Universität Bielefeld Fakultät für Physik

Physikalisches Kolloquium

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Nonequilibrium quantum chains: From ballistic to diffusive transport

Non-equilibrium quantum physics has become one of the central fields of research in particular due to an impressive degree of control in recent cold atom and quantum optics experiments. On the theoretical side, the topic provides a very fruitful playground where many seemingly diverse fields of theoretical and mathematical physics meet and overlap, such as condensed matter theory, statistical mechanics and field theory, string theory, quantum information, and dynamical systems. Having relevant and nontrivial exactly solvable models displaying key universal phenomena is a crucial aspect of every successful theory. In non-equilibrium quantum interacting many-body systems, such exact solutions have been very rare, and only very recently substantial progress has been made. In this talk I will describe one thread of recent progress, which started from exact solutions of boundary driven master equations of interacting quantum spin chains and ended up in discovering new families of quasilocal conservation laws. The latter are relevant for describing equilibration after quantum quenches and rigorously establishing ballistic or diffusive high temperature transport in integrable systems.

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