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A complete asymptotic description of ultrawideband/ultrashort electromagnetic pulse propagation in causally dispersive, attenuative media has been developed and will be extended to complex dielectric, conducting, and magnetic media exhibiting temporal dispersion.

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Asymptotic Description of Ultrashort Pulse Propagation in Complex Dispersive Media

AFOSR Grant # F49620-97-1-0300

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Our long-term research goal is to develop a rigorous analytic formulation and, based upon this, a uniform asymptotic description of pulsed electromagnetic beam-field propagation, reflection, and transmission phenomena in causally dispersive dielectric and conducting media. Emphasis has been placed first on a formulation that has been rigorously obtained from the macroscopic Maxwell's equations with physically appropriate constitutive relations, followed by the development and application of the required uniform asymptotic expansion techniques that are necessary to provide a completely continuous description of the space-time evolution of the pulsed beam-field at sufficiently large propagation distances from the input plane. A detailed description of the most recent results of this research have been presented in the invited paper on "Transient Field Properties of Ultrawideband Pulse Propagation in Complex Dispersive Media," at the 1997 Progress in Electromagnetics Research Symposium (PIERS) in Cambridge, Massachusetts. A portion of this research resulted in the following publications (reprints attached if available):

K. E. Oughstun, "Nonlinear Optical Pulse Propagation in the Single-Cycle Regime: Comments," *Physical Review Letters* (submitted).

H. Xiao and K. E. Oughstun, "Hybrid Numerical-Asymptotic Code for Dispersive Pulse Propagation Calculations," *Journal of the Optical Society of America A* (submitted).