Sarah Rumbley
Devyn Shafer
Senior Division Physics
Polarimetry With Laser-Illuminated Digital Holography

This project seeks to develop a method of polarimetry for combination with a previously established method of digital holography. Unlike existing technology that can perform either polarimetry or holography, but not both, our goal is to unify these two functions into a single system for a more practical and efficient imaging process. Such a device would be useful in several applications, including military situations, national security, and ground surveying. The three-dimensional imaging component relies on active imaging technology that uses infrared lasers to illuminate an area and capture the reflected light. This method can produce high-quality images at long distances. By analyzing the light reflected by the imaged object, we can transform a spatial frequency spectrum into a coherent image. To construct a three-dimensional image, the data is collected at two different wavelengths and depth is calculated from the phase difference between those wavelengths. Our part of the project focuses on the integration of polarimetry into an already existing three-dimensional imaging system. For the polarimetric component, we compare the polarization of the reflected light to that of the transmitted light at each pixel. This data can help identify the materials of the objects by referencing the known polarization properties of the materials. We have found that the images produced by this method accurately relay information concerning the appearance, depth, and material of a given object. In the future, we hope to further improve the system by better calibrating the polarization data and expanding the range of material identification through polarization.