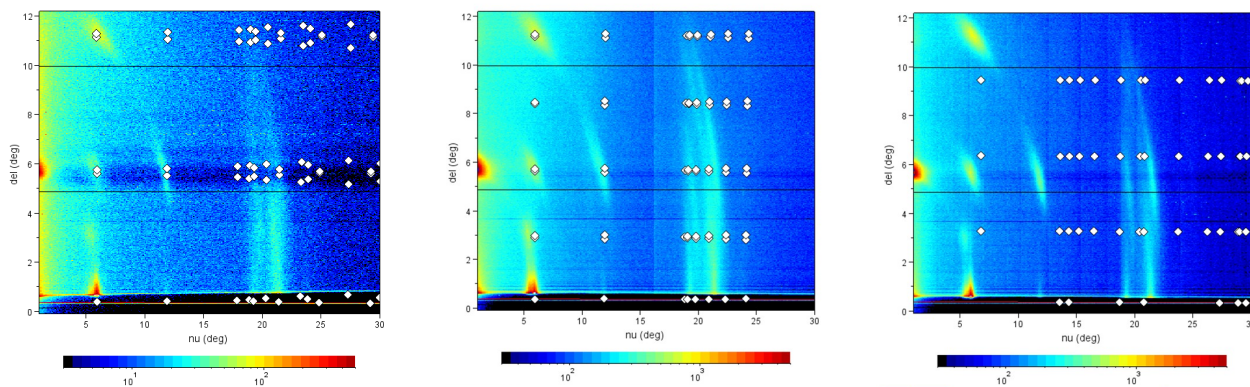


Last fall Dr. Kintzel and I applied for a Faculty-Undergraduate Student Engagement (FUSE) grant to analyze ultrathin molecular films. The film we decided to look at was composed of copper phthalocyanine (CuPc) because of its use in solar energy applications. The films were deposited on pieces of glass approximately 1/8th of an inch thick. The glass substrate was chosen because it is a smooth surface to deposit the films onto so we would not have to deal with any interference with the orientation of the molecules. The main focus of this research was to determine if the orientation of the CuPc molecules would change if deposited on substrates at different temperatures.

I created at the Advanced Materials Institute using a physical evaporator. Three films were created for each of the different substrate temperatures. I heated the substrates to 50°C, 100°C and 150°C while the CuPc film was being deposited. Unfortunately due to an error with the deposition thickness gauges, the films ended up being thicker than initially desired. Since the focus of this research was based on the temperature of the substrate we determined that we were still able to use the films in the experiment.

The Cornell High Energy Synchrotron Source (CHESS) at Cornell University was used to perform the analysis on the films. Using the G2 station at CHESS which allows Grazing Incident X-Ray Diffraction, we were able to rotate the detector in the around the detector in a horizontal direction and we also angle the detector in the vertical direction as well. Analyzing each film took approximately four hours once the set up is complete. The set up for the samples consist of insuring that the film is level, this is achieved by reflecting a laser off of the sample. Each time I would scan the sample I would get an image of the films reciprocal space, this is what allows us to analyze the crystal structure and orientation of the film.



*Drawing 1: CuPc films deposited on substrates at 50 (left), 100 (middle) and 150 (right) degrees Celsius*

The images above are examples of the type of data that I recovered from the experiment. The data matched results from other experiments very well. Our conclusion is that the orientation of the molecules do not depend on the temperature of the substrate. Work may continue in the future not only by making films that are more uniform in thickness but also by treating the films to see how that affects the orientation of the molecules.