Nano-optics with Professor Caldwell

*Me*: What inspired you to enter the field of nano-optics?

*Caldwell:* When I started my educational career at Virginia Tech, my original goal was to become a mechanical engineer due to my love for physics. However, after participating in a summer fellowship at the National Renewable Energy Laboratory, I decided that mechanical engineering had too much of a numerical focus. Instead, I took a course in physical chemistry and fell in love with optics, and I chose to travel to the Naval Research Laboratory. I loved the questions we had to answer: What is the new science that can drive the navy? New materials, new components?

*Me*: That’s fascinating. What products were created during your fellowship?

*Caldwell*: The most famous product we created was night vision goggles, specifically ITT Night Vision goggles. The science behind it is that light enters the front of the goggles, and the photons from the light hit an object within the goggles known as a photocathode. It then shoots those photons to certain components within the goggles and amplifies the energy to create a visual.

*Me*: What are some misconceptions about your work?

*Caldwell:* Most people think that nano-optics is simply about lenses and seeing. However, nano-optics is a huge field that even includes nano-particles that are smaller than a hair strand. One of the most revolutionary properties that we have observed in nano-optics is the ability for a particles’ properties to change when shrunk to the nano-scale. This has resulted in major developments in the minimization of current technologies. Unfortunately, there is a limit as to how small an object can go on the nano-scale.

*Me*: Has this experiment opened a new topic that you will continue to delve deeper into?

*Caldwell*: I am primarily interested in vibrational spectroscopy, which tests the movement of particles on the nano-scale and its ability to correlate with certain frequencies. Vibration will result in properties, such as wavelength and refraction, that are similar to light and can be measured similarly to photonic energies.

*Me*: I’m sorry if I’m interrupting, but I don’t quite understand what it means to correlate vibration to light properties. Could you provide an example?

*Caldwell*: Sure, no problem! For example, let’s say we shine a light on a block of silver, so what happens to the light?

*Me*: It bounces off, right?

*Caldwell*: Correct! And light is made up of photons, which is basically a form of energy. When light is shined on silver, its free electrons move and oscillate to create a magnetic field due to opposing charges that does not allow light to pass through. This is due to how transition metals contain free electron properties that will oscillate when energized, because of its distance from the nucleus and the weakness of the attraction.

*Me*: Thank you for the clarification! Are there any questions that I may have missed?

*Caldwell*: I don’t think so.

*Me*: Well, thank you for your time. It was nice talking to you Professor Caldwell!

*Caldwell*: Thanks for stopping by. Let me know if you would be interested in anything else!