Theme 1: harmonic

An inverse problem for data-driven prediction in quantum mechanics

Pedro Caro

Data-driven prediction in quantum mechanics consists in providing an approximative description of the motion of any particles at any given time, from data that have been previously collected for a certain number of particles under the influence of the same Hamiltonian. The difficulty of this problem comes from the ignorance of the exact Hamiltonian ruling the dynamic. In order to address this problem, Alberto Ruiz and I have formulated an inverse problem consisting in determining the Hamiltonian of a quantum system from the knowledge of the state at some fixed finite time for each initial state. We focus on the simplest case where the Hamiltonian has an electric potential V which is non-compactly supported. During the talk I will present uniqueness results for time-dependent potentials V = V(t,x). Roughly speaking, these results are uniqueness theorems, that explain why the Hamiltonians ruling the dynamics of all quantum particles are determined by the corresponding initial and final states of all these particles. As a consequence, one expects to be able to solve the data-driven prediction problem in quantum mechanics.

The theorems I will discuss are the result of collaborations with Alberto Ruiz.