Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Quantification of Nanoscale Density Fluctuations in Biological Cells/Tissues: Inverse Participation Ratio (IPR) Analysis of Transmission Electron Microscopy Images and Implications for Early-Stage Cancer Detection PRABHAKAR PRADHAN, DHWANIL DAMANIA, HRUSHIKESH JOSHI, ALLEN TAFLOVE, HEMANT ROY, VINAYAK DRAVID, VADIM BACKMAN, Northwestern University, Evanston, IL — We report a study of the nanoscale mass density fluctuations of biological cells and tissues by quantifying their nanoscale light-localization properties. Transmission electron microscope (TEM) images of human cells and tissues are used to construct corresponding effective disordered optical lattices. Light-localization properties are studied by statistical analysis of the inverse participation ratio (IPR) of the eigenfunctions of these optical lattices at the nanoscales. Our results indicate elevation of the nanoscale disorder strength (e.g., refractive index fluctuations) in early carcinogenesis. Importantly, our results demonstrate that the increase in the nanoscale disorder represents the earliest structural alteration in cells undergoing carcinogenesis known to-date. Potential applications of the technique for early stage cancer detection will be discussed.

Prabhakar Pradhan
Northwestern University

Date submitted: 08 Dec 2009 Electronic form version 1.4