ESI Erwin Schrödinger International Institute for Mathematics and Physics

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Seminar

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Control Engineering Taken to the Limits of Quantum Systems Theory — Framework, Recent Results, and Perspectives

Monday, October 7, 2019

at 14:00 h

ESI, Boltzman Lecture Hall

Abstract: Quantum optimal control is often key to exploiting the full potential of experimental setups pertinent to emerging quantum technologies. We sketch a Lie frame for quantum systems theory, where symmetries and conservation laws are in a quantum Noether-type 1:1 correspondence. Thus one can fully assess feasibility of quantum engineering in terms of controllability (or accessibility) for closed (or open) systems. In view of quantum sensing, similar results settle observability and tomographiability. We now see which symmetries to break for more control and we show how to apply optimal control to exploit quantum dynamics within the enlarged accessible territory. Our recent proposal for an optomechanical oscillator extended by a two-level atom perfectly illustrates these principles: without breaking the system symmetries of an optomechanical oscillator(in the linear regime), one can only interconvert within states of the same Wigner negativity. Coupling to an additional atom breaks the symmetry and thus allows to go between them, e.g., from Gaussian states to non-classical ones. Theory and worked examples thus elucidate guiding principles for quantum technologies 2.0.

T. Calarco

October 3, 2019