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Revealing missing charges in few-body cold-atom systems with generalised quantum fluctuation relations

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The out-of-equilibrium dynamics of quantum systems is one of the most fascinating problems in physics, with outstanding open questions on issues such as relaxation to equilibrium. An area of particular interest concerns few-body systems, where quantum and thermal fluctuations are expected to be more relevant and play an important role in the efficient design of novel quantum nano-devices.

In this talk, I will present a new set of exact relations between out-of-equilibrium fluctuations and equilibrium properties of a quantum system. Then, I will illustrate its application to reveal the conserved quantities (or 'charges') constraining the out-of-equilibrium dynamics of a few-body system implementing the Dicke model with a state-of-the-art cold-atom system [2,3].

[1] J. Mur-Petit, A. Relaño, R. A. Molina & D. Jaksch, "Revealing missing charges with generalised quantum fluctuation relations", Nature Communications 9, 2006 (2018).
[2] D. Blume, "Few-body physics with ultracold atomic and molecular systems in traps", Rep. Prog. Phys. 75, 046401 (2012).
[3] S. An et al., "Experimental test of the quantum Jarzynski equality with a trapped-ion system", Nature Phys. 11, 193 (2015).

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