

# Put Light to Work: Exploring the Ultrafast with Light

2022 HSSP Course Syllabus

## Teacher Information:

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Contact us at [X15080-teachers@esp.mit.edu](mailto:X15080-teachers@esp.mit.edu) with any questions and thoughts!

You can also use [X15080-students@esp.mit.edu](mailto:X15080-students@esp.mit.edu) to discuss questions and raise thoughts with your classmates!

## Class information:

(tentative: Please send us feedback on what you want to learn about and what you do not!)

Date and time: Sat 3:05 pm--3:55 pm, Jul. 9th - Aug. 13th

### Class 1: Introduction to light

1. Classic description of light: wave-like
2. Quantum description of light: particle-like

### Class 2: Introduction to light matter interaction

1. Reflection, transmission and absorption of light: a phenomenological overview
2. Quantum mechanical description of matter: particle in box
3. Quantum description of absorption

### Class 3: Introduction to laser and ultrafast laser systems

1. Comparison between different light source
2. Working principle of continuous wave laser
3. Mode locking and ultrafast laser systems
4. History of laser development

### Class 4: Introduction to pump probe experiment

1. What is pump probe experiment
2. Why is pump probe experiment important: dynamical processes in the physical world
3. How to perform a pump probe experiment

## Class 5: Application of pump probe in material research

1. Bird eye's view of condensed matter research: important topics
2. Photoinduced phase transitions in condensed matter systems

## Class 6: Application of pump probe in biological systems

1. Ultrafast studies in photosynthesis
2. Energy transfer dynamics in purple bacteria