

Abstract Submitted  
for the MAR07 Meeting of  
The American Physical Society

**Moments Formulation of Optical-Pulse Propagation in Insulators**<sup>1</sup> DAVID Y. SMITH, University of Vermont and Argonne National Laboratory, WILLIAM KARSTENS, Saint Michael's College — We have developed general expressions for the group velocity and its dispersion in insulators in terms of moments of the material's IR (ionic) and UV (electronic) absorptions. The formulation, which is based on Kramers-Kronig dispersion theory, is independent of material models, and involves only independently measurable quantities. The carrier frequency at which a signal propagates with minimum distortion is determined by the ratio of the first moment of the ionic absorption to the inverse-third moment of the electronic absorption\*. This represents a balance between ionic and electronic effects and depends only on their respective contributions to dispersion in the index, not on the magnitude of the refractive index. Physically, minimum distortion corresponds to propagation of a compound ionic-electronic polaron at a frequency for which the ionic and electronic components remain in phase. Applications to silicate-glass fibers will be considered. \*This is a generalization of a result given by S. H. Wemple, *Appl. Opt.* **18**, 31 (1979).

<sup>1</sup>Work supported by US Department of Energy, Office of Science, Materials Science Division under contract DE-FG02-02ER45964, and Office of Nuclear Physics under contract DE-AC02-06CH11357.

David Y. Smith  
University of Vermont and Argonne National Laboratory

Date submitted: 15 Nov 2006

Electronic form version 1.4