ONLINE SOLVAY COLLOQUIUM

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THE CAVITY KERR MEDIUM MODEL AND THE SURPRISING HISTORY AROUND IT

The model formulated in[1] (called LLE in the following) was introduced more than thirty years ago with the aim of providing a paradigm for pattern formation in nonlinear optical systems. The criterion of simplicity followed in formulating the LLE led to consider a Kerr medium enclosed in a nonlinear bistable optical cavity of high quality driven by a coherent light beam. The possibility of localized solitonic structures was predicted in[2].

The rather idealized conditions assumed in the LLE met physical realizations in a passive fiber cavity[3] and in broadband Kerr frequency combs in driven microresonators with very high Q[4]. It has soon become clear that the LLE is the model for the description of Kerr combs; the history that starts from the LLE and goes to soliton-based Kerr frequency combs is described in[5].

These results have led to worldwide research activity on this topic. Today Kerr frequency comb generation is a mature field and the technology has been applied to numerous areas, including coherent telecomunications, spectroscopy, atomic clocks as well as laser ranging and astrophysical spectroscopic calibration.

A companion paper to[1], published in 1988[6], extended the LLE concept to the case of a laser instead of a passive system. A very recent paper[7] indicates that a model formulated in[6] is closely linked to quantum cascade lasers.

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