University of Texas
at San Antonio

Department of Physics & Astronomy

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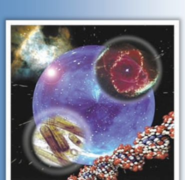
Optical Properties of Nanoscale Nanoelectronic Materials

Nanoscale dimensions clearly alter the optical properties of materials. All too often, changes in key optical properties such as direct gap transitions are attributed to quantum confinement. The origin of changes in optical properties depends on several factors including crystal structure, stress, material type (metal, semiconductor, or dielectric), and temperature. First, the talk describes the effect of stress on Si(1-x)Gex alloys that are pseudomorphic on Si (001). Next, scatterometry based measurement of the shape and dimension of silicon fins and fins having Si(1-x)Gex layers on top of the Si fins is discussed. Here the need for Mueller Matrix ellipsometry and an understanding anisotropic optical properties is presented. High Resolution X-Ray Diffraction characterization will also be discussed. The last topic will be the effect of nanoscale dimensions on ultra-thin silicon films. Temperature dependent determination of the dielectric function of ultra-thin silicon on insulator films was used to show that electron-phonon interactions alter optical transitions. This leads to a better understanding of how changes in the phonon dispersion will alter room temperature optical properties. In this talk, the impact of nanoscale dimensions will be explored using examples that include fully-stressed pseudomorphic silicon- germanium alloys, thin silicon “fin” & Si(1-x)Gex/Si “fin” structures, and ultra-thin silicon films.



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