

Physics 4410
Quantum Mechanics 2

Lecture 38

The adiabatic theorem

December 4, 2020

Activity (teaser): Quantum annealing.

One of the immediate commercial applications of quantum mechanics is the solution of hard math (combinatorics) problems via quantum annealing. (How “quantum” existing devices are is a contentious question!)

Describe how to solve the graph coloring problem on a toy quantum annealer.

1. State the adiabatic theorem in quantum mechanics.

2. Sketch the proof of the adiabatic theorem.

3. Estimate how slow $H(t)$ needs to change to be adiabatic.

Activity: Quantum annealing.

We can estimate the behavior of quantum annealers with a crude 2-state model:

Argue that the time a quantum annealer needs to spend to solve a hard problem of N spins scales as $\tau \sim \exp[cN]$, for some constant c .