The Abdus Salam International Centre for Theoretical Physics
50th Anniversary 1964–2014

United Nations Educational, Scientific and Cultural Organization

IAEA International Atomic Energy Agency

Workshop on Coherent Phenomena in Disordered Optical Systems
26 - 30 May 2014, Trieste, Italy

Statistical Properties of Random Lasers: Toward an *ab initio* and Analytic Theory

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Abstract:

We present a microscopic and statistical theory of random lasers made of scatterers that can be either passive or active. The non-linear problem is solved in the basis of non-Hermitian Hamiltonians whose spectra are characterized analytically. We calculate the modal intensities as well as the number of lasing modes in terms of microscopic parameters such as the transport mean free path, and show that strong modal interactions may lead to a gain clamping transition. We also point out important differences between lasers made of passive scatterers embedded in an amplifying medium and lasers made of scatterers that amplify light.