My research studies within the photonic crystal research group at the Physics Department involves the fabrication and characterization of synthetic opal photonic crystals for optical applications in the visible spectral range. This work is funded by the Nanotechnology section at the NSF and is headed by Prof.s Efros and Vardeny.

My research is focused on the synthesis of mono-dispersed silica spheres with diameters in the range of 200-800nm. Using these spheres I grow thin-film opals on glass substrates that are composed of self-assembled silica spheres having a hexagonal symmetry. A central goal is to control the number of layers in such a film by varying the growth conditions. Long-range periodicity is dependent on mono-dispersivity of the sphere diameters, and thus the other main goal is to control sphere diameter and minimize size distribution. These properties are dependent on conditions of synthesis, and the aim of my work is to tune sphere dimensions at will. Imaging with a scanning electron microscope and performing statistical analysis of the results help to evaluate the synthetic opal films and bulk crystals and the silica sphere samples. In addition, we also use optical methods to investigate the optical band gap and the light scattering length in the fabricated samples.

Future work is to synthesize mono-disperse spheres of titania in the rutile phase. The high refractive index of such spheres makes them of great interest to research for optical photonic band-gap studies.