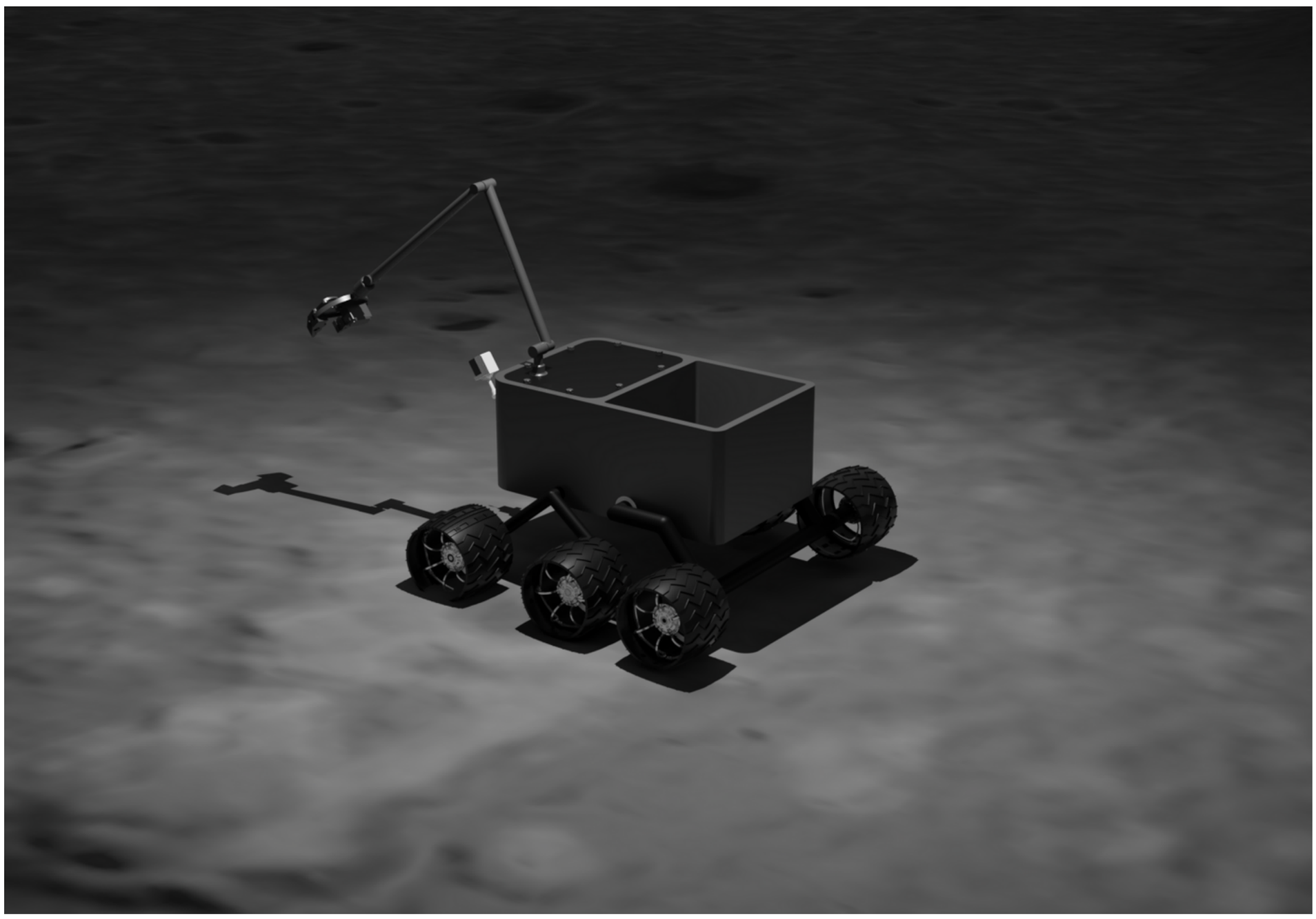
GalactaRover
User Manual



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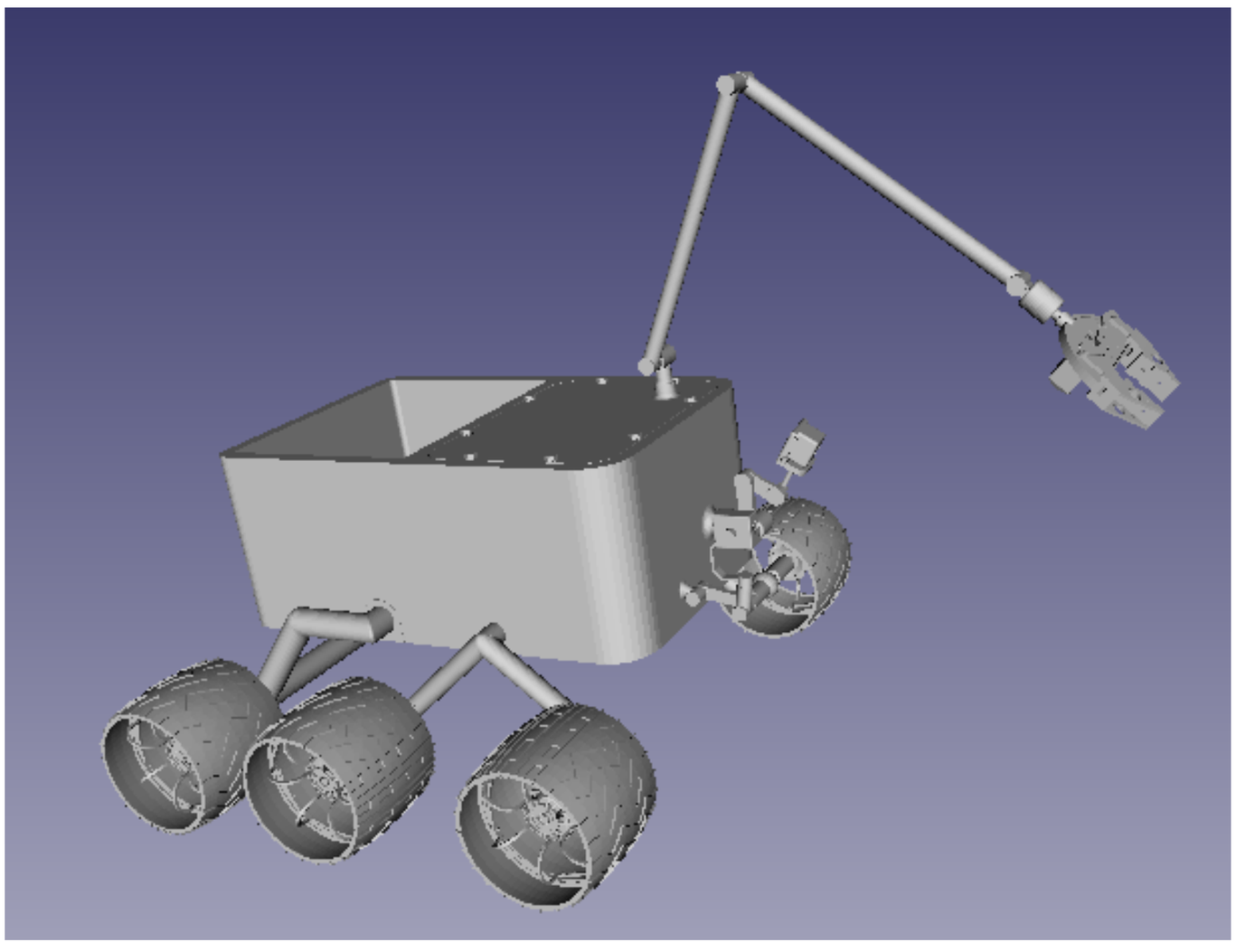
II. Getting Started

I.1. Purpose of the Manual

This manual is designed to provide comprehensive instructions on how to operate the Moon Rover, a robot designed for space exploration. It includes detailed information on the rover's features, and how they operate.

I.2. Overview of the Moon Rover

The Moon Rover is a robot designed for space exploration. It is equipped with a ChemCam for analyzing rocks and surfaces, a gripper for grabbing samples, a LASER to cut samples that can be carried by the rover and special wheels for collecting and condensing electrons from lunar dust.



I. Introduction to the Moon Rover

II.1. Powering On and Off

To power on the Moon Rover, press the power button located on the control panel. This action sends a signal to the rover's ultra-high frequency (UHF) antenna, which then communicates with the base station on Earth. The base station sends back a confirmation signal, and the rover's systems are activated.

To power off the Moon Rover, press the same power button. This action sends a signal to the rover's UHF antenna, which then communicates with the base station on Earth. The base station sends back a confirmation signal, and the rover's systems are deactivated.

In addition to the power button, the rover can also be powered on and off remotely using X-Band signals. These signals are sent from the base station on Earth and received by the rover's high-gain antenna. The rover interprets these signals and powers on or off accordingly.

If the rover is out of range, it will continue to operate based on its last received command until it comes back into range.

II.2 Charging the Rover

- **Electrostatic Multilayer Systems**

The rover's special wheels are equipped with Electrostatic

- **Multilayer Systems**

These systems can act as a power source by collecting and condensing electrons from the lunar dust. This method is more complex and will be further explain in section IV. Advanced Features subsection IV.1. Scientific Instrumentation Usage.

III. Operating the Moon Rover

III.1 Navigating Terrain

To handle various obstacles such as rocks, craters, and steep slopes, the rover wheels are designed to be flexible and adaptive. Its wheels have the capability to deform or change shape, enabling them to roll over obstacles rather than getting stuck or damaged by them.

It is also equipped with advanced sensors and navigation systems that help them autonomously detect and navigate around obstacles.

III.2. Using Cameras and Sensors

The rover is equiped with a ChemCam which is used for a variety of tasks, including capturing images of the Lunar terrain, analyzing the elemental composition of materials, and providing close-up views of the minerals, textures, and structures in Lunar rocks.

IV. Advanced Features

IV.1. Scientific Instrumentation Usage

IV.1.1. ChemCam

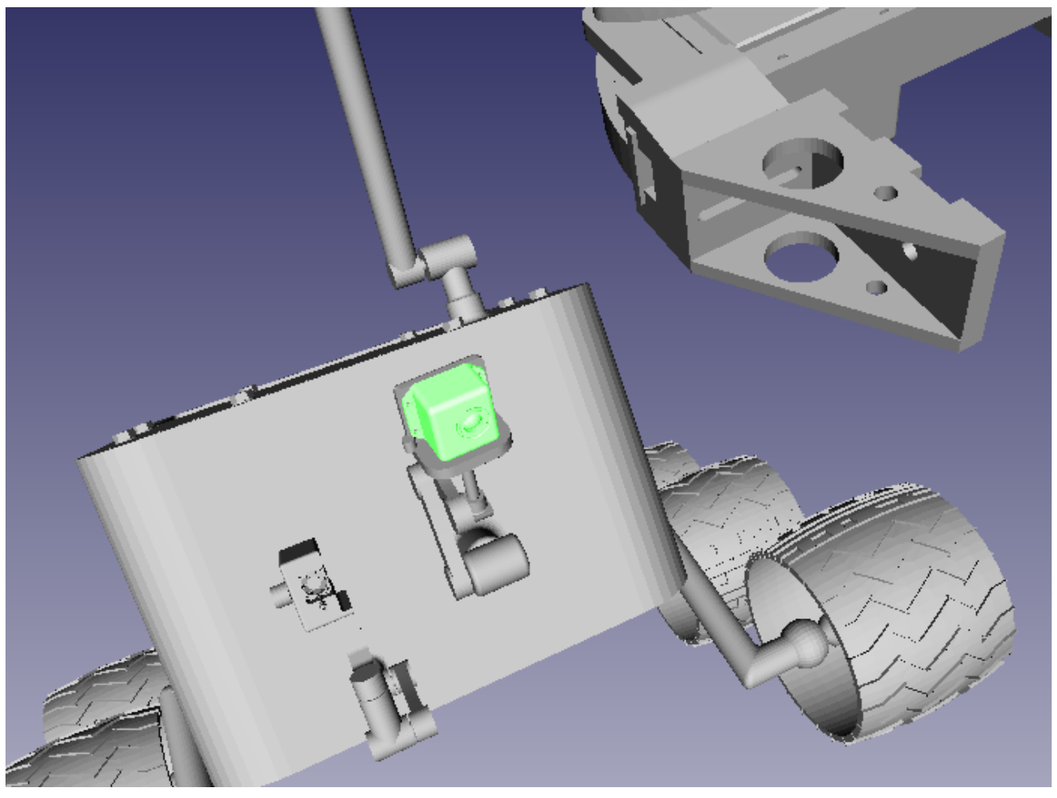
The ChemCam is a suite of remote sensing instruments on the Moon Rover that is designed to identify atomic elements in Martian rocks. It is a combination of a Laser-Induced Remote Sensing instrument and a Remote Micro Imager (RMI) telescope.

The Laser-Induced Breakdown Spectroscopy (LIBS) instrument is the primary component of the ChemCam. It is designed to provide elemental compositions of rock and soil.

The LIBS instrument can target a rock or soil sample from up to 7 meters away, vaporizing a small amount of it with about 30 5-nanosecond pulses from a 1067 nm infrared laser and then observing the spectrum of the light emitted by the vaporized rock 1.

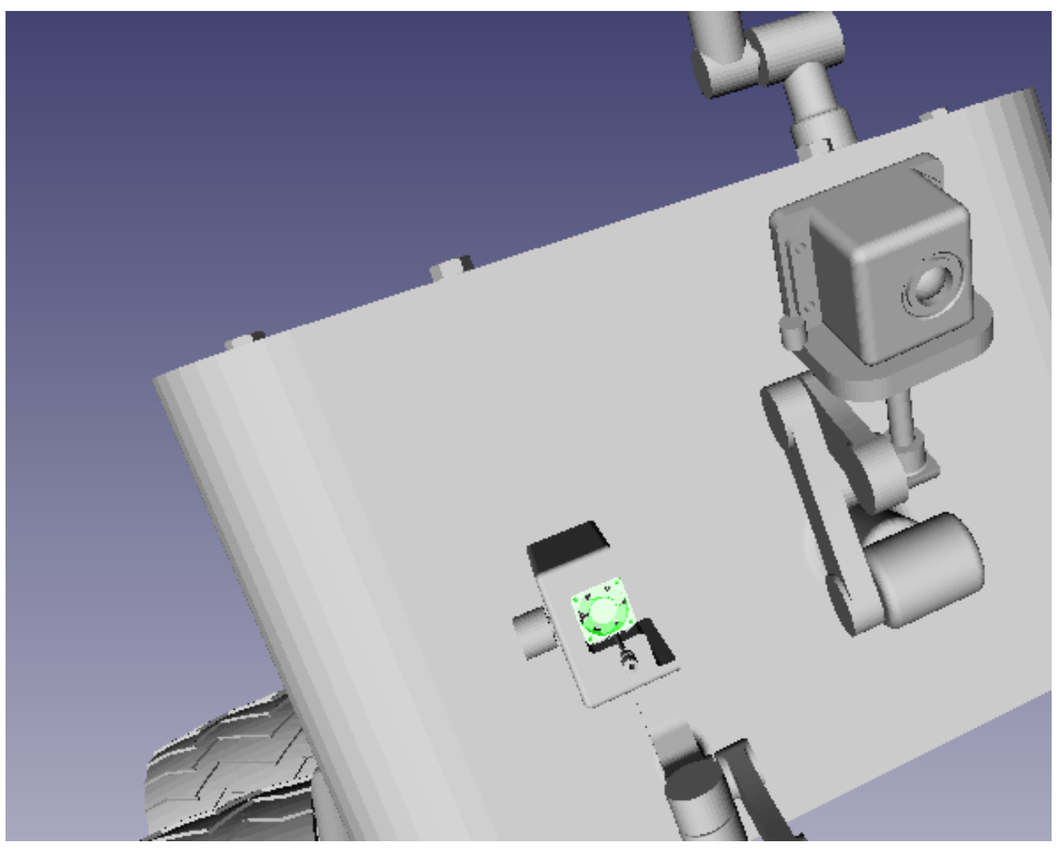
The RMI is used to provide high-resolution images of the sampling areas of the rocks and soil that LIBS targets.

Using the same collection optics, the RMI provides context images of the LIBS analysis spots.
The RMI resolves 1 mm objects at 10 m distance, and has a field of view covering 20 cm at that distance 1.
ChemCam also uses the laser to clear away dust from Martian rocks and a remote camera to acquire extremely detailed images.



IV.1.2. Laser

The moon rover includes a laser which is a powerful tool, that can be used to cut samples from rocks. By focusing a high-intensity beam of light, the laser can vaporize a small amount of the rock, allowing the rover to collect and analyze the sample. This method is non-invasive, as it does not physically damage the rock.



IV.1.2. Wheels

The wheels are covered by an electrostatic multilayer systems enable actuation, demonstrating robust performance in power density, actuation strain, and speed under high electric fields. However, they face challenges such as rapid force decay due to interfacial charging. The remedy often involves high-frequency polarity inversion of driving voltages, which results in significant power consumption and undesirable force oscillations.