

# Astro photography

The OST can, of course, be used for astro photography. Since two of our [CCD cameras](#) are equipped with filter wheels, they can take pretty pictures - this article shall be a short manual for this and it shall document our progress in the=is field. It shall still grow, get more details etc., so it's not

considered complete so far. 😊

The images can be found in our [gallery](#) - click on the pictures to see more details on their exposure time, filters, dates, etc.

## Images with the CCD

### Object selection

In general, the selected objects must be visible long enough at the night sky and not be too close to the horizon. The objects should be at least  $20^\circ$  above the horizon to reduce atmospheric effects. Please note, that Berlin is in eastern direction so light pollution is much stronger and conditions are generally worse in this direction. Furthermore, pay attention to the conditions during the observation: high seeing values and low sky transparency generally prevent deep sky observations. Observable objects include:



Field of view with of the ST-8 in comparison to the size of the moon

1. the moon - too large for the field of view of our cameras → mosaic exposures
  2. planets - Mercury & Venus are close to the Sun → can only be observed close to daybreak or nightfall
  3. globular/open clusters (some open clusters are too big for the field of view of our cameras)
  4. galaxies - moonlight disturbs (also, e.g. M31 is too big for the field of view)
  5. nebulae - moonlight disturbs
  6. stars - well, photography of stars...
- useful webpages:
    - CalSky
    - [Simbad](#)
    - further websites can be found [here](#)

## Filter choice


There are several different filters available for our cameras (see [here](#)). Please note, that filters have transmission curves that absorb most of the photons, so the exposure times are getting (much) longer. Depending on the object, some filters are more useful than others. For emission nebulae, e.g., narrow band filters (H-Alpha/Beta, OIII) are especially useful. For stars and galaxies, broad band filters (U/B/V/R/I) make more sense. To construct a (pretty) RGB image later on, best use the B, V, and R band filters.

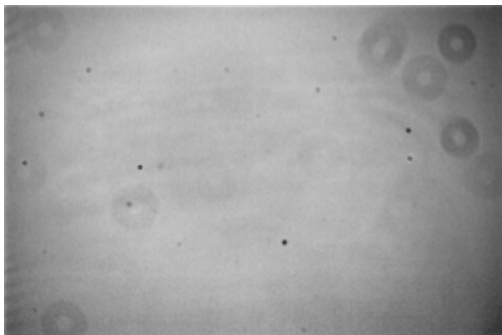
## Exposure times


- extend here - maybe a small gallery
- [40min exposure](#) - stars until V  $\sim$  18mag can be observed

## Correction exposures



 Darkframe of the ST-8



 Flatfield of the ST-8

Correction exposures are necessary to correct the “science” exposures for interfering effects that are caused by the CCD or defects in the optics of the telescope. Darkframes are exposures without light entering the telescope. These exposures thus only count the electrons excited due to the temperature of the CCD and the bias current. These exposures (with the same exposure time as the “science” exposure) will be subtracted from the “science” exposures. Flatfields are exposures of a uniformly illuminated wall, a part of the sky, clouds, or preferentially our flatfield foil. These exposures are used to correct for pollutions (dust grains) and effects of the optics (uneven illumination), by dividing the “science” exposure through the them.

## Darkframes + Flatfields

- Darkframes
  1. attach the protective cover to the telescope
  2. switch off the light in the dome
  3. per filter (for the observation) take a number (3 or more) exposures with equal exposure times
- Flatfields
  1. select the same filter as used for the "science" observation
  2. attach (carefully!) the flatfield foil (from the lab room , 2.009) and switch it on (power supply in the locker in the dome)
  3. please note, the flatfield foil must evenly illuminate the whole aperture of the telescope
  4. take a number of exposures with short exposure times (around 3 seconds), prevent the CCD from overflowing

## Data reduction / Stacking

### Data reduction by means of *Fitswork*:

1. drop bad raw frames (note the total exposure time)
2. create master dark(s) (for different exposure times)
3. create master flats (for different filters)
4. create master flatdarks (the subtraction of the flatdarks from the flats takes place automatically)
5. subtract the master dark from the raw images
6. divide that images by the corresponding master flats
7. add up the images (in each filter)
8. if needed, compensate for different exposure times
9. mark two common objects in the images
10. combine the exposures to a RGB-image (with offsets)
11. if the offsets are not good enough, mark a characteristic region (e.g. a star) in the RGB-image and shift the color layers relative to each other
12. define the background color to be black (right click) and maybe choose one star to define the white balance (right click)
13. cut the image

## Postprocessing

In the postprocessing one can adjust things like the contrast, the saturation, the hue, the white balance etc. to reveal more details.

- via *Fitswork*: Edit → Color functions
- via *PS/Gimp* ...

## Photography with a DSRL

We have a Canon EOS 700D, which is a digital (single) reflex camera (DSLR). This camera allows for

very short exposure times (until 1/4000s), while our CCDs only allow for a minimal exposure time of 0.09s. Accordingly, this camera is useful for objects that require short exposure times. Please note that those objects need to be bright enough for such short exposure times. The field of view of the DSLR is larger compared to the other cameras (see [here](#)).

Interesting objects are e.g.:

- planets
- the Moon
- comets

## Lucky imaging how-to

This part will hopefully be filled soon...

## Photography with the webcam

- we own one of these, too



**To be continued...**

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