UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Modern Physics II

1920-3-E2701Q062

Aims

The main goal of this Course is to provide to students the formal tools needed to understand some fundamental

Contents

General formalism of quantum mechanics

Electron spin

Approximate methods

Spin-orbit interaction

Fine structure of the hydrogen atom

Zeeman effect

Many-particle formalism

He atom

Many-electron atoms

Light-matter interaction

Detailed program

Formalism of quantum mechanics: Hilbert spaces, operators associated with physical observables, indetermination

Electron spin: Orbital magnetic moment, Ster and Gerlach experiment, spin magnetic moment, Pauli matrix, spin

Approximate methods: static perturbation theory for non-degenerate and degenerate levels, variational principle.

Spin-orbit interaction: spin-orbit interaction term, total angular momentum operator.

Fine structure of the hydrogen atom: spin-orbit correction to the electronic levels, relativistic correction.

Zeeman effect: level splitting in the presence of a magnetic field, strong and weak Zeeman effect.

Many-particle formalism: identical particles, Slater determinant, Pauli esclusion principle.

He atom: ground state by neglecting electron-electron repulsion, perturbative and variational correction, single and

Many-electron atoms: the central potential approximation, the Hartree method, symbol terms, Hund rules, atomic

Light-matter interaction: time-dependent perturbation theory, electric dipole approximation, absorption, stimulated

Prerequisites

Students should have already tackled the crisis of classical physics, the particle-wave dualism, the Schrodinger

Teaching form

The teacher explains and formally derives each new concept by live-writing on a tablet wired to a video projector

Textbook and teaching resource

Fully explicative slides, including derivations of the full course, are made available to the students through the

Text book followed by most of the Course:

David J. Griffiths, Introduction to Quantum Mechanics.

Semester

First semester (from October to January)

Assessment method

Students are evaluated through a written exam followed by an oral one. In the written exam students have to solve

Questions are asked only on topics explicitly treated during the lessons.

Office hours

From Monday to Friday at any working hour, provided that students fix an appointment with the teacher by email.