

Planetary Imaging Primer Labs

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Introduction

The goals of the labs are to provide students an opportunity to get hands-on experience in setting up and capturing images with their equipment. All labs are optional. Students who are comfortable with this process or have equipment too heavy to bring to the lab are welcome to skip the lab, or partner up with another student who has equipment they bring to the lab provided they agree to this arrangement.

There are four labs associated with this class:

- **Lab 1: Setup** Groups of 2-4 students with similar hardware to cover the basics of setting up your telescope for viewing and imaging.
- **Lab 2: The Moon** Imaging Session focused on imaging the moon.
- **Lab 3: The Sun** Imaging Session during the day focused on imaging the sun.
- **Lab 4: Planets** Imaging session focused on imaging on whatever planet(s) are best positioned for imaging.

The Moon



The Sun



Mars, Venus, Saturn and Jupiter



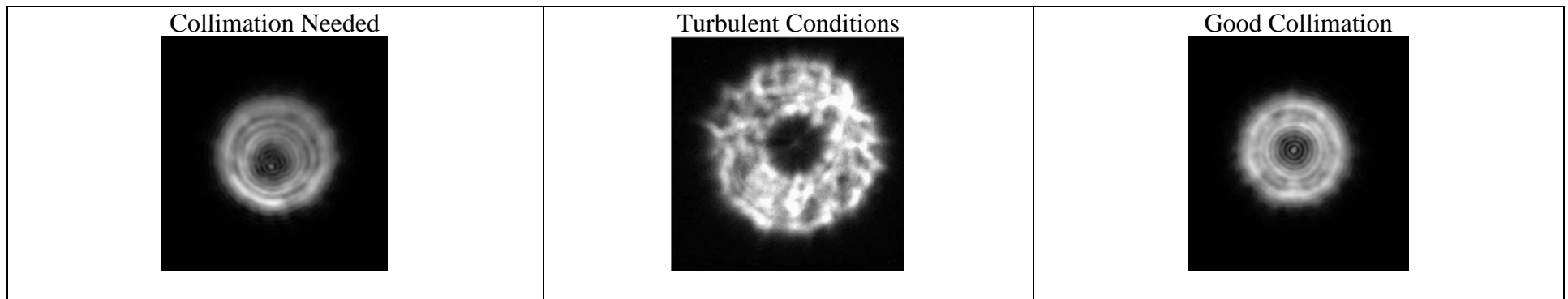
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Lab 1: Set Up & The Moon

This first lab will be held as small groups of 2-4 persons with similar telescopes to ensure plenty of one-on-one time between the instructor and each of the students. The goal of this lab is to ensure students have a familiarity with their equipment and have a basic handle on how to perform the following tasks:

- Finder Scope Alignment
- Telescope Alignment
- Telescope Collimation
- Techniques on ensuring good focus
- Imaging Hardware setup
- Image Capture

Defocus Star Test

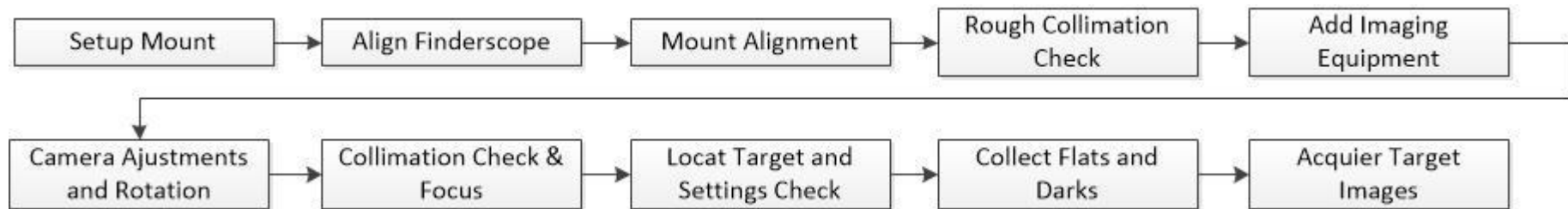


References and Resources

| Title | Type | Description |
|-------------------------------------------------|---------|------------------------------------------------------------------------------------|
| How to Align Any Finderscope | Video | Video covers alignment for telescopes and various finderscopes |
| How to Collimate a Telescope | Website | Instructions on Collimating a reflector type of telescope using a laser collimator |
| How to Collimate your SCT | Video | How to collimate your Schmidt-Cassegrains Telescope (SCT) |
| Collimate your Laser Collimator | Video | Instructions on making sure your collimator is collimated properly |

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With knowledge of setting up our telescope of imaging including collimation check we will focus on imaging the moon. Best images of the moon are typically obtained when moon is high in the sky and by focusing on the terminator; the dividing line marking the edge between day and night on the moon. The flow diagram below may provide guidance on the process flow for imaging.



References and Resources

| Title | Type | Description |
|--------------------------------------------------|-------------|-----------------------------------------------------------------------------------------|
| Stellarium Web | Website | Free online Planetarium. |
| EVAC Lunar Program | Website | Lunar observation program my provide ideas on items to photograph |
| The Sky Live: Moon | Website | Info on current moon conditions |
| Moon Globe HD (iOS) | Application | iOS application with moon atlas |
| Moongiant: Moonmap | Website | Online moon map |
| Virtual Moon Atlas | Program | Free application to install on your PC. This is a large application with lots of detail |
| Baader Moon & Skyglow Filter | Website | Moon and sky pollution filter |

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Lab 2: The Sun

NOTE: Solar photography should only be attempted with proper equipment and filters. Never point your telescope at the sun unless the telescope is specifically designed to observe the sun, or for regular telescopes, they have a full aperture filter designed specifically for viewing or imaging the sun.

This lab we focus on imaging the disk of the sun and sunspots. Listed below are a few points that may help with setting up and imaging the sun.

- **Locating the Sun** – Regular finder scopes cannot be used to locate the sun, make sure the finder scope aperture is covered. If you don't have a solar finder scope, use the shadow of the telescope to help get you in the right general area. The smaller the shadow the closer you are to pointing at the Sun.
- **Focus** – Since there will be no stars (besides the sun) to focus on, you should concentrate on the edge of the disk for focusing and try to get the edge of the disk of the sun as sharp as possible.

References and Resources

| Title | Type | Description |
|--------------------------------------------|---------|-------------------------------------------------------------------------------|
| SOHO Observatory | Website | NASA website with near real time images of the sun utilizing various filters. |
| Baader: Solar Film | Website | Film and filters for solar imaging and viewing |
| Thousand Oaks Optical | Website | Solar filters for observation and imaging |
| Make your own Solar Filter | Website | Instructions on how to make a solar filter once you purchase solar film |
| | | |

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Lab 3: Planets

Planetary photography can be challenging, Locating the planet on a small sensor takes technique and practice.

- Make sure the finder scope is well aligned with the main scope.
- The focus point for visual vs a camera can be considerably difficult. You will most likely need to change your focus when replacing an eyepiece with a camera.
- If you are greatly out of focus (Typical). You may need to drastically increase the exposure time to see the defocus “doughnut”.
- Two parameters are typically played with to obtain an image bright enough to view and record details: Exposure and Gain.
- Pay attention to the histogram and make sure the Exposure/Gain are set to ensure you are not clipping data. Hump of curve should be between 30% - 70% of graph.

Conservative Capture Duration Rules of Thumb

| Target | Detail of Interest | Capture Duration |
|---------|--------------------|------------------|
| Sun | Sunspots | 180s |
| Moon | Moon features | 600s |
| Mercury | Phase | None |
| Venus | Cloud features | 120s |
| Mars | Planetary features | 90s |
| Jupiter | Planetary features | 45s |
| Saturn | Planetary features | 600s |
| Uranus | Disk of planet | None |
| Neptune | Disk of planet | None |

References and Resources

| Title | Type | Description |
|------------------------------------------------|---------|---------------------------------------------------------------------------------------|
| SkySafari 7 Plus | App | Smartphone/iPad/Online Astronomy software |
| Jupiter's Moons | App | iOS App for showing where the moons of Jupiter are at for a given date/time |
| Planets Visible Tonight | Website | Shows what planets will be up in the night sky and when they are visible. |
| Brightness and size of planets | Website | Provides size of planets for given date and time |
| Field of View Calculator | Website | Place tool in “Imaging Mode” to get an idea of what it will look like on your system. |