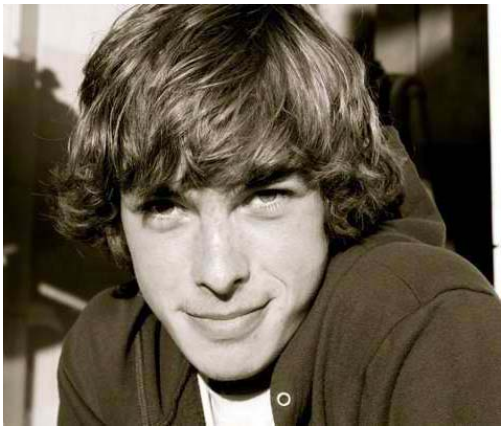
Research in the Physical Sciences
Forget Cells and Proteins, We're Talking Lasers and Atoms

By: Neelam Phalke, Sophomore Majoring in Biochemistry



Martin Seifrid, Sophomore, B.S. Chemistry

Chemistry of Dreams

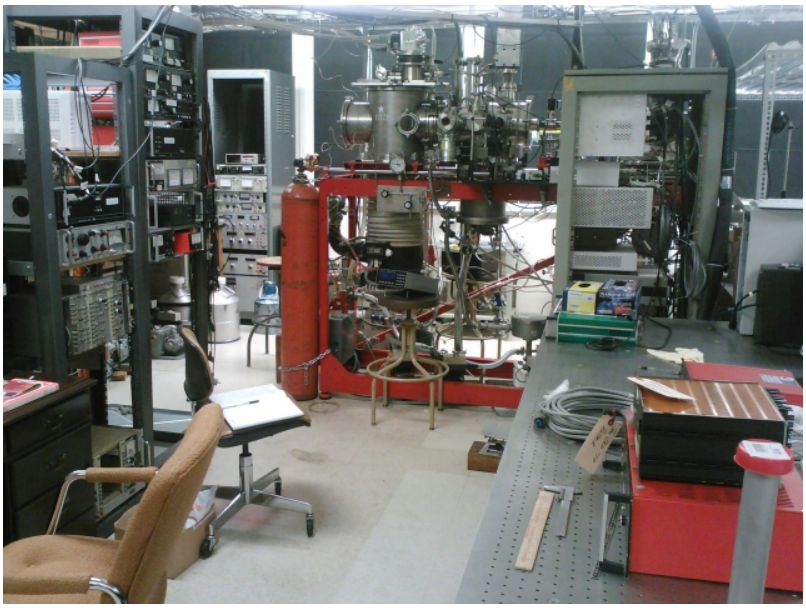
Martin Seifrid is an undergraduate sophomore in the Dana and David Dornsife College of Letters, Arts, and Sciences majoring in Chemistry. His father, Dr. Thomas John Seifrid, is a professor of Russian Literature here at the University of Southern California. Martin was born and raised in Los Angeles, California where he attended Le Lycée Français de Los Angeles, a high school based off the French curriculum and taught entirely in the French language. Originally interested in Physics, it was during high school that Martin first realized he would rather pursue Chemistry in college.

As part of the exit exam process of his high school's French curriculum, Martin had to prepare and present a project on a topic of interest to him. The original idea for the project was to study the "Chemistry of Dreams," but the project took a spin as the group decided they wanted to study the effects of LSD instead. The group had to learn a lot about the chemical structure and properties of LSD, which proved to be much more interesting than the General Chemistry Martin was learning in class; this is where Martin first gained his passion for Chemistry.

Understanding the 3D structure of Silver Droplets

Martin began his research, working under Dr. Vilesov in Seaver Science Center during the summer after his freshman year as part of USC's Summer Undergraduate Research Fund (SURF) program. Dr. Vilesove utilizes helium droplets to capture single atoms of elements and study their physical properties.

In Dr. Vilesov's lab, Martin assists on a project to understand the 3D structure of silver droplets. He spent the first month of summer learning and developing the theoretical predictions for the experiment and developing a computer program to perform the experiment's calculations. During his second month of the summer semester, he began learning about the laboratory setting and how all the equipment functioned. This led into his work throughout the semester.



Methods

The idea behind the project is to pass a laser through a beam of helium droplets to which silver atoms have been added and measure how the light is scattered in order to create an image of the droplets' structures. Martin is trying to determine if the silver cluster forms a vortex. A vortex is exactly what you imagine it to be, a sort of tornado of fast-moving atoms. Martin's theoretical predictions were guesses of how the light should scatter if the silver cluster in the droplet were spherical or nearly spherical. If the scattered laser matches his predictions, this indicates that the silver atoms are not in a vortex.

The "doped" droplets (silver contained in helium) are shot onto a copper grid covered in carbon. This causes the helium to evaporate off, leaving just the clustered silver behind. A Transmission Electron Microscope (TEM) is utilized to visualize the silver. However, at certain temperatures, lines of silver are shown on the grid, rather than dots that would indicate a vortex Thus, Martin must also determine if this discrepancy is caused by a temperature difference between the room temperature grid and the helium droplets that have been cooled to 5-8 Kelvin.

Since the experiment is just in its initial stages, Martin does not have many results yet, but in the future hopes to further study the magnetism of the clusters. His laboratory will work to determine the size barrier at which silver stops being magnetic.

Unlike research in fields such as biology, neuroscience, or medicine, there often times is not a greater end goal for research in a physical science such as Chemistry. Martin's research is about

discovery and understanding of atomic structures. Perhaps in the future someone may find an application for the findings from this research, but for now Martin’s research is purely for knowledge, driven by passion for science.