Course Guide
44425 Nanomagnetism and molecular spintronics

COURSE DATA

Data Subject

<table>
<thead>
<tr>
<th>Código</th>
<th>44425</th>
</tr>
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<tbody>
<tr>
<td>Name</td>
<td>Nanomagnetism and molecular spintronics</td>
</tr>
<tr>
<td>Cycle</td>
<td>Master's degree</td>
</tr>
<tr>
<td>ECTS Credits</td>
<td>4.5</td>
</tr>
<tr>
<td>Curso académico</td>
<td>2018 - 2019</td>
</tr>
</tbody>
</table>

Study (s)

Degree | Center | Acad. year | Period
--- | --- | --- | ---
2208 - M.U. en Nanociencia y Nanotecnología Molecular | FACULTY OF CHEMISTRY | 1 | First term

Subject-matter

Degree | Subject-matter | Character
--- | --- | ---
2208 - M.U. en Nanociencia y Nanotecnología Molecular | 9 - Nanomagnetism and molecular spintronics | Obligatory

Coordination

<table>
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<tr>
<th>Name</th>
<th>Department</th>
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<tr>
<td>CORONADO MIRALLES, EUGENIO</td>
<td>320 - QUÍMICA INORGÁNICA</td>
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SUMMARY

The general aim of the course is to provide the students with a coherent and modern education of a wide range of fundamental, methodological and technological aspects on nanomagnetism and molecular spintronics.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

There are no specified enrollment restrictions with other subjects of the curriculum.
OUTCOMES

2208 - M.U. en Nanociencia y Nanotecnología Molecular

- Students can apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
- Students are able to integrate knowledge and handle the complexity of formulating judgments based on information that, while being incomplete or limited, includes reflection on social and ethical responsibilities linked to the application of their knowledge and judgments.
- Students have the learning skills that will allow them to continue studying in a way that will be largely self-directed or autonomous.
- Students have the knowledge and understanding that provide a basis or an opportunity for originality in developing and/or applying ideas, often within a research context.
- To possess the necessary knowledge and abilities to continue with future studies in the PhD program in Nanoscience and Nanotechnology.
- For students from field of knowledge (e.g. chemistry) to be able to scientifically communicate and interact with colleagues from another field (e.g. physics) in the resolution of problems laid out by the Molecular Nanoscience and Nanotechnology.
- To acquire the basics knowledge in fundamentals, use and applications of microscopic and spectroscopic techniques used in nanotechnology.
- To assess the relationships and differences between the materials macroscopic properties and those of unimolecular systems and nanomaterials.
- To assess the molecules and hybrid materials relevance in electronics, spintronics and molecular nanomagnetism.
- To know the main molecular nanomaterials technological applications and to be able to put them in the Material Science general context.
- To know the main applications of nanoparticles and nanostructured materials obtained or functionalised using a molecular approach- in magnetism, molecular electronics and biomedicine.

LEARNING OUTCOMES

• To acquire the basic knowledge as well as the overall view of the principal research lines of the Nanomagnetism area, including electronic, magnetic and transport properties of low dimensional magnetic systems and nanostructures.
• To know the main experimental technologies (skills) to characterize electronic, magnetic properties and of transport of nanoestructuras. To be able to use experimental tools for measuring magnetic and transport properties of magnetic nanostructures.
• To know and to understand the most relevant magnetic, electronic and transport properties in magnetic materials at the nanoscale and in nanostructures.
• To know the multiple applications of the magnetic nanostructures as well as the future trends of research within the Nanomagnetism area.
DESCRIPTION OF CONTENTS

1. Molecular nanomagnetism and spintronics.
   1. Nanomagnetism basic concepts. Artificial interphases influence, proximity and dimensionality effects. Magnetic textures (magnetic domain, magnetic vortices, skirmions).
   2. Magnetic properties and scales. Magnetic inversion process, size effects and dynamic processes. Spintronics (spin valves, MTJ, spin torque effect), orbitronics (Spin Hall effect, Inverse SHE).
   4. Fundamental theoretical models for magnetism and nanoscopic scale related phenomena study.
   5. Recent developments and future recent tendencies in Molecular Nanomagnetism (magnetic molecules, single-molecule magnets).

WORKLOAD

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<tr>
<th>ACTIVITY</th>
<th>Hours</th>
<th>% To be attended</th>
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<tr>
<td>Theory classes</td>
<td>22.50</td>
<td>100</td>
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<tr>
<td>Seminars</td>
<td>7.50</td>
<td>100</td>
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<tr>
<td>Tutorials</td>
<td>6.00</td>
<td>100</td>
</tr>
<tr>
<td>Other activities</td>
<td>2.00</td>
<td>100</td>
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<tr>
<td>Preparation of evaluation activities</td>
<td>56.50</td>
<td>0</td>
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<tr>
<td>Preparing lectures</td>
<td>18.00</td>
<td>0</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>112.50</strong></td>
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TEACHING METHODOLOGY

- Theory classes, participatory lectures
- Articles discussion.
- Chaired debate or discussion.
- Practical cases or seminar problems discussion.
- Seminars.
- Problems.
- Laboratory practices and demonstracions and visit to installations.
- Experts conferences.
- Attendance to courses, conferences and round tables.
EVALUATION

<table>
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<tr>
<td>Written exam about the subject basic contents</td>
<td>70-90%</td>
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<tr>
<td>Attendance and active participation in seminars.</td>
<td>0-10%</td>
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<tr>
<td>Questions answering</td>
<td>10-20%</td>
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REFERENCES

Basic