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Introduction

The present volume is devoted to the transitions in hydrogen-like atoms, also called hydrogenic atoms. One means by hydrogenic atom, an atom considered as owning one electron as the hydrogen atom. It is the case for an atom whose all the electrons, except one, are not considered, either because they have been thrown out or because their action is neglected.

Corrective terms taking into account this action, or the size of the nucleus, may be used. But they are obtained by means of approximative instead of exact calculations, and they will not be taken into consideration in our elementary presentation.

So the problem, in its relativistic approach, is the first one of the resolution of the Dirac equation for a central potential of the form eZ/r, where $e > 0$ is the charge of a proton (with $-e$ as the charge of the electron) and Z is the number of protons in the nucleus of the atom. The question of the transitions between two states of the electron is solved by taking into account the two solutions of the Dirac equation corresponding to these states, by the construction of the probability current of transition between these two states and at least by the determination of the electromagnetic field at large distance associated with this current. The processes of the transition are also to be taken into account: spontaneous emission in the absence of all external field, stimulated transition in the presence of an external plane wave, and multiplication of the transitions in the case where a magnetic field separates into several levels of energy, the level common to the states corresponding to a same level in the absence of a magnetic field (Zeeman effect).