



Sonderforschungsbereich 1277

Emergent Relativistic Effects in Condensed Matter -
From Fundamental Aspects to Electronic Functionality



SFB – Colloquium

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Topic: Disentangling entanglement

Abstract:

Properties of quantum systems are not only perplexing, they are also entangled. The story of entanglement is old and its role of a side conceptual peculiarity has changed only recently. First, I will shortly describe the history from EPR paradox to this year's Nobel Prize, discuss conceptual meaning of entanglement, nonlocality and correlations and their relevance for quantum information processing. It is known that success in the area of quantum technologies depends on our ability to fight with the unwanted effects of decoherence and especially the question of noise resistance of quantum entanglement is of highest importance. In the second part I will introduce the notions of entanglement-breaking [1] and entanglement-annihilating processes [2] - the most destructive types of noise completely disentangling quantum systems, thus, disabling any entanglement-based technology. I will discuss the current stage of understanding for these type of processes (e.g. [3, 4, 5]) and illustrate the key features of entanglement dynamics on particular examples.

[1] M. Horodecki, P. W. Shor and M. B. Ruskai, *Entanglement Breaking Channels*, Rev. Math. Phys. **15**, 629 (2003)

[2] L. Moravčíková, M. Ziman, *Entanglement-annihilating and entanglement-breaking channels*, J. Phys. A **43**, 275306 (2010)

[3] S. N. Filippov, M. Ziman, *Bipartite entanglement-annihilating maps: necessary and sufficient conditions*, Phys. Rev. A **88**, 032316 (2013)

[4] L. Aolita, F. de Melo and L. Davidovich, *Open-system dynamics of entanglement: a key issues review*, Rep. Prog. Phys., **78**, 042001 (2015)

[5] Chung-Yun Hsieh, *Resource Preservability*, Quantum **4**, 244 (2020)

Host: PD Dr. Denis Kochan