

## CHAPTER OVERVIEW

### 4: Mixed States and the Density Operator

So far we have considered states as vectors in Hilbert space that, according to the first postulate, contain all the information about the system. In reality, however, we very rarely have complete information about a system. For example, the system may have interacted with its environment, which introduces some uncertainty in our knowledge of the state of the system. The question is therefore how we describe systems given incomplete information. Much of contemporary research in quantum mechanics is about gaining full control over the quantum system (meaning to minimize the interaction with the environment). This includes the field of quantum information and computation. The concept of incomplete information is therefore central to modern quantum mechanics.

[4.1: Mixed States](#)

[4.2: Decoherence](#)

[4.3: Imperfect Measurements](#)

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