



Course: Modern Physics  
Code: 18875  
Location: Faculty of Sciences  
Degree: Science & Engineering Program Boston University-Faculty of Science UAM  
Fall 2017-Spring 2018  
Type: Elective subject  
Number of credits: 6

## ASIGNATURA / COURSE TITLE

Modern Physics

### 1.1. Código / Course number

18875

### 1.2. Materia / Content area

Physics

### 1.3. Tipo / Course type

Elective subject

### 1.4. Nivel / Course level

Bachelor (first cycle)

### 1.5. Curso / Year

3<sup>rd</sup>

### 1.6. Semestre / Semester

2<sup>nd</sup> (Spring semester)

### 1.7. Número de créditos / Credit allotment

6 ECTS credits

### 1.8. Requisitos previos / Prerequisite

Students should be familiar with classical physics and mathematical analysis.

### 1.9. Requisitos mínimos de asistencia a las sesiones presenciales / Minimum attendance requirement

Attendance is highly advisable.



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## 1.10. Datos del equipo docente / Faculty data

Docente / Lecturer: Juan Antonio Porto (Coordinator)  
Departamento / Department of: Física Teórica de la Materia Condensada  
Facultad / Faculty: Ciencias  
Despacho - Módulo/ Office - Module: 511 - 05  
Teléfono / Phone: +34 91 497 8628  
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Página web / Web page: <http://www.uam.es/ja.porto>  
Horario de atención al alumnado/Office hours: by appointment

Docente / Lecturer: Manuel Marqués  
Departamento / Department of: Física de Materiales  
Facultad / Faculty: Ciencias  
Despacho - Módulo/ Office - Module: 514 - 04  
Teléfono / Phone: +34 91 497 6427  
Correo electrónico/Email: manuel.marques@uam.es  
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Horario de atención al alumnado/Office hours: by appointment

Docente / Lecturer: Manuel Plaza Domínguez  
Departamento / Department of: Física de la Materia Condensada  
Facultad / Faculty: Ciencias  
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Horario de atención al alumnado/Office hours: by appointment

Docentes / Lecturer: Eva Villaver  
Departamento / Department of: Física Teórica  
Facultad / Faculty: Ciencias  
Despacho - Módulo / Office - Module: 315 - 08  
Teléfono / Phone: +34 91 497 6797  
Correo electrónico/Email: eva.villaver@uam.es  
Página web / Web page:  
Horario de atención al alumnado/Office hours: by appointment

## 1.11. Objetivos del curso / Course objectives

The aim of this course is to provide the students with a basic knowledge of modern physics, including subjects such as quantum physics, relativity, and the structure of matter. In addition, nuclear and particle physics, astrophysics, and cosmology will be briefly introduced.



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## 1.12. Contenidos del programa / Course contents

### Lecture contents:

- 1.- The experimental basis of quantum physics.
- 2.- The structure of the atom.
- 3.- Wave properties of matter.
- 4.- Quantum mechanics.
- 5.- The hydrogen atom.
- 6.- Many-electron atoms.
- 7.- Statistical physics.
- 8.- Molecules and solids.
- 9.- Semiconductors.
- 10.- Relativity.
- 11.- Nuclear and particle physics.
- 12.- Astrophysics and cosmology.

### Laboratory contents:

- 1.- Photoelectric effect.
- 2.- Electron diffraction.
- 3.- Electron charge/mass ratio.
- 4.- Speed of light.
- 5.- Atomic emission.



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### 1.13. Referencias de consulta / Course bibliography

#### Main reference:

- S.T. Thornton and A. Rex, “*Modern Physics for Scientists and Engineers*”, (Brooks Cole, International edition of the 4<sup>th</sup> edition, 2012).

#### Other textbooks:

- P.A. Tipler and R. A. Llewellyn, “*Modern Physics*”, (W.H.Freeman, 6<sup>th</sup> edition, 2012).

- R.A. Serway, C.L. Moses, and C.A. Moyer, “*Modern Physics*”, (Brooks Cole, 3<sup>rd</sup> edition, 2004).

## 2. Métodos docentes / Teaching methodology

- Lectures.
- Problem-solving sessions.
- Seminars.
- Tutorials.
- Experimental laboratory sessions.

## 3. Tiempo de trabajo del estudiante / Student workload

|  |                                      | Number of hours | Percentage |
|--|--------------------------------------|-----------------|------------|
| Face-to-face tuition                             | Lectures<br>Problem-solving sessions | 40 h            | 40%        |
|  | Laboratory experiments               | 20 h            |            |
| Independent study                                |                                      | 90 h            | 60%        |
|  |                                      |                 |            |
| <b>Total student workload: 25 hours x 6 ECTS</b> |                                      | <b>150 h</b>    |            |



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#### 4. Métodos de evaluación y porcentaje en la calificación final / Evaluation procedures and weight of components in the final grade

- Exams:
  - Mid-term exam: 20%
  - Final exam: 30%
- Homework assignments and class participation: 20%
- Laboratory: 30%\*

\*The assessment of laboratory experiments is done based on the reports that include results and discussions, as well as on an oral presentation of one of the experiments carried out by the student.

#### 5. Cronograma\* / Course calendar\*

| Contents                         | Face-to-face tuition (Contact hours) | Independent study time | Week  |
|----------------------------------|--------------------------------------|------------------------|-------|
| 1                                | 3                                    | 5                      | 1     |
| 2                                | 2                                    | 5                      | 2     |
| 3                                | 3                                    | 5                      | 3     |
| 4                                | 6                                    | 10                     | 4 - 5 |
| 5                                | 3                                    | 5                      | 6     |
| 6                                | 3                                    | 5                      | 7     |
| <b>Mid-term exam</b>             |                                      |                        | 7     |
| 7                                | 3                                    | 5                      | 8     |
| 8                                | 2                                    | 5                      | 9     |
| 9                                | 2                                    | 5                      | 10    |
| 10                               | 6                                    | 10                     | 11-12 |
| Experimental laboratory sessions | 20                                   | 20                     | 12    |
| 11                               | 4                                    | 5                      | 13-14 |
| 12                               | 3                                    | 5                      | 14-15 |
| <b>Final exam</b>                |                                      |                        | 16    |

\*This course calendar might be liable to some changes.