

CHAPTER OVERVIEW

13: Potential Surfaces and the Heisenberg Uncertainty Principle

Inarguably the most recognized statement in quantum mechanics is, “You can’t know where something is and how fast it is going”, which is the Heisenberg uncertainty principle. However, the real meaning is more far-reaching and unfortunately complex than this statement reveals. The uncertainty principle exists due to the statistical nature of quantum mechanics, and the fact that different physical properties are connected to each other by the quantum mechanical operators that describe them. Furthermore, the Heisenberg uncertainty principle is dynamic. For example, let’s say that you know a quantum particle is trapped in a very small spot. As a result, you can’t know the velocity at all, which makes the speed (and kinetic energy) very high. Last, there are actually several different uncertainty principles beyond the famous one between position and speed.

Before we go further, we must first introduce more complex systems to study, which is dependent on the nature of the potential energy surface. In the process, we will understand why some dyes are red or green, discuss new materials such as “quantum dots”, and reveal new phenomenon such as tunneling.

[13.1: Potential Energy Surfaces](#)

[13.2: Complex Potential Energy Surfaces- Vibration](#)

[13.3: Uncertainty and Superposition- Wavefunctions as Waves](#)

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