Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Inverse Participation Ratio (IPR) Analysis of Transmission Electron Microscopy (TEM) Images: Quantification of Optical Disorder Strength Due to Nanoscale Refractive Index Fluctuations of Tissues/Cells P. PRADHAN, V. TURZHITSKY, H. SUBRAMANIAN, A. HEIFETZ, D. DAMANIA, J. L. HOOGHEEM, M. J. JUNG, H. K. ROY, V. BACKMAN, Northwestern University, Evanston, IL 60208 — An IPR analysis technique is developed for the first time to analyze and to quantify TEM images of cells/tissues by projecting them to optical lattices and quantifying their short-range nanoscale refractive index fluctuations. The value of IPR of a finite optical lattice provides the measure of the localization of light due to the lattice refractive index fluctuations. The high resolution (∼1nm) of the TEM technique enables imaging of the nanoscale refractive index fluctuations of thin tissue/cell sample slices (∼50-100 nm). TEM images have been widely used in biology for pathological and visual observation of cells and sub-cellular structures. However, properties of the nanoscale fluctuations in the images have not been fully understood. Results of our IPR study of human tissue/cell TEM images show that average short range nanoscale refractive index fluctuations in tissues/cells increase (i.e. increase of the IPR value) with the progress of carcinogenesis. Presently available detection techniques are unable to detect these changes. Potential applications of the IPR analysis to probe other nanoscale biological changes are also discussed.

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Date submitted: 24 Jan 2008 Electronic form version 1.4