Laser-matter interactions: from fundamentals to applications

Course at a Glance

Physics of lasers, properties of laser radiation and basic fundamentals of light-matter interactions with examples of key laser-based applications.

Instructors

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Credits: 4

Synopsis

Lasers have become ubiquitous in our daily lives. From DVD players to bar code scanners, printers, or even in medicine, laser-based applications are countless. Not to mention the pivotal role that lasers are playing in science and in state of the art industrial processes. But what are the characteristics of lasers that make them so broadly used?
In this brief course we will answer this question by describing the physics of laser systems and the properties of laser radiation. We will also explain the basic interactions between laser light and materials, and we will give examples of applications where lasers are the enabling technology.

This course is intended for PhD students who anticipate working with lasers. No background in lasers is required. Emphasis is placed on the physical interpretation of lasers and on their applications, with mathematics kept at a minimum.

Syllabus

The course develops in 12 hours in the classroom.

- Fundamentals of lasers: lasers, laser radiation characteristics, laser types
- Interaction of lasers with materials: absorption, dispersion, photophysical processes, photochemical processes
- Lasers at IIT: 3D microfabrication, nanoparticle generation, photolithography, surface structuration, optical characterization

The examination consists in a written exam and periodic assignments.

Reading list

[1] D. Bauerle, Laser Processing and Chemistry, Springer, 2011 ISBN: 978-3-642-17613-5
[2] S. Ezekiel, Understanding lasers and fiberoptics, MIT Open Course **http://ocw.mit.edu/resources/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/**

Venue

IIT - Italian Institute of Technology, Via Morego 30, Genova

Course date

September - October 2015