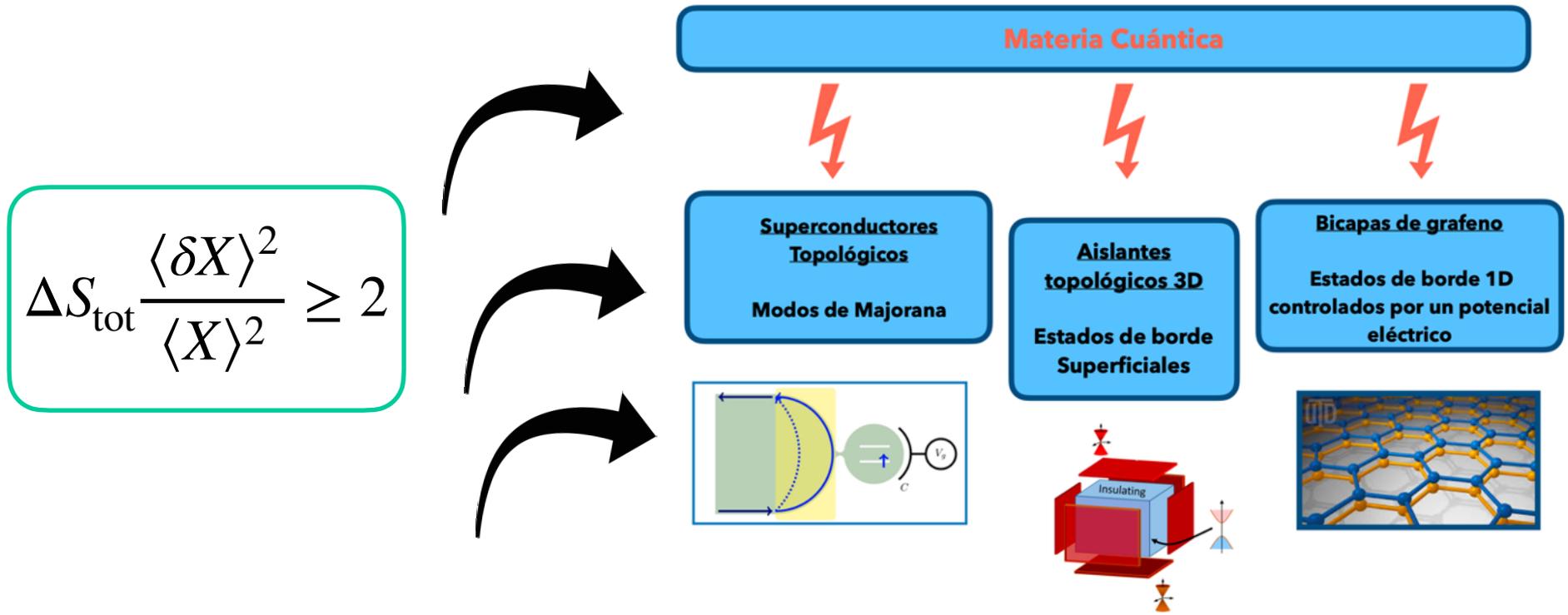
Thermodynamic Uncertainty Relation
Demonstrated for Markovian, Classical
Systems (Biological systems)

Quantum Systems



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Thanks!