Second Harmonic Spectroscopy of Silicon Nanocrystals Embedded in SiO$_2$

Junwei Wei, Adrian Wirth, Michael C. Downer
Physics Department, the University of Texas at Austin

Si nanocrystals have properties & applications different from those of bulk Si

“Si lasers start to take shape”

Observation of optical gain in Si nanocrystals embedded in SiO$_2$

Those interesting properties originate at Si NC/SiO$_2$ interfaces
SHG has a reputation for being interface-specific
Cross-polarized two-beam SHG (XP2-SHG)*

**Dipolar SHG**

For planar interfaces

\[ \mathbf{P}_{\text{dipolar}}^{(2\omega)} \propto \mathbf{E} \mathbf{E} \]

**Quadrupolar SHG**

For nano-composites

\[ \mathbf{P}_{\text{quadrupolar}}^{(2\omega)} \propto (\mathbf{E} \cdot \nabla) \mathbf{E} \]

Summary of main results

**SHG spectroscopy**

Quadrupolar SHG appears to be selectively sensitive to nano-interface structure (in close analogy to dipolar SHG of planar interfaces)