Contribution ID: **127** Type: **Oral Presentation**

Can bath-induced coherences be useful for thermodynamic tasks?

Wednesday, 10 July 2019 14:20 (20 minutes)

Several promising innovations in quantum thermodynamics and more generally in quantum technologies rely on the use of quantum coherences. However, it is far from obvious how coherences, most of the time assumed to be present initially, are supposed to be prepared and what would be the associated energetic and/or entropic costs. These are important questions which might challenge the realisation of these operations or at least their overall energetic efficiency (fundamental in thermodynamic tasks). Nevertheless, it is well-known from superradiance [1] that under
specific circumstances coherences can appear naturally in a system interacting with a bath. Focusing on quantum thermodynamics, we ask the following question: can these bath-induced coherences be useful for thermodynamic tasks? As a partial answer, we use the framework introduced in [2] to investigate the thermodynamic impact of bath-induced coherences in the equilibrium process and steady state of degenerate systems. Focusing on spin (or
two-level atom) ensembles, we show two promising effects emerging from bath-induced coherences. The first one is the mitigation of the bath's action, tending to preserve the energy and entropy of the system against the influence of the bath. This mitigation effect can probably find applications in state protection or state preparation. The second effect is the opposite of the first one, namely the amplification of the bath's action, tending to increase the influuence of the bath on the energy of the system. This amplification effect is promising for instance for cooling tasks and energy storage in quantum batteries.

This work is based upon research supported by the South African Research Chair Initiative of the Department of Science and Technology and National Research Foundation.

[1] M. Gross and S. Haroche, Physics Reports, 93, 301-396 (1982).
[2] C. L. Latune, I. Sinayskiy, F. Petruccione, Quantum Sci. Technol. 4, 025005 (2019).

Apply to be
 considered for a student
   award (Yes / No)?

No

Level for award
 (Hons, MSc,
   PhD, N/A)?

N/A

Primary author: Dr LOMBARD LATUNE, Camille (UKZN)

Co-authors: Prof. PETRUCCIONE, Francesco (UKZN); Dr SINAYSKIY, Ilya (University of KwaZulu-Natal and National Institute for Theoretical Physics)

Presenter: Dr LOMBARD LATUNE, Camille (UKZN)

Session Classification: Theoretical and Computational Physics

Track Classification: Track G - Theoretical and Computational Physics