# Scattering Description of the Resonant Modes of Open 2D Dielectric Cavities

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Resonances of quasi-2D open dielectric cavities are usually identified as complex poles of the scattering matrix. In this contribution, we propose an alternative description of the resonance phenomenon based on scattering by real wavenumber fields. In order to circumvent the apparent inability to uniquely define resonant modes with real wavenumbers, we obtain a matrix formulation of the excess energy caused by the presence of the cavity in an otherwise empty universe. Characteristic modes of the cavity are associated with the eigenvectors of this matrix and their eigenvalues are understood as resonance time-delays (i.e. lifetimes or quality factors). In addition to being orthogonal, these modes are also self-replicating through interaction with the cavity, meaning that the incoming part of the characteristic modes interact with the cavity, and then leave with the same wavefront structures. We will present the numerical scheme implementing these ideas and will gather quantitative results to compare with other standard approaches. The method is quite general and allows for different geometries of the boundaries of the cavities as well as inhomogeneous (continuous and/or discontinuous) dielectric media.

**Keywords:** open dielectric cavities, scattering formulation, resonant modes and lifetimes, arbitrary geometries and media