Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Wigner-function approach to study the radiation of complex electromagnetic sources GABRIELE GRADONI, STEPHEN CREAGH, GREGOR TANNER, School of Mathematical Sciences, The University of Nottingham, MATHEMATICAL PHYSICS TEAM — In this work, we develop a mathematical framework to predict the radiation of complex electromagnetic sources in free-space. We show how to propagate field-field correlation functions from near- to far-field using the formalism of Wigner-Weyl quantum mechanics. In so doing, the key point is to make a connection between the field-field correlation function in configuration space and a corresponding Wigner function in phase space. We make an analogy between the evolution of waves and the evolution in phase space of the underlying classical trajectories, for which we derive and generalize a Frobenius-Perron Equation. In the context of electromagnetic problems, the Wigner-function approach has been championed by Marcuvitz using the "quasiparticle" picture of wave evolution. In the proposed approach, we approximate the propagation of field-field correlation functions by propagating phase-space densities of ray families, which is effectively a lower-dimensional calculation and therefore easier to compute. In particular, we discuss how the Wigner-function approach can be extended to boundary-value problems by using the results of semiclassics and the random matrix theory.

Gabriele Gradoni
The University of Nottingham

Date submitted: 14 Nov 2013 Electronic form version 1.4