Quantum Cooling through Measurements

Yuval Gefen[1], Josias Langbehn[2], George Mouloudakis[2], Emma King[3], Raphael Menu[3], Giovanna Morigi[3], Igor Gornyi[4], and Christiane Koch[2]

[1]*The Weizmann Institute, Department of Condensed Matter Physics, Herzl St, Rehovot 76100, Israel*

[2]*Freie Universität Berlin, Fachbereich Physik and Dahlem Center for Complex Quantum Systems, Arnimallee 14, 14195 Berlin*

[3]*Theoretical Physics, Department of Physics, Saarland University, 66123 Saarbrücken, Germany*

[4]*Institute for Quantum Materials and Technologies and Institut für Theorie der Kondensierten Materie, Karlsruhe Institute of Technology, Karlsruhe 76131, Germany*

Quantum steering is a measurement-based state-engineering protocol. It represents a high-efficiency approach to generating resources for quantum computations, entanglement generation, quantum control and quantum cooling. I will provide a pedagogical overview of this important field. I will then discuss recent results concerning universal (state-independent) approach to cooling of many-body system. I will show that a quantum system can be cooled without knowledge of system details when system-meter interactions and meter splittings are chosen randomly. For sufficiently small interaction strengths and long interaction times, the protocol ensures that resonant energy-exchange processes, leading to cooling, dominate over heating.