Abstract for Dynamics Days Crete 2006
Topic: Nonlinear Dynamics in Optical Systems

Beam Splitter Design Using Mixed Phase Space Cavities

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Electromagnetic or electronic switches and beam-splitters are key elements in optical information processing, imaging, integrated photonic, and optical communication systems. We present a novel way to construct switches and splitters by using 2D chaotic multi-mode and multi-lead (in optics: multi-port) waveguides. Here we want to focus on the so-called *Cosine Billiard* of shape

$$y(x) = d + a\cos(2\pi x/L) \quad ,$$

where $w = d + a$ is the width, a is the amplitude, and L is the length of the cavity. Such a prototype two-lead waveguide is locally deformed in order to produce a ternary incomplete horseshoe proper of mixed phase space. Due to quantum mechanical tunneling (QMT) to the phase space stability islands the appearance of quasi-bound states (QBS) is induced. Then, we attach transversal leads (ports) to the waveguide on the deformation region in positions, where the phase space structure is only slightly perturbed. We show, how QBS can be guided out of the waveguide through the attached transversal leads (ports) giving rise to frequency selective switches and beam-splitters ([1, 2]).

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[1] O. Bendix and J.A. Mendéz-Bermúdez, *Opt. Lett.* **30**, 1396 (2005).

[2] O. Bendix, J.A. Mendéz-Bermúdez, G.A. Luna-Acosta, U. Kuhl, and H.-J. Stöckmann, *Microelectronics Journal* **36**, 285 (2005).