Creating a System for Automated Imaging of Atmospheric Gravity Waves

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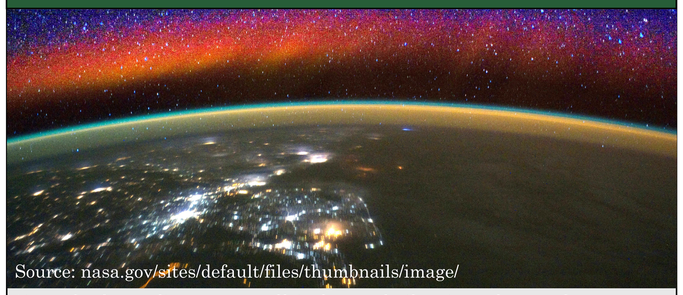
Motivation



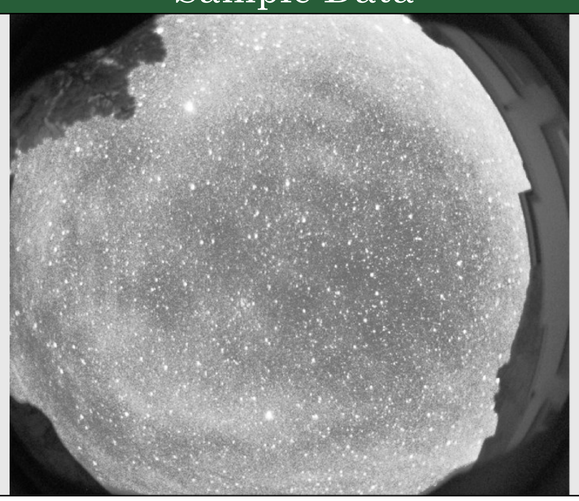
Source: nasa.gov/sites/default/files/thumbnails/image/

Atmospheric gravity waves are disturbances in the atmosphere and near-space environments caused by displacement of air in a stable environment. These waves transport energy away from the source of the disturbance and can transfer large amounts of energy between atmospheric regions through wave dissipation. One of the regions of most energy transfer is the mesopause region, in the transition between the Earth's atmosphere and the near-space environment. This is a region that is difficult to observe, but the presence of certain atoms and molecules allows for remote sensing of faint emissions called airglow. As the waves pass through the airglow, they leave a signature that is detectable by specialized cameras. We are developing a network of cameras to image airglow in regions of interest. This presentation describes the design of the camera and control system.

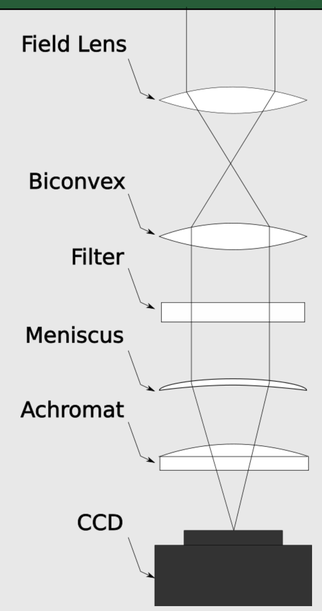
Objectives

- Automate the process of imaging airglow.
- Make camera settings editable from a website.
- Cameras able to take images when not connected to internet.
- Cameras image only during dark hours.
- Cameras send images back to central location for storage and processing.

Sample Data



Camera Design



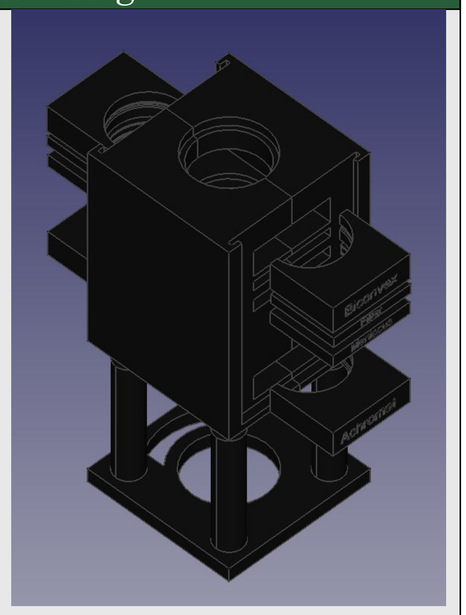
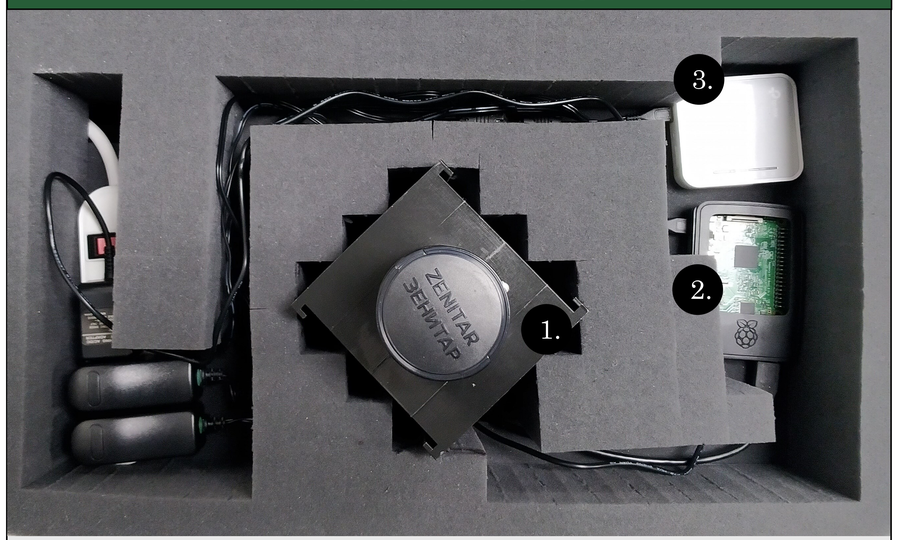


Figure left: ray tracing of filtering and reimaging optical system

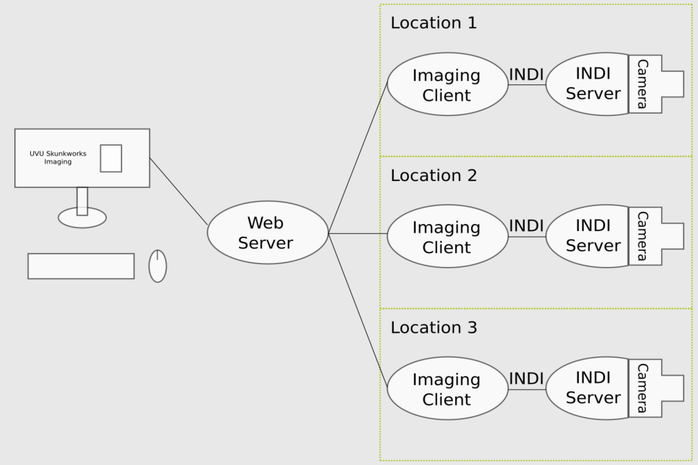
Figure right: 3D model of imaging system assembly

What's in the Box



1. The camera assembly collimates the light from the stars, so it can be filtered for specific wavelengths, then reimages the light onto the CCD.
2. A Raspberry Pi runs the software that controls when and how often the imaging system takes pictures. The system knows when to take images by calculating the angle of elevation for its geographic location.
3. Wireless access point: creates a local network that allows you to control the imaging system from a web page even when internet is unavailable.

Imaging Software

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    </defSwitch>
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On
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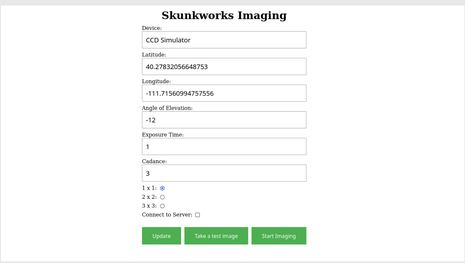

The imaging system is controlled using the Instrument Neutral Distributed Interface (INDI). It should allow us to control multiple different devices with the same code base. Settings for the camera can be set from a webpage locally, or remotely if the camera is connected to the internet.

Summary

We have been working to create an automated system for airglow imaging. The imaging process is scheduled by calculating the angle of solar elevation. By utilizing web technologies and the INDI protocol we can control cameras over the internet.

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