Cavity solitons and dynamical states in a laser with saturable absorber

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Abstract:

Lasers with saturable absorber are often considered as model systems for the study of many different nonlinear phenomena. Bistable and self-pulsing (Q-switching) operation can be encountered depending on the system parameter values. Self-localized states have also been predicted [1] in this kind of system and later on observed both in semiconductor laser systems in an extended-cavity configuration [2] and in a monolithic microcavity [3]. We present recent experimental results on the control and dynamics of cavity solitons in a monolithic, vertical cavity surface emitting laser with a saturable absorber section (cf. Fig.1). Laser cavity solitons appear as self-localized microlasers [4] on top of the laser-off state. They form a zero-parameter family of solutions whose size is fixed by the system parameters and appear in single peaked or cluster states. They can be controlled (created or destroyed) by an external beam. On one hand, we show the fast and independent manipulation of two laser cavity solitons and demonstrate a flip-flop operation with a single control-beam. On the other hand, we evidence the existence of a pulsing localized structure and demonstrate the control of a pulsing multispot structure that can be switched-on and off. These results are promising in view of the obtainment of a pulsed and monolithic cavity soliton laser.

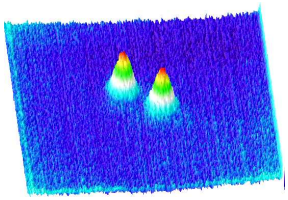

Figure 1: Three dimensional surface plot of the surface image of the cavity soliton laser showing two self-localized microlasers.

References:

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