Exploring the Inner Workings of an Observatory: A Comprehensive Look at its Components

Introduction

Observatory is an astronomical observation facility. It is equipped with telescopes, cameras, and spectrometers to study celestial objects. The main goal of an observatory is to collect and analyze data from the universe. This presentation will discuss the inner workings of an observatory and its various components.

Telescopes

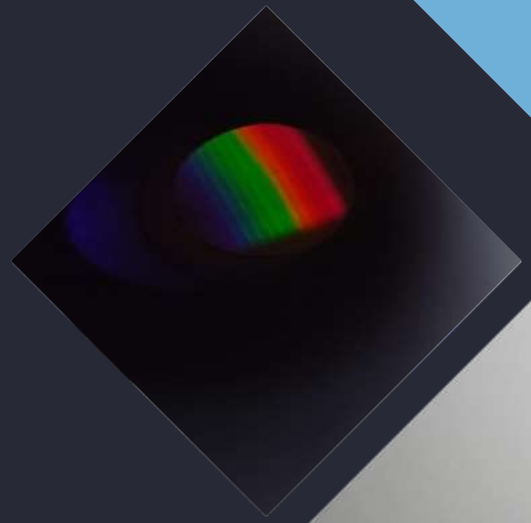
A telescope is the main component of an observatory. It collects and focuses light from celestial objects. There are two main types of telescopes: reflecting and refracting. Reflecting telescopes use mirrors to reflect light, while refracting telescopes use lenses to refract light. The size of the telescope determines its light-gathering power.

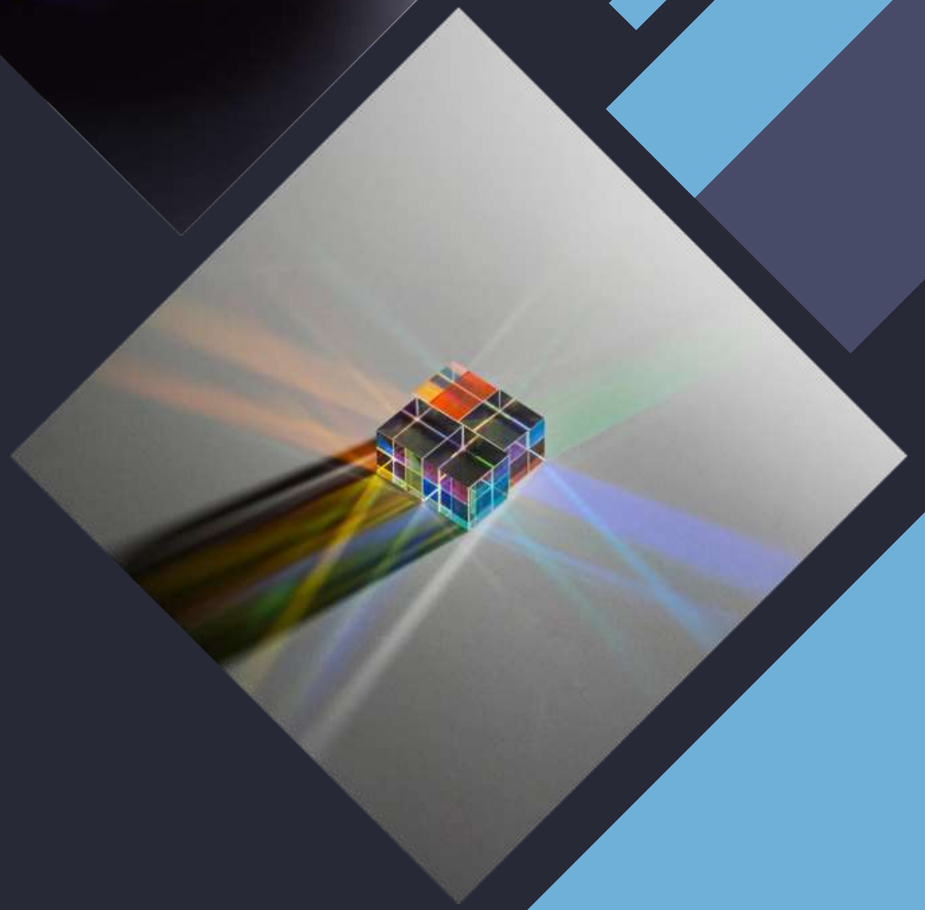
Cameras

A camera is used in conjunction with a telescope to capture images of celestial objects. There are many types of cameras used in astronomy, including CCD and CMOS cameras. CCD cameras are more sensitive and produce higher quality images, while CMOS cameras are faster and more efficient. The camera is mounted on the telescope and controlled remotely.

Spectrometers

A spectrometer is used to analyze the light from celestial objects. It separates the light into its different wavelengths, allowing astronomers to determine the composition and temperature of the object. There are two main types of spectrometers: grating and prism spectrometers. Grating spectrometers use a diffraction grating to separate the light, while prism spectrometers use a prism.





Observatory Operations

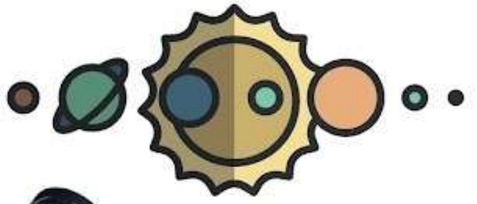
Observatories are operated by a team of astronomers, engineers, and support staff. The observatory is controlled remotely using computers and specialized software. Astronomers use the data collected by the observatory to study celestial objects and make discoveries. Observatories also play a key role in education and public outreach.

OBSERVATORY AUTOMATION

Aim: To automate the various processes of telescope and observatory to the extent such that basic night sky observation and astrophotography can be done remotely with ease.

Benefits

Automation of astrophotography processes
Human presence-independent
Remote access
Wider reach to the public
Faster means of data collection



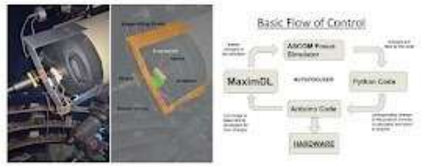
Dome Telescope Alignment

Set of Data Points to determine Dome-Telescope relative positions
Extrapolation and Graphing - MATLAB

Astrometry

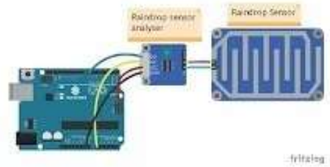
To get RA and DEC of the centre of the image
Reference database: Nova Astrometry
client.py file with some changes from nova.astrometry.net

Autofocuser



Raindrop Sensor

Droplet detector which responds to change in resistance



Telescope

Telescope basics: Celestron CGEM DX 1400 HD
Aperture: 14 inches
Weight: approx. 80 kg
Mount: Equatorial (motorised)
Dome: Retractable, Alt-Az

Hardware:

Arduino UNO microcontrollers
PTFE slabs cut into 8-tooth and 33-tooth gears
Motor
Motor Driver
Raindrop sensor kit

Software:

MaxIm DL
ASCOM Simulator
Arduino Editor
Digital Dome Works
MATLAB
Adobe Photoshop
DeepSkyStacker

Online Databases

AccuWeather
Nova Astrometry

Additions

Image Processing
Database Management
Photometry
Spectroscopy

Conclusion

Observatories are complex facilities that require specialized equipment and expertise. Telescopes, cameras, and spectrometers are the main components of an observatory. They are used to collect and analyze data from celestial objects. Observatories play a vital role in advancing our understanding of the universe and inspiring the next generation of astronomers.

Thanks!