Iterated multidimensional wave conversion*

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Ray tracing in $n \geq 2$ spatial dimensions follows the evolution of a family of rays in a $2n$-dimensional phase space. Families of rays are necessary in order to compute the focusing or defocusing of neighboring rays, which governs the evolution of wave amplitude. Mode conversion leads to the exchange of action between the different wave types. At the ray level, mode conversion causes a `splitting' of the incoming ray into two outgoing rays: a *transmitted ray* and a *converted ray*. Furthermore, the $(2n\text{-}2)$-dimensional mode-conversion manifold is shown to possess a Dirac-bracket structure that is inherited from the Poisson bracket on ray phase space.

In a cavity, rays can be re-entrant, and conversion can occur multiple times. Thus, even for $n = 2$ spatial dimensions, eikonal calculations require following large numbers of rays in a four-dimensional space, while allowing for the doubling of the number of rays at each conversion. Here, we present some novel ideas that allow for a complete and global visualization of the ray evolution, even under iterated conversions.

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