# Advanced LASER Mining Array (ALMA)

Principal Investigator: Dr. Vikas Sudesh

Student Team: Jacob Romeo, Joseph DeMartini,

and Paige Loverick

April 2023

## 1    Abstract

ALMA is a fiber-laser (FBL) apparatus that will show a technique to mine water ice in space. The ALMA will use absorbance to its advantage to melt water ice at low power so that energy consumption is not an issue in space. Water ice's absorption coefficient peaks in the near-infrared range, thus the FBL will have an output ranging from 1060nm-1100nm. The FBL is going to have a source (coupled diode) of 976nm, which will be of low wattage at 1.2W, being pumped through the Ytterbium doped fiber cable. This is going to be done by using a variety of fiber Bragg gratings to polarize the output to a specific wavelength. The purpose of this process is to experimentally derive the absorption coefficient of water ice by melting it and reading its spectra from a spectrometer so that the extinction coefficient can be solved. The extinction coefficient is then used to find the absorbance, solving for the Intensity of the beam. After this is done, python will be used to numerically solve (using the coefficients found) the equations for the physics inside the FBL, so that Ansys can simulate a high-powered laser in a space environment. The reason for doing this is due to costs, thus the ALMA team will be submitting future proposals to NASA for larger grants in the future. This project is an huge learning curve and amazing experience for the students working on this, including the assembly of the apparatus, the physics and concepts, simulations, and working under time constraints.