

CHAPTER OVERVIEW

9: Elements of Relativistic Quantum Mechanics

The brief introduction to relativistic quantum mechanics, presented in this chapter, consists of two very different parts. Its first part is a discussion of the basic elements of the quantum theory of the electromagnetic field (usually called quantum electrodynamics, QED), including the field quantization scheme, photon statistics, radiative atomic transitions, the spontaneous and stimulated radiation, and so-called cavity *QED*. We will see, in particular, that the *QED* may be considered as the relativistic quantum theory of particles with zero rest mass - photons. The second part of the chapter is a brief review of the relativistic quantum theory of particles with non-zero rest mass, including the Dirac theory of spin- $1/2$ particles. These theories mark the point of entry into a more complete relativistic quantum theory - the quantum field theory - which is beyond the scope of this course.¹

[9.1: Electromagnetic Field Quantization](#)

[9.2: Photon Absorption and Counting](#)

[9.3: Photon Emission- Spontaneous and Stimulated](#)

[9.4: Cavity QED](#)

[9.5: The Klien-Gordon and Relativistic Schrödinger Equations](#)

[9.6: Dirac's Theory](#)

[9.7: Low Energy Limit](#)

[9.8: Exercise Problems](#)

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