



**Theoretical and Physical Chemistry Institute
National Hellenic Research Foundation**

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LECTURE

“Lasers Exploring the nanoworld: Polarization-resolved non-linear microscopy”

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**Institute of Electronic Structure and Laser (IESL)
Foundation for Research and Technology-Hellas (FORTH),
Heraklion, Crete, Greece**

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Seminar room, ground floor, NHRF

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Recently, advanced non-linear optical measurements combined with microscopy have created new opportunities in characterizing nanomaterials (both organic and inorganic). Non-linear optical signals (2-photon excited fluorescence, second harmonic generation and third harmonic generation) excited using femtosecond lasers, are used to extract structural information at the nanoscale. In addition, the polarization sensitivity of these non-linear signals provides more detailed information than the intensity only measurements and thus enhanced means for optical characterization at the nanoscale.

In this talk, I will first introduce the laser raster-scanning microscopy technique, where a femtosecond laser is used to excite non-linear phenomena. Next, I will describe the theory used to interpret polarization-resolved non-linear optical measurements and the associated analysis methods. I will then demonstrate how these tools are applied to evaluate the crystal quality of atomically thin 2D transition metal dichalcogenides (TMDs), calculate the twist angle between TMD bilayers, measure the valley polarization, probe the in-plane anisotropy in orthorhombic 2D materials, and image the strain applied to TMD monolayers placed on patterned surfaces. Finally, I will present applications of polarization-resolved non-linear imaging in nano-biophotonics.