# Propagation of Correlation Functions in Cavities

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Predicting the radiation of complex electromagnetic sources inside semi-open cavities and resonators is an exciting topic in optics, microwave engineering, and electromagnetic compatibility (EMC). We have recently derived an approximated formula to propagate correlation functions of fields radiated from complex and extended sources in free-space. The formula is based on a ray dynamical phase-space picture of the electromagnetic field, the so-called Wigner distribution function. Our approximation includes interference effects and evanescent wave corrections on classical ray-tracing schemes.

In this contribution, we derive a ray-tracing approximation for the propagation of correlation functions within cavities. The theory is based on the transport of Wigner functions, which is driven by a linear map in phase-space. The map is given by the geometry of the cord connecting a point of the boundary to another. Once the boundary is discretized, our formalism can be used with great flexibility as it naturally embeds multiple reflections and scattering within arbitrary shaped cavities. In particular, the correlation function of cavity fields can be constructed by a semiclassical approach solving for the boundary integral equation in terms of shift, and then transfer, operator.

The effect of chaotic dynamics on the propagation of correlation functions is explored by studying *non-integrable billiards*. Furthermore, we analyze the dynamics of correlations when cavity boundaries are semi-open, i.e., in the presence of apertures. Specifically, *a model of two polygonal billiards coupled by an aperture is presented and solved in presence of a large random source.*

Our theory and the achieved results are of interest for radiated emission and immunity tests in EMC, for broadband wireless systems operating in arbitrary environments, as well as for fundamental studies of semi-open and coupled wave chaotic systems.