



The Advanced Laser Mining Array for Mining on Lunar Surfaces

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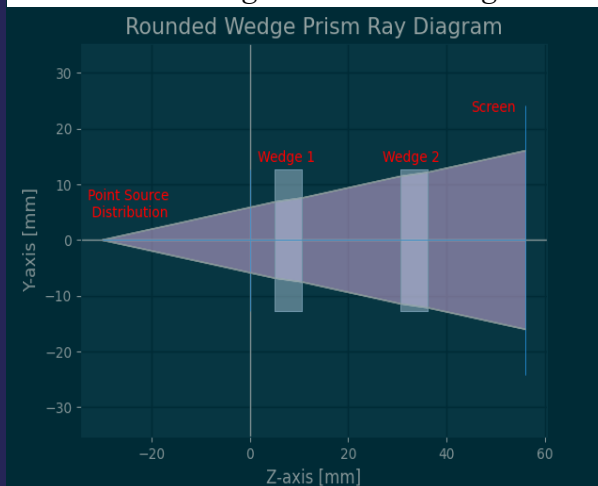
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ABSTRACT

The main goal and mission for ALMA is to demonstrate one of the most efficient mining techniques for mining water ice on the moon with a laser. The reasoning behind using a helical shape is so that the intensity of the beam is evenly spread across the surface area without losing the peak intensity of the beam. This has been shown through large mining corporations that mine on Earth with lasers. Also being researched in multiple published papers and shown that helical mining is one of the more efficient patterns for mining.

Figure 1. Simulation in Python is used to see how the wedges interact with light.



BACKGROUND

The initial mission for ALMA was to build a Fiber laser and test it by mining ice in situ. Using a spectrometer to read the spectra from melted ice. This would produce an absorption curve, giving the absorption coefficient which is used to derive the intensity which needs to be produced. Due to a lack of money, the project was detoured to research efficient mining techniques shown in Figure 3. The helix is not perfectly spaced due to the printed parts shaking.

Figure 3. The apparatus rotated the first wedge at 25 deg/s and the second at 25.5 deg/s, allowing for the helical shape to be made.

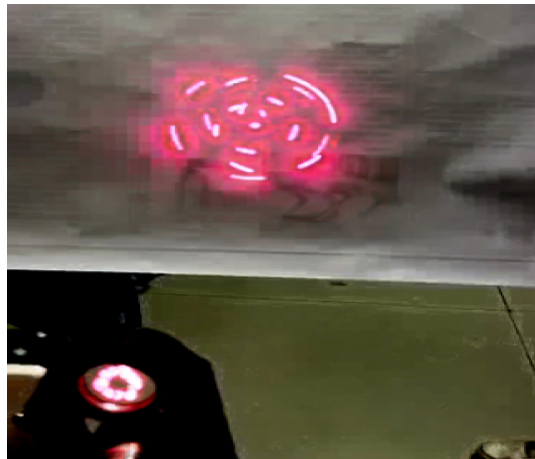
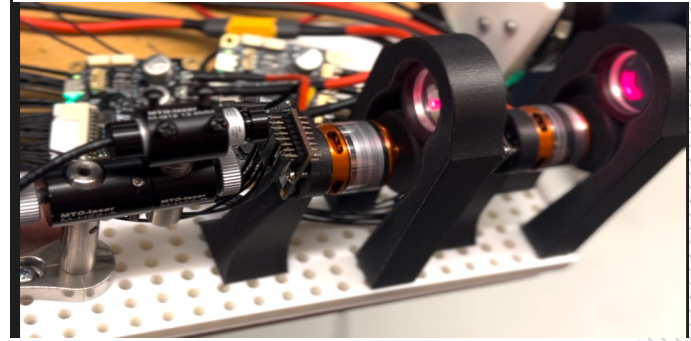


Figure 2. The apparatus makes the helical shape by using moteus controllers, BLDC motors, a 5mW laser, and 3D-printed assemblies.



METHODS

- The design to rotate the wedges which make the helical pattern is entirely 3D-printed.
- Used double helical gears which are attached to the brushless motors and wedges, allowing them to rotate.
- The moteus controllers allow for efficient programming and smooth runtime.

FUTURE WORK

- Testing the apparatus using a Fiber laser to melt the ice and extract the spectra.
- Expanding on the apparatus and making a more efficient revision.