Chapter 1

WAVE FUNCTION

Quantum Mechanics is such a radical and revolutionary physical theory that nowadays physics is divided into two main parts, namely *Classical Physics* versus *Quantum Physics*. Classical physics consists of *any* theory which does not incorporate quantum mechanics. Examples of classical theories are Newtonian mechanics (F = ma), classical electrodynamics (Maxwell's equations), fluid dynamics (Navier-Stokes equation), Special Relativity, General Relativity, etc. Yes, that's right; Einstein's theories of special and general relativity are regarded as classical theories because they don't incorporate quantum mechanics. Classical physics is still an active area of research today and incorporates such topics as chaos [Gleick 1987] and turbulence in fluids. Physicists have succeeded in incorporating quantum mechanics into many classical theories and so we now have Quantum Electrodynamics (combination of classical electrodynamics and quantum mechanics) and Quantum Field Theory (combination of special relativity and quantum mechanics) which are both *quantum* theories. (Unfortunately no one has yet succeeded in combining general relativity with quantum mechanics.)

I am assuming that everyone has already taken a course in Modern Physics. (Some excellent textbooks are [Tipler 1992, Beiser 1987].) In such a course you will have studied such phenomena as black-body radiation, atomic spectroscopy, the photoelectric effect, the Compton effect, the Davisson-Germer experiment, and tunnelling phenomena all of which cannot be explained in the framework of classical physics. (For a review of these topics see references [Tipler 1992, Beiser 1987] and chapter 40 of Serway [Serway 1990] and chapter 1 of Gasiorowicz [Gasiorowicz 1996] and chapter 2 of Liboff [Liboff 1992].)