1. INTRODUCTION

The task of performing rigorous theoretical calculations for radiative processes important in partially ionized gases must begin with the equations of quantum theory. Some of these processes have been described in Chapter II, particularly in Sec. 9. The conceptual bases for many radiative processes stem from classical considerations, and often approximate quantitative estimates can be made employing relatively simple semi-classical arguments. It is to this latter subject that this chapter is principally directed.

The classical theory of radiation starts with Maxwell's equations for the electromagnetic field. We shall begin our discussion by deducing from these equations the fundamental classical notion that radiation originates from accelerating charges. Using this central idea, we shall then describe classical processes which give rise to continuous and line emission. We shall discuss next a classical model for line absorption and then bring together some of these ideas in making some remarks about blackbody radiation.

2. MAXWELL'S EQUATIONS AND RELATED CONCEPTS

Our point of departure in this chapter will be the set of equations formulated by J. C. Maxwell in 1865, which provides the basis for a classical description of all electromagnetic phenomena. In rationalized MKS units, these equations are

\[ \nabla \cdot \mathbf{D} = \rho, \]
\[ \nabla \cdot \mathbf{B} = 0, \]
\[ \nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}, \]
\[ \nabla \times \mathbf{H} = \mathbf{j} + \frac{\partial \mathbf{D}}{\partial t}. \]

(2.1a)
(2.1b)
(2.1c)
(2.1d)