Minicolloque n° PMQ32   ☒ **Oral**   ☐ **Poster**

One-dimensional spin-1/2 fermionic gases with two-body losses: weak dissipation and spin conservation

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Experiments dealing with ultracold gases constitute an excellent candidate for performing experimental studies of the influence of dissipation on quantum systems in controlled conditions by means of a coupling to a bath or of tailored particle losses. In literature there are already some preliminary theoretical and experimental results (see [1] and [2], respectively) in which fermionic systems subjected to dissipative dynamics show interesting physics regarding the properties of stationary states. Our work [3] deals with the problem of finding a theoretical description, at any timescale, for the dissipative dynamics of fermionic atomic quantum gases confined in 1D optical lattices. We present a theoretical analysis of the dynamics of a one-dimensional spin-1/2 fermionic gas subject to weak two-body losses. Our approach highlights the crucial role played by spin conservation in the determination of the full-time evolution. We focus in particular on the dynamics of a gas that is initially prepared in a Dicke state with fully symmetric spin wavefunction, in a band insulator, or in a Mott insulator. In the latter case, we investigate the emergence of a steady symmetry-resolved purification of the gas. Our results could help the modelisation and understanding of recent experiments with alkaline-earth(-like) gases like ytterbium or fermionic molecules."

[1] Foss-Feig, M et al., Phys. Rev. Lett., 4, 230501 (2012)
[2] Sponselee et al., Quantum Sci. Technol., 4, 014002 (2019)
[3] L. Rosso, D. Rossini, A. Biella, L. Mazza, arXiv:2104.07929