# Single-spin flip dynamics in the Ising model

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The Si(001) surface is formed by dimers of surface atoms arranged in parallel rows which are alternatingly buckled both along and between the rows. The dimerized Si(001) surface can be mapped onto an anisotropic 2D Ising model on a rectangular lattice such that the two states of the Ising spin correspond to the two buckling orientations of the Si dimers.

In order to study the real-time dimer-flip dynamics, we perform kinetic Monte Carlo simulations of spin-flip dynamics in the Ising model. We analyze the waiting-time distribution between subsequent flips of a single spin. For a ferromagnetic 1D Ising model, we find that that large temperatures the waiting-time distribution shows an exponential decay due to thermal excitation and relaxation of spins. At low temperatures, it is dominated by an algebraic decay which is caused by the random walk of domain walls. The latter can be suppressed by an external magnetic field which mimics the coupling to neighbouring dimer rows. The presence of defects is modelled by quenched boundary conditions which lead to an increased (decreased) life time of spins which are parallel (antiparallel) to boundary spin. Finally, we compare our results of the 1D case to a simulation of the 2D Ising model.