Angela Stelson

Biography

My name is Angela Stelson, and I am a second year PhD student in the materials science and engineering department at Cornell. Ever since I was little, I’ve loved puzzles; my Uncle used to challenge me to “puzzle offs” where we would try to figure out better solutions to tricky riddles. I was raised in a bilingual household, and had a bug to travel from an early age. I studied abroad in Germany, Chile and Jordan during high school, which exposed me to many different cultures and educational systems.

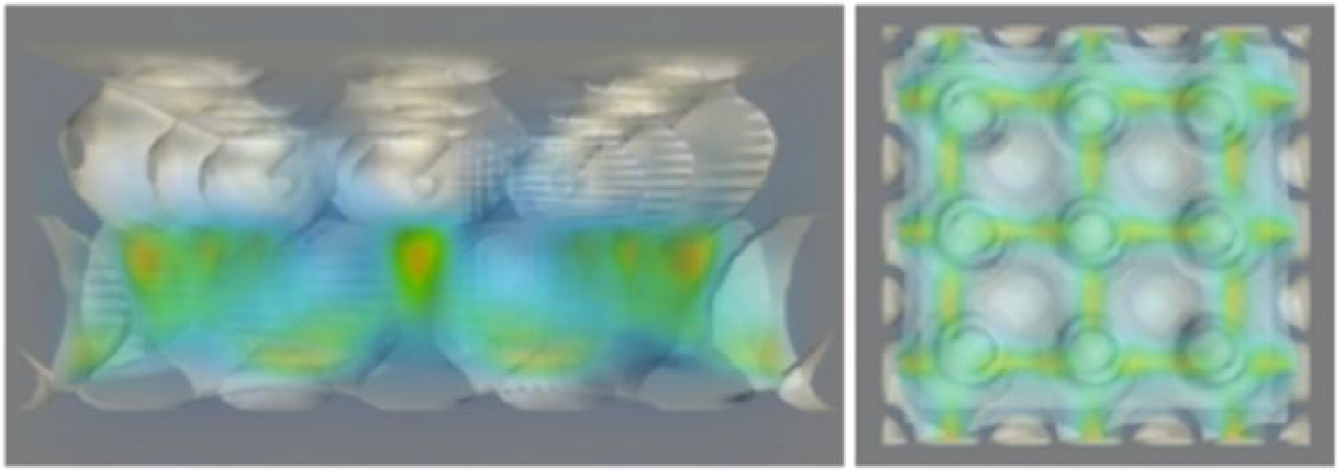
When I went off to college at the University of Oregon, I had no idea what I wanted to be. I tried History, Philosophy, and German before deciding I wanted to be a scientist, and graduating with majors in Physics, Mathematics and Political Science in 2012. I had many different opportunities to help me decide what I wanted to be, including interning for a political campaign, teaching 3^{rd} graders German and working at a research library. When I started becoming more interested in science, I interned at a specialty chemical company making solar cell components and a semiconductor company. During these experiences, I found myself thinking. “I wish I could just study the materials”~~,~~ and this led me to pursue a degree in materials science. My interest lies in photonic crystals, which are materials that control the way light moves. These materials have applications in energy applications such as solar panels, and are seen in nature in iridescent butterfly wings and opals. I’ve had a lot of opportunities to teach different audiences from third graders to college students, and it has been both enjoyable and illuminating.

Research

In my research I study photonic crystals, materials that control the flow of light. These crystals have many applications, including solar cells and even computers that run on light instead of electricity. Photonic crystals work by diffracting light into different directions causing constructive and destructive interference. This works similarly to waves on a beach flowing over rocks - depending on the size, shape and position of the rocks, different patterns form from the incoming waves. Equivalently, we can make structures that interact with light by making “rock structures” that are the same size as the wavelength of light. Length [LC1|file:///C:/Users/Tyler/Desktop/Summer%2014/GK12/G1_Angela%20Stelson_Bio%20and%20Research%20Final%20Draft.docx#_msocom_1] is very important in photonic crystals- after all, you can’t control a tsunami with pebbles! By making crystals that reflect certain wavelengths of light, while blocking others, we can make optical switches, the first step toward optical circuits.

In order to make our photonic crystals, we use metamaterials, or materials made of other materials. We assemble micrometer-sized particles with unusual shape (mushroom caps, peanuts and dumbbells)~~,~~ under confinement and electric field. By confining the particles to a small space, they arrange themselves differently, and using an electric field causes them to orient along specific directions. Applying these assembly forces allows us to generate new structures with new optical properties. These particle structures serve as templates for photonic crystals.

Photonic crystals are difficult to manufacture, so predicting which structures we want to fabricate is important to narrow the field of experiments. By using iterative computational techniques, we can model the flow of light through the material and determine if there are certain wavelengths of light not allowed in the structure (a photonic bandgap). Determining which structures have photonic bandgaps, and what characteristics of a structure (symmetry, material, particle shape) are important in forming a bandgap is an area of active research to understand how light interacts with matter.[LC2|



This image depicts the displacement field (proportional to the electromagnetic field) concentration within a photonic crystal of self-assembled particles. When there is no concentration of electromagnetic field in the structure, a photonic band gap is present.

[LC1|file:///C:/Users/Tyler/Desktop/Summer%2014/GK12/G1_Angela%20Stelson_Bio%20and%20Research%20Final%20Draft.docx#_msoanchor_1]In what context? Wavelength?

[LC2|file:///C:/Users/Tyler/Desktop/Summer%2014/GK12/G1_Angela%20Stelson_Bio%20and%20Research%20Final%20Draft.docx#_msoanchor_2]Is this the research you're planning on doing with your teacher?