



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Struttura della Materia II

2021-3-E2701Q062

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#### Aims

The main goal of this Course is to provide students with 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, Stern 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 exclusion 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 final 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.

During the Covid-19 outbreak, exams will be online using WebEx. A dedicated news will be posted on the e-learning page of the course with a public link to freely access the virtual room where the exam will take place.

## **Office hours**

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

During the Covid-19 outbreak, discussions will take place using the WebEx personal room of the teacher.

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