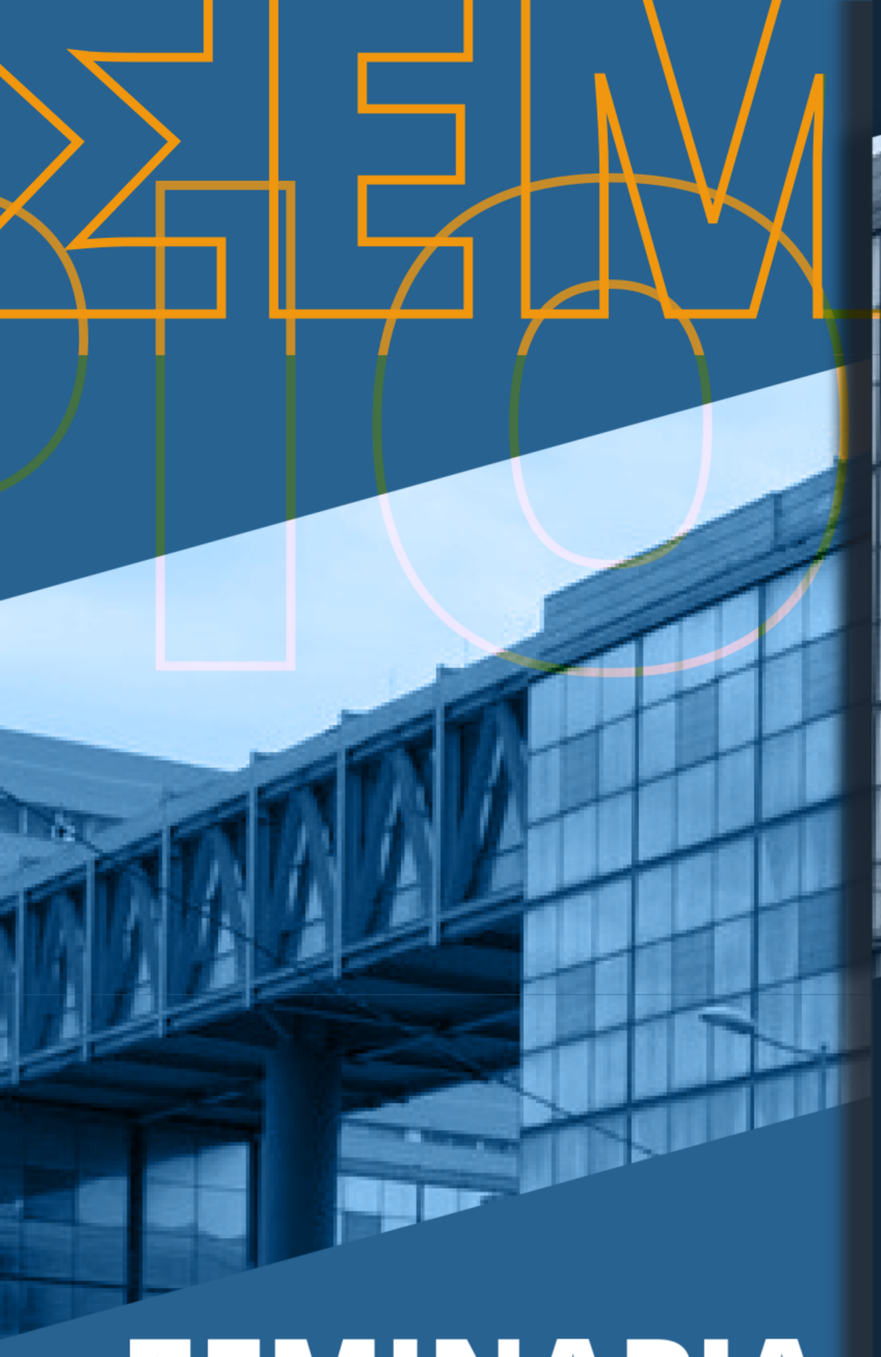


ΣΕΜΙΝΑΡΙΑ Τμ. ΦΥΣΙΚΗΣ

Τετάρτη
20 Μαΐου 2026
12:15

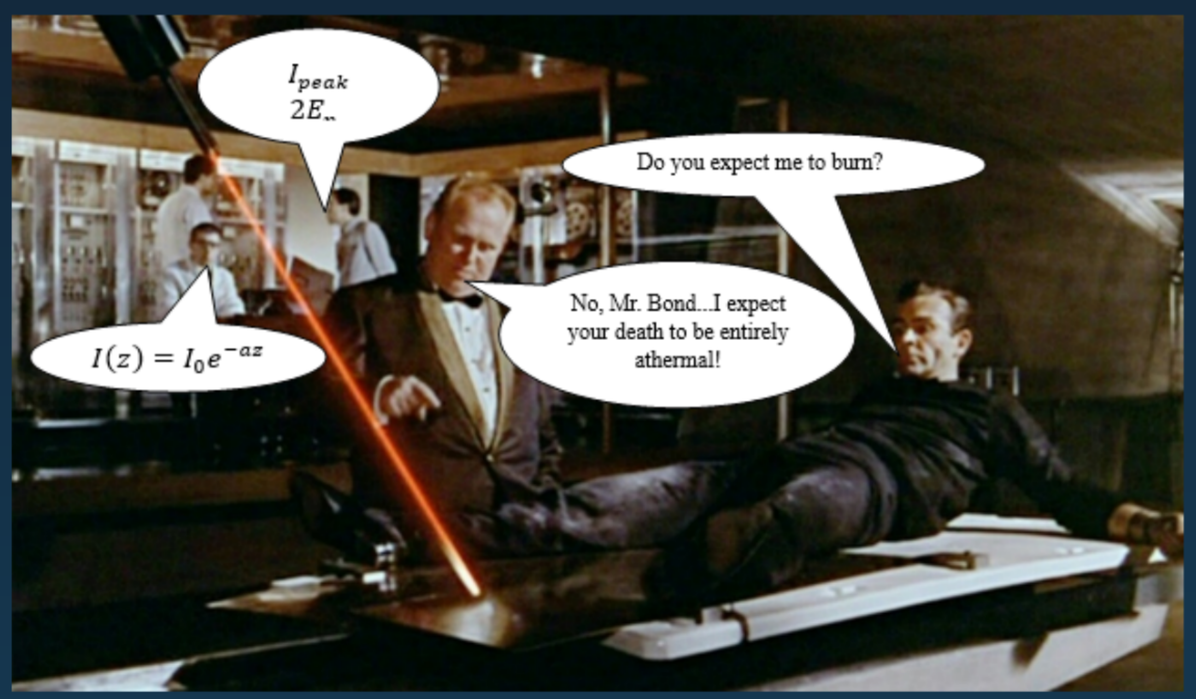
ΣΘΕ, 1ος όροφος
Αίθουσα Α31

Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης
ΤΜΗΜΑ ΦΥΣΙΚΗΣ

ΑΡΙΣΤΟΤΕΛΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΟΝΙΚΗΣ

100 ΧΡΟΝΙΑ ΑΠΘ | ΑΡΙΣΤΟΤΕΛΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΟΝΙΚΗΣ
ΓΝΩΣΗ ΚΑΙΝΟΤΟΜΙΑ ΠΟΛΙΤΙΣΜΟΣ

Ultrafast Lasers: From Fundamental Light–Matter Interaction to Advanced Materials Processing



Δρ. Αλέξανδρος Μουσκευτάρας

CNRS, Marseille, France

Ever since the invention of the laser in 1960, it has often been described as "a solution looking for a problem". Owing to its ability to remotely deliver extremely high power densities with remarkable spatial and temporal control, it quickly became evident that lasers would revolutionize materials processing. Over the following decades, scientists engaged in a race to shorten laser pulse durations, driven by the need for ultrafast diagnostic tools capable of probing phenomena occurring on extremely short timescales. This progress led to the emergence of ultrafast science, a field dedicated to the study of matter on femtosecond and picosecond timescales, with major impact on solid-state physics, nonlinear optics, and a wide range of other disciplines.

Ultrashort laser pulses, typically in the picosecond-to-femtosecond regime (10^{-12}–10^{-15} s), induce highly nonlinear and non-equilibrium light–matter interaction mechanisms, enabling the processing of otherwise transparent materials with unprecedented precision and minimal thermal damage. Both the hardest materials (e.g., diamond) and the most fragile ones (e.g., glass) can be modified either at the surface or deep inside their volume, enabling true three-dimensional fabrication. This capability has led to breakthroughs in technologies such as microfluidic devices, integrated photonics, optical data storage, and many others.

In this talk, we will first review the fundamental mechanisms governing ultrafast laser–matter interactions, with particular emphasis on state-of-the-art applications in materials processing. Finally, we will discuss future perspectives and emerging technologies enabled by ultrafast laser processing, ranging from integrated photonics to next-generation manufacturing.

Dr. Alexandros Mouskeftaras was born in Thessaloniki in 1985. He is a tenured researcher at the French National Centre for Scientific Research (CNRS) in Marseille, working at the Lasers, Plasmas and Photonics Processes laboratory (LP3). He holds a BSc in Physics from the University of Rouen, an MSc in Optics and Photonics from the University of Paris-Sud, and a PhD in Physics from École Polytechnique in Paris. Before joining CNRS, he worked as a laser process engineer at The Swatch Group Research and Development and as a scientist at the École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland. His current research focuses on ultrashort-pulsed laser–matter interactions in transparent materials, with an emphasis on fundamental interaction mechanisms and the development of laser-based techniques for enhanced material functionalization.