For this case study, we sought to use our knowledge of linear algebra to help predict the transmission of light through a lens. We were given base matrices and with that we plotted out rays in reference to the lens. We first created a model that formed rays that started from two different points in the and then generated a rather blurry rendering of the image we were given. For the next part we took our initial conditions and generated the rays as it hit through a lens with a given focal point of 150 mm, using matrix multiplication for each step of the way. We then rendered an even clearer image of the planet, which turned out to be Saturn. Finally, for our last part we wanted to see if we could basically reverse the process, by creating an inverse matrix, and so we created the inverse matrix and ended up with another extremely clear image of Saturn through reverse processing.

I. Introduction

For this project, we had to use our base understanding of linear algebra and apply it to the properties of light and its transmission through a lens. When light travels, it splits into many different rays before hitting an object and making it visible. In this instance, we wanted to get a clearer image, so we wanted to control the propagation of the light by essentially modeling it ourselves and sending it through a lens.

For the first part, we just used an initially given matrix to model the rays as they emerged from two different specified points. With that initial matrix we applied it with a given distance and we wished to get some sort of image returned when we propagated it.

For the next part, we essentially just put rays through different transformations with different matrices to get a clearer image through a lens. We had to model the rays as they went across distances of d_1 and d_2, as well as how it goes across the lens. We did all of this through matrix multiplication, so we could model a new image.

For the last part, we calculated an inverse for our initial M matrix, and then we used reverse processing to compute a resulting image without a need for a physical imaging system.