UNIVERSITÀ DI PISA

# QUANTUM PHYSICS OF MATTER

## GIUSEPPE CARLO LA ROCCA

| | |
|---|---|
| Anno accademico | 2022/23 |
| CdS | MATERIALS AND NANOTECHNOLOGY |
| Codice | 397BB |
| CFU | 6 |

| Moduli | Settore/i | Tipo | Ore | Docente/i |
|---|---|---|---|---|
| QUANTUM PHYSICS OF MATTER | FIS/03 | LEZIONI | 48 | GIUSEPPE CARLO LA ROCCA |

### Obiettivi di apprendimento

*Conoscenze*
Become familiar with the basic concepts of quantum mechanics and learn how to make use of the Schroedinger equation. Use these tools for an elementary microscopic description of the properties of atoms and molecules.

### Prerequisiti (conoscenze iniziali)
General physics and calculus.

### Programma (contenuti dell'insegnamento)
*1. Introduction to quantum mechanics*
Waves and particles. Wave-particle duality and uncertainty principle. Wave function. Schroedinger equation and stationary states. Expectation values. Examples: potential well and harmonic oscillator. Transition probability and selection rules.
*2. Atomic physics*
First atomic models and their shortcomings. Hydrogen atom: energy spectrum, angular momentum and eigenfunctions. Electron spin. Pauli exclusion principle. Helium atom, singlet and triplet states. Many-electron atoms, periodic system of elements. Atomic spectroscopy.
*3.Molecular physics*
The ionized hydrogen molecule. The hydrogen molecule. Homonuclear and heteronuclear diatomic molecules. Polyatomic molecules. Molecular vibrations. Molecular Spectroscopy.

### Bibliografia e materiale didattico
hand-out notes
Alonso-Finn: “Fundamental university physics, vol. 3: quantum and statistical physics”
Landshoff-Metherell-Rees: “Essential Quantum Physics”, Cambridge

### Indicazioni per non frequentanti
please contact: giuseppe.larocca@sns.it

### Modalità d'esame
oral exam

*Ultimo aggiornamento 08/11/2022 17:21*