Broadband nonlinear optics: fractals, white light and multiplexing

McDonald, GS, Christian, JM, Huang, JG, Laughton, G, Chamorro-Posada, P and Sanchez-Curto, J

New Trends in Nonlinear Optics, Glasgow, UK, Feb 23, 2005.

"Broadband Nonlinear Optics: Fractals, White Light and Multiplexing"

Authors:
Graham S McDonald, James M Christian, Jungang Huang,
Gary Laughton, Pedro Chamorro-Posada, Julio Sanchez-Curto

Abstract:
We will present an overview of some recent works that collectively fall under the banner of "Broadband NonLinear Optics". Firstly, a generic mechanism for the spontaneous formation of spatial optical fractals has been proposed. Willie's classic single-feedback-mirror system will be used to demonstrate this principle; similar results are expected for other configurations. It is useful to describe convention pattern formation as "single-frequency" in this context, whereby the broadband "scale-less" case corresponds to fractal generation. Secondly, our investigations of broadband Raman effects have recently ventured into the cavity domain. In earlier (cavity-less) configurations, two input beams could generate an evolving white light spectrum. Switching over to the driven-damped world inside a cavity, we have discovered a remarkable self-synchronization effect in which this bandwidth not only doubles in size but also locks to a fixed steady pattern. Finally, the broad spatial bandwidth associated with obliquely multiplexed or interacting beams has proved to be a goldmine of analytical developments. A map of developments in this field will be presented. This will include the first analytical description of spatial Kerr solitons interacting at arbitrary angles, along with new families of further Helmholtz solitons, waves, and interface effects.