Moon_planner.py – User Manual

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1. Overview

"moon_planner.py" is a Python script designed to plot the Moon's altitude/elevation and speed for a given site over a specified date range. It provides visualizations of the Moon's conditions as seen from a specific location.

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2. Purpose and Functionality

- Plots the **Moon's altitude/elevation** and **movement speeds** over a given period.
- Supports input for:
  - **Preset location** (default: Koschny Observatory, code: B12)
  - **Custom coordinates** (latitude, longitude, and height)
- Produces a **PNG plot** that can be visualized with an external program.

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3. Required Libraries

The following Python libraries are required:

- **sys**: For system calls, e.g. reading command-line parameters.
- **io:** For input and output handling.
- **csv:** For handling comma-separated files.
- **NumPy:** For numerical computations.
- **AstroPy**: For astronomical calculations and coordinate transformations.
- **AstroQuery**: For querying external web pages.
- **Matplotlib**: For generating the plots.
- **Astroplan**: For observer-related calculations (this is noted as potentially removable for cleanup).

Additional Requirements:

- **Internet Connection**: Required for some astronomical calculations.
- **External File**: horizon.xls for horizon data.

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4. Installation

A. Install Required Libraries

Open a terminal and use the following commands:

>>pip3 install astropy pandas matplotlib astroplan …

B. Downloading the Script

- Save the moon_planner.py script to a directory of your choice.

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5. Usage

The script can be run in two main ways:

A. Using IAU code for the location (default: B12 = Koschny Observatory)

```
>>python moon_planner.py B12 2022-02-09 2022-02-15
```

- This generates a plot of the Moon's conditions from **B12 (Koschny Observatory)** for the night of **2022-02-09** to **2022-02-15**.
- The output is saved as a **PNG file**, one for each night.

B. Using custom coordinates

```
>>python moon_planner.py "(4.4906, 52.07899, -65)" "2025-05-17"
```

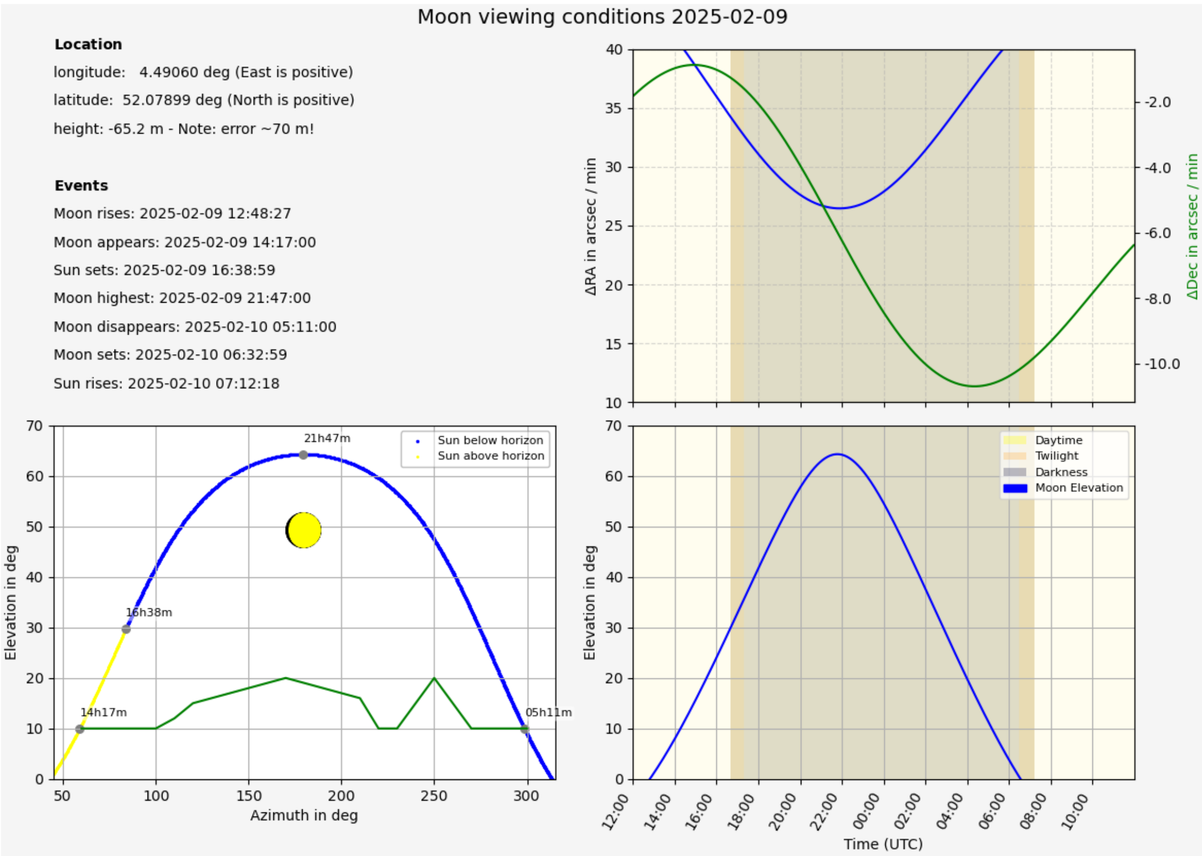
- This generates a plot for the specified date and custom coordinates:
    - **Latitude:** 4.4906
    - **Longitude:** 52.07899
    - **Height:** -65

Notes on Usage:

- When entering custom coordinates, use quotes around the latitude, longitude, and height.
- The script supports one-night plots or a range of dates.
- The output is saved as a PNG file, which can be viewed using any image viewer.

Explaining the output:

The following plot shows an example of an output file.



There are four panels.

- The upper left panel gives information on the location. Check whether this is correct, don't mix up latitude and longitude! The 'events' are sorted by time. If an event does not occur (e.g. if the Moon never comes above the defined custom horizon), it will not be shown.
- The lower left panel shows the elevation of the Moon as a function of azimuth. The custom horizon is shown as a green line. The path of the Moon is yellow when the Sun is above the horizon, blue for the Sun below the horizon. Key times are marked.
- The upper right panel shows the apparent speeds of the Moon in right ascension (RA) and declination (Dec) in arcseconds per minute. Due to its movement around the Sun,

the Moon always moves in the positive direction in RA. The movement in Dec is a result of the fact that the observer normally does not sit in the Earth's center, but on the rotating surface of the Earth (= parallax).

- The lower right panel shows the elevation of the Moon as a function of time. Both right panels show daytime as light yellow, night as grey. The intermediate area denotes twilight.

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6. Known Limitations and Dependencies

- Requires the external file **horizon.csv** for horizon data. It is simply a list of azimuths and elevations of your real horizon.
- The script uses the **astroplan** library, mainly for observer calculations.
- **Internet connection** is necessary for some astronomical calculations.

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7. Version History

- **V1.0 (17 Feb 2025)**: Initial version, ready for beta testing.
- **V1.1 (20 Feb 2025)**: Added support for passing custom observer coordinates.

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8. Troubleshooting and Known Issues

- **ImportError**: Ensure all required libraries are installed.
- **Incorrect Times or Phases**: Verify system date/time settings and ensure the correct geographic coordinates are entered.
- **File Not Found**: Confirm the presence of horizon.csv in the working directory.
- The day/twilight/night color background in the right two plots is not working properly outside Europe. This will be fixed in a future version of the script.

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9. Support and Feedback

For questions, support, or feedback, please contact the developer at:

- **Email:** detlef 'dot' koschny 'at' tum 'dot' de.

Summary

The **Moon Planner** is a tool for planning lunar observations, supporting both preset and custom locations. This manual provides a comprehensive guide to installation, usage, and troubleshooting, ensuring a smooth user experience.