Highly Directional Emission from Inhomogeneous Dielectric Microcavities

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We propose a novel method of extracting light beams from 2D microcavities. The concept is based on *inhomogeneous dielectric cavities* (IDC) where the inhomogeneities arise from a space-dependent refractive index whose variations may be continuous (e.g. a localized induced gaussian profile of the index) or discontinuous (e.g. holes or refractive steps in the cavity material). Instead of the so-called asymmetric resonant cavities (ARC), which are smooth deformations of a circular cavity and produce directional output while sacrificing the quality factor Q, we intend to operate with an integrable geometry (a disk) and induce directionality through the (possibly reconfigurable) medium while preserving a high Q. The systems are interesting on two counts. Firstly, as classical objects, the IDC are equivalent to dielectric billiards (i.e. photonic escape is possible) where the broken symmetry of the material can induce a transition from regular to chaotic dynamics: chaos in an integrable billiard geometry, an almost unique combination. Secondly, guided by the classical phase space information, the wave dynamics can be "engineered" to produce highly directional emission with tailored optical properties, the grail of microcavity research. We have studied a number of configurations and will present results on their respective performances.

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