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Relaxation dynamics of a fermionic quantum gas with high spin NICK FLAESCHNER, JASPER KRAUSER, KLAUS SENGSTOCK, CHRISTOPH BECKER, Institut fuer Laserphysik, Universitaet Hamburg, Germany, ULRICH EBLING, MACIEJ LEWENSTEIN, Institut de Ciencies Fotoniques, Castelldefels, Spain, ANDRE ECKARDT, Max-Planck-Institut fuer Physik komplexer Systeme, Dresden, Germany — The relaxation of a closed quantum system constitutes a fundamental question in many-body physics. We present a detailed study of relaxation dynamics in a fermionic quantum gas of 40K atoms with high spin. The fermions are initially prepared far from equilibrium occupying only a few spin states. This induces a complex relaxation dynamics towards an equal spin population; meanwhile the whole spin system provides a bath for the thermalization for its individual spin subsystems. Our experimental results yield a good agreement with a kinetic Boltzmann equation, derived from a microscopic approach without free parameters. We identify several collisional processes governing the dynamics on fully different time scales and demonstrate the high experimental control by tuning the crucial parameters of the system, e.g. density and magnetic field. Our results open the path to engineering an open system with controllable dissipation into empty subsystems.

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