

# 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.

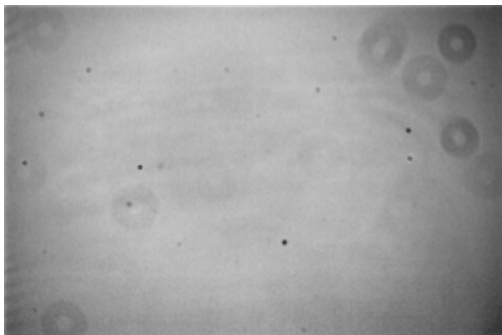
## Exposure times


- 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 and Flatfields help to eliminate effects of CCD (dark current, cosmics, bad pixels) and optics (dust grains, uneven illumination)
- Darkframes
  - attach the protective cover to the telescope
  - select filter: \*EMPTY\*
  - per filter (for the observation) take a number (3 or more) with equal exposure time
- Flatfields
  - attach (carefully!) the Flatfield foil (from the practical room,) and switch it on (power supply in the board at the dome)
  - select the filters as for the observation
  - note, the Flatfield foil must evenly illuminate the whole aperture of the telescope
  - take a number of exposures with short exp. time (around 3 seconds), prevent the CCD from overflowing

## Data reduction / Stacking

- Useful Software: Fitswork
1. drop bad raw frames (note the total exposure time)
  2. create Masterdark(s) (for diff. exp. times)
  3. create Masterflats (for diff. filters)
  4. create Masterflatdarks (subtract the Masterdark with the Flat's exp. time from the Flats)
  5. subtract the Masterdark from the raw images
  6. add up the images (for each filter)
  7. divide that image by the Masterflatdark
  8. if needed, compensate for different exposure times
  9. mark common objects in the images
  10. combine the RGB-image (with offsets)
  11. if the offsets are not good enough, mark the regions and shift the color layers relative to each other
  12. define black background (rightclick) and the whiteness (stars)
  13. cut the image

## Postprocessing

- in the finishing one can adjust things like contrast, saturation, hue, white balance etc. to reveal more details
  1. via fitswork: Bearbeiten→Farbfunktion
  2. via PS/Gimp ... see there 

## Photography with the DSRL

- if the correct adapter (T-Ring) is available, one can also make use of the Canon EOS at the telescope
- such exposures can be interesting for short time exposures, as the CCDs only allow minimal

exposure times of 0.12 seconds

- interesting objects:
  - planeten
  - the moon
  - comets
  - cranes, trees, buidlings etc. (daytime)

## Photography with the Webcam

- we own one of these, too
- see lucky imaging howto
- to be continued...



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