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Mathematical Physics

Effective mode volumes and Purcell factors for leaky optical cavities

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(Submitted on 22 Jul 2011)

We show that for optical cavities with any finite dissipation, the term "cavity mode" should be understood as a solution to the Helmholtz equation with outgoing wave boundary conditions. This choice of boundary condition renders the problem non-Hermitian, and we demonstrate that the common definition of an effective mode volume is ambiguous and not applicable. Instead, we propose an alternative effective mode volume which can be easily evaluated based on the mode calculation methods typically applied in the literature. This corrected mode volume is directly applicable to a much wider range of physical systems, allowing one to compute the Purcell effect and other interesting optical phenomena in a rigorous and unambiguous way.

Submission history

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