The Electronic and Optical Properties of Nanoscale Meta-lattice Made by High Pressure CVD ZHAOHUI HUANG\textsuperscript{1}, VINCENT CRESPI\textsuperscript{2}, Pennsylvania State Univ — Meta-lattice can be defined as an artificial 3D super-lattice with periodic structural modulation occurred at 10nm scale. One viable route to synthesize can be as follows: A template is first prepared by close-packed nanoscale silica spheres, then Si/Ge or a binary semiconductor is infiltrated into voids by high pressure chemical vapor deposition (CVD). Later silica spheres can be removed by chemical method, and voids in the inverse meta-lattice offer a second opportunity for infiltration. Due to the characteristic length of voids, meta-lattice provides a platform to test novel mesoscopic electronic and optical phenomena. More specifically, a meta-lattice solid can be taken as a collection of molecular clusters connected by thin and narrow metabonds. Electronic properties are expected to share both characteristics of Bloch electrons and molecular states, for example, localized optical transition. Since a significant portion of atoms are located on the surface, the structural details may play a critical role. Here we employ large scale tight-binding calculations and non-equilibrium Green’s function method to investigate the electronic (including electronic transport) and optical properties for Si meta-lattices.

\textsuperscript{1}Dept. of Physics  
\textsuperscript{2}Dept. of Physics