230559 - MICROMW - Optical Micromanipulation Workshop

Degree competences to which the subject contributes

Transversal:
1. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
2. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.
3. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.
4. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

Learning objectives of the subject

This is an eminently practical course on optical tweezers/traps that consists of four laboratory projects. Each session is divided into two parts, an initial and brief introduction, in which the theoretical background is discussed with the students, and an extended laboratory stay with a very hands-on approach. We expect that all students build and align a simple optical tweezers setup, calibrate and measure forces, and generate traps and manipulate samples on a holographic setup.

BIBLIOGRAPHY

Basic
· Grier D G 2003 A revolution in optical manipulation Nature 424 810-816


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- Dholakia K and Reece P 2006 Optical micromanipulation takes hold Nanotoday 1 18-27
- Neuman K C and Block S M 2004 Optical trapping Rev. Sci. Instrum. 75 2787-2809

Advanced

Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group:</th>
<th>22h 30m</th>
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<td>Hours medium group:</td>
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<td>Hours small group:</td>
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<td></td>
<td>Guided activities:</td>
<td>2h 15m</td>
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<td>Self study:</td>
<td>50h 15m</td>
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### Content

#### 1. Introduction: micromanipulation with optical tweezers

**Degree competences to which the content contributes:**

**Description:**

#### 2. Building an optical tweezers setup

**Degree competences to which the content contributes:**

**Description:**
- Main components of an optical tweezers setup: laser, steering optics, high numerical aperture objective. System constraints. Alignment of the optical setup. Trapping and moving a sample.

#### 3. Calibration of an optical trap

**Degree competences to which the content contributes:**

**Description:**

#### 4. Holographic optical tweezers: advanced micromanipulation

**Degree competences to which the content contributes:**

**Description:**

### Qualification system

- Written report (100 %): The students will be evaluated mainly by the outcome of their practical work in the lab. They will have to present a written formal report of their activities and results, which will be graded accordingly. Also, the laboratory sessions may need thorough preparation and advanced study on the part of the student, work that we intend to take into account as well to set the final scores.

### Bibliography