

## Master Physique fondamentale et applications

### Physique atomique et moléculaire - atom. and mol. physics

#### Informations

Composante : Faculté des Sciences

#### Langue(s) d'enseignement

Anglais

#### Contenu

##### Radiation

Emission of electromagnetic field.

Charge distribution in atoms and molecules. Electric and magnetic dipole and quadrupole moment.

Group theory and symmetries. Character tables.

Interaction with the electromagnetic field.

Absorption, scattering and dispersion. Natural lifetime, collision (critical density) and doppler broadening.

The Einstein coefficients and Laser physics

##### Atomic physics

Intro. to Atomic Units.

Reminders on operators, commutation rules and consequences, angular momentum in Quantum.

Mechanics. One-elec. atoms (quick remind of main results).

Many-electrons atoms – N-elec. Hamiltonian - The central-field model (CFM).

Schrodinger equation for independent electrons in the CFM.

Principle of asymmetry and consequences (Slater Determinants).

Subshells – Configurations – Atomic states. Periodic Classification.

Beyond the 0-order treatment: Corrections to the CFM and treatment of the Spin-Orbit interaction by direct diagonalization. Fine structure levels.

Beyond the 0-order treatment: the historical approach : multiplet theory, Hund's Rules.

Typical central-field models in atomic physics (Hartree-Fock, Hartree-Fock-Slater, Parametric potential).

##### Molecular Physics

Born-Hoppenheimer approximation

Rotational spectroscopy

Vibrational spectroscopy

Molecular energy levels

Selection rules

#### Bibliographie, lectures recommandées

- \_ J. D. Jackson, Classical Electrodynamics, Wiley, 1967
- \_ P. W. Atkins, Molecular quantum mechanics, 1970
- \_ Les Lasers, Didier Dangoisse, Daniel Hennequin, Véronique Zehnlé-Dhaoui, Dunod (1998)
- \_ Principles of Plasma Spectroscopy, H.R. Griem, Cambridge University

Press, Cambridge (1997) \_ Atomic Physics in Hot Plasmas, D. Saltzmann, Oxford University Press, Oxford (1998)

\_ The Theory of Atomic Structure and Spectra, R.D. Cowan, University of California Press, Berkeley (1981)

\_ Theoretical Atomic Physics, H. Friedrich, Sd Edition, Springer (1998)

\_ Plasma Spectroscopy, T. Fujimoto, Oxford University Press, Oxford (2004)

\_ Physical Chemistry: A Molecular Approach, University Science Books, 1997

\_ J. M. Hollas, Modern Spectroscopy, 4th edition, Wiley, 2004

#### VOLUME HORAIRE

- Volume total: 40 heures
- Cours magistraux: 20 heures
- Travaux dirigés: 20 heures

#### Codes Apogée

- SPFBU05C [ELP]

#### Pour plus d'informations

[Aller sur le site de l'offre de formation...](#)



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