



University of Crete
Department of Physics

Physics Colloquium

Thursday, 6 November 2025 | 17:00 – 18:00, Seminar Room 3rd Floor

Optical Thermodynamics of Nonlinear Highly Multimode Systems

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ABSTRACT

In recent years, there has been a resurgence of interest in multimode structures, driven primarily by the growing demand for higher information capacities. This renewed focus has sparked a surge of activity in the field of nonlinear multimode optics. The inherent complexity of these systems—where hundreds or even thousands of nonlinearly interacting modes collectively behave as a many-body system—has led to the discovery of novel optical phenomena that would be unattainable in single-mode settings.

In this talk, a new thermodynamic framework for describing complex, highly multimode, nonlinear optical systems will be presented. It will be shown that mode occupancies in such systems exhibit a universal behavior, consistently evolving toward maximizing the system's entropy. This thermodynamic response is universal—it occurs regardless of the specific nonlinearities at play and can be harnessed to either heat or cool an optical system. Special emphasis will be placed on new methodologies for coherent beam combining using principles of optical thermodynamics.