

## CHAPTER OVERVIEW

### 12: Quantum Mechanics of the Hydrogen Atom

A thorough review of the structure of the hydrogen atom will be presented with emphasis on the quantum-mechanical principles involved rather than calculational detail, which will be minimized. First, the relationship of the Heisenberg uncertainty principle to the hydrogen atom will be discussed briefly. This is followed by a discussion of the energy level structure of the hydrogen atom, including fine structure, in the context of the quantum-mechanical theories of Bohr, Schrödinger, and Dirac. Finally, smaller-order corrections to these theories will be discussed, including the Lamb shift, hyperfine structure, and the Zeeman effect.

[12.1: The Uncertainty Principle](#)

[12.2: Bohr Model of the Hydrogen Atom](#)

[12.3: Schrödinger Theory of the Hydrogen Atom](#)

[12.3.1: Schrödinger Theory of Hydrogen](#)

[12.3.2: The Spin-Orbit Effect](#)

[12.3.3: Kinetic Energy Corrections](#)

[12.4: Dirac Theory of the Hydrogen Atom](#)

[12.5: Smaller Effects](#)

[12.5.1: Hyperfine Structure](#)

[12.5.2: The Lamb Shift](#)

[12.5.3: The Zeeman Effect](#)

[12.6: Conclusion and References](#)

### Contributors and Attributions

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