



# Starting out with astrophotography



Brought to you by AAL / Eric Dondelinger

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# Photo equipment

- If you have any, use it!
- Else, consider there's lots of gear available for Canon
- Lenses:
  - Prime lens usually better than zoom
  - Look for wide aperture
  - Avoid “STM” focusing lenses
- Body:
  - Low end: start at 450D, first with “live view”
  - High end: full frame 6D

# Photo equipment (2)

- Programmable timer, e.g. JJC TM-C or TM-A
- Tripod and (ball or 3-way tilting) head
- Bahtinov mask (focusing help)
- Astro modification: removal of IR/UV filter in front of the sensor: [dslrmodifications.com](http://dslrmodifications.com) by Gary Honis
- Self:
  - Bodies 450Da, 7Dii, 6D
  - Lenses 50mm f/1.8, 200mm f/2.8 L, Walimex 14mm f/2.8, ...



# Software

- FOSS Free and Open Source Software
  - GIMP: GNU Image Manipulation Program
  - DSS Deep Sky Stacker
  - Siril
  - RawTherapee
  - ...
- Free-as-in-beer
  - Fitswork
  - AutoStakkert
  - Registax
  - PIPP Planetary Imaging PreProcessor
  - Regim
  - ...

# Before starting

- Familiarize yourself with the sky
- Sky atlas such as Oculum Deep Sky Atlas
- Planetarium software such as Stellarium
- Depending on site / visible objects, meteo, gear: choose your targets

# Single shots on a tripod

- Put the camera on a tripod
- Use a remote, mirror lock to avoid vibrations
- Use the lens aperture, push the ISO
- Use the RAW format
- To avoid star trails: maximum exposure time:
  - APS-C:  $300 / \text{focal length} = \text{max. time in seconds}$
  - Full frame:  $500 / \text{focal length} = \text{max. time in seconds}$
- Develop the picture in your favorite program (RawTherapee, DarkTable, LightRoom, ...)



# Star trails

- Use a programmable timer to take a series of shots as before (no mirror lock though) – no long delay between pictures
- lower ISO (less noise), longer exposure (we want those trails)
- In GIMP, open the pictures as layers, set the layer mode to “lighten only”
- Additionally, you may want to eliminate the tracks from airplanes/satellites or other lights using the stamp tool, or simply brush over in black (you’ll get those parts from the other pictures)



# Beidweiler 2020-09-11



EOS 6D  
Walimex Pro  
14mm  
JJC TM-A  
Sirui KTV204  
149x 45s  
ISO800, f/5  
GIMP

# Stacks of pictures

- Take a series of wide-angle pictures, respecting the time limits as for the single shot.
- Push the exposure so as to have the histogram peak in the middle, make sure the histogram doesn't hit the right end (burn out lights) “expose to the right”
- Take flats, darks, bias frames
  - Flats: put an uniform light source in front of your lens, take a picture, histogram in the middle (AV mode?)
  - Bias: cover the lens, shortest possible exposure, e.g. 1/4000th or 1/8000th second
  - Dark: cover the lens, same exposure settings as for the “lights”

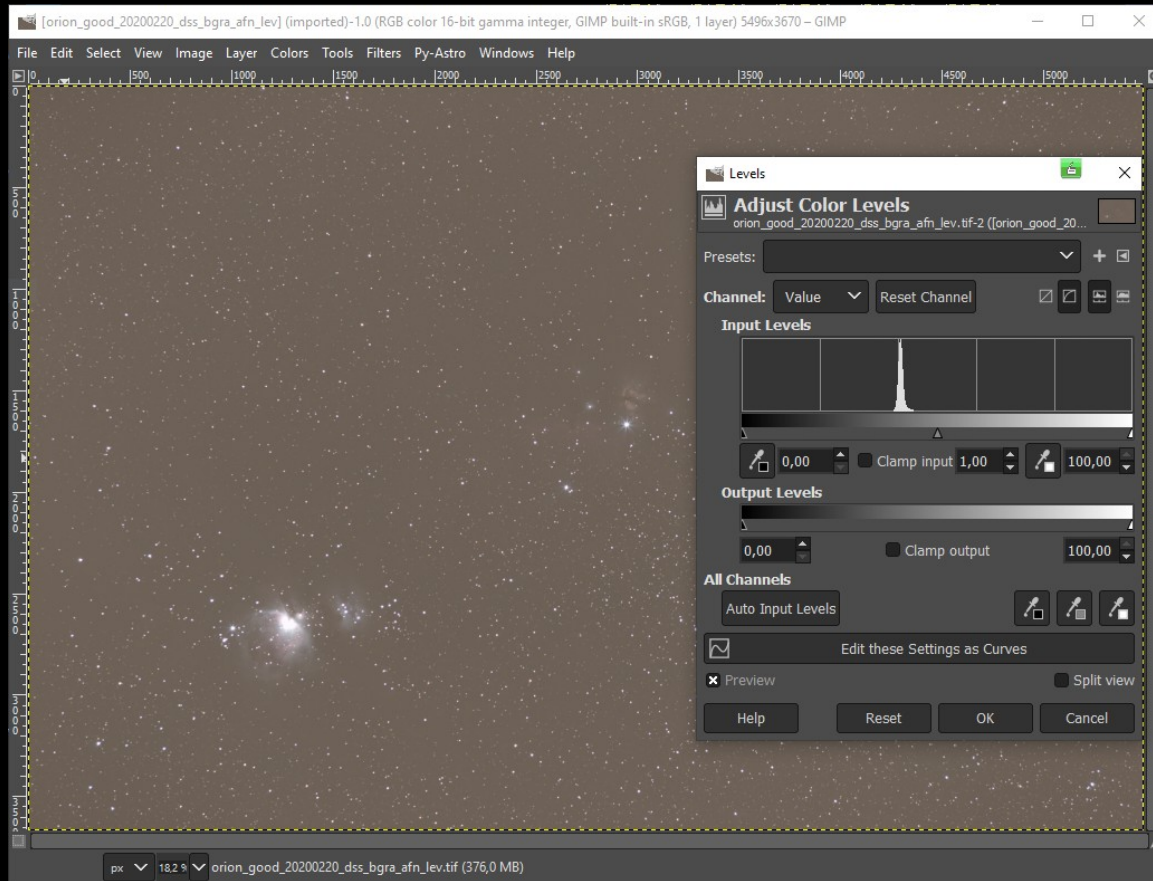
# Stacks of pictures (2)

- Stack the pictures in DSS (or equivalent), export result to TIFF
- Open the file in fitswork, flatten background
  - Push the histogram some, gamma value
  - Background gradient removal automatic
  - Automatic flatten for nebulas
  - (Lines to equal values + rotate 90°) x4
  - Export result to TIFF

# Stacks of pictures (3)

- Open the TIFF in GIMP
- Stretch the picture:
  - Adjust histogram for the red/green/blue channels
  - Multiple instances of “levels”, moving the gamma value and the black point (when more confident, try “curves”)
  - Increase saturation
  - Cut off the noise by applying a last black point, then contrast
  - Finalize according to your taste

# Stretching via Levels in GIMP



- Channel: R, G, B
- Black Point
- Gamma



2019-08-25 Feldberg 11mm 20s f/2.8 ISO3200 7DII x13, bias darks

# Stacking moon photos

- Take a series of pictures of the moon – tele lens
- Use PIPP to crop the pictures and center the moon
- Use AutoStakkert to stack these pictures, include the sharpening
- Further sharpen in Registax using wavelets
- Final processing in GIMP

# Full Moon 2019-02-19



high saturation

7Dii  
100-400L  
52x 1/1000s  
ISO100, f/5,6  
PIPP  
AutoStakkert  
GIMP



neutral

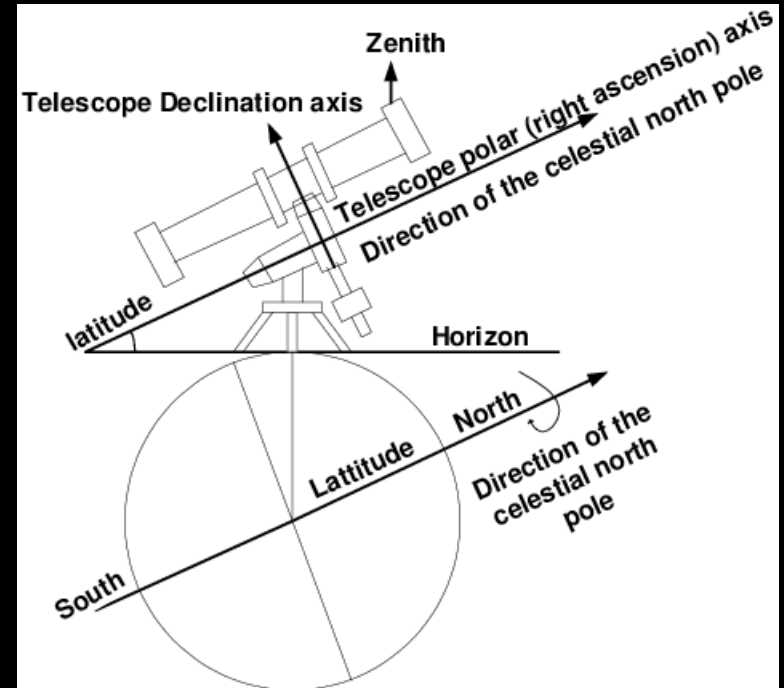


# Upgrade to an equatorial mount

- Travel mount: SkyWatcher Star Adventurer
  - Kit for ca. 360 EUR
  - USB Powerbank ca. 20 EUR
  - Good ball head (Sirui KX-30 ca. 140 EUR)
- Wind-up version for 1h of tracking: Omegon LX3, kit ca. 220 EUR
- Used mount in the EQ3-EQ5 class or better
- Allows for much longer exposures, telescope

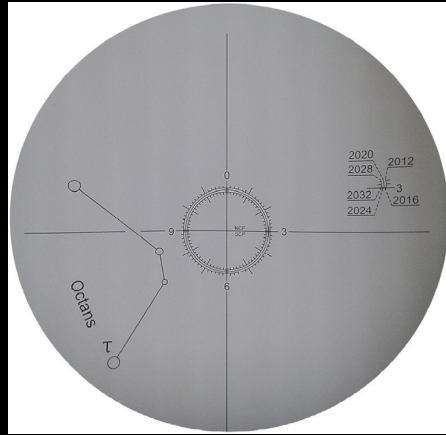
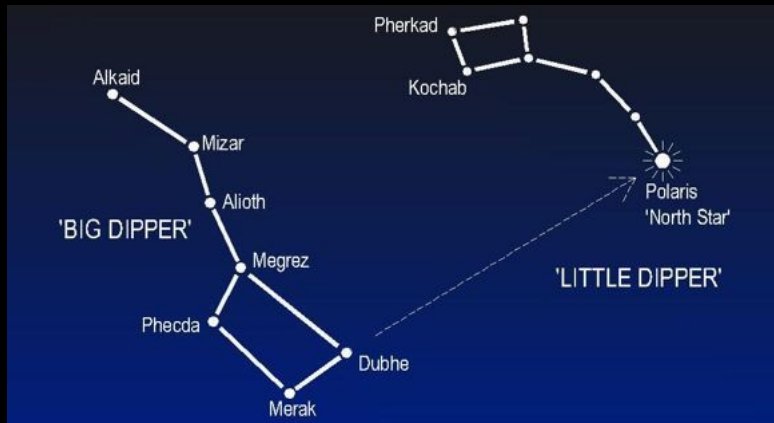
# Set up equatorial mount

- Put the tripod +/- into water level
- Orient the mount to the north (compass or Polaris)
- Use the polar finder to properly align the mount



# Kochab method

- Locate Kochab (second brightest star of the little dipper / Ursa Minor)
- In the polar finder, put Polaris in the same position on the circle as Kochab is to Polaris



# C/2020 F3 NEOWISE



Site: Plateau Bourglinster

2020-07-21

6D

200L

Star Adventurer

31x 30s

ISO1600, f/4

DSS

GIMP

# Orion 2020-02-20



Site: Falkau (near Feldberg,  
Schwarzwald, Germany)

6D

200L

16x 60s

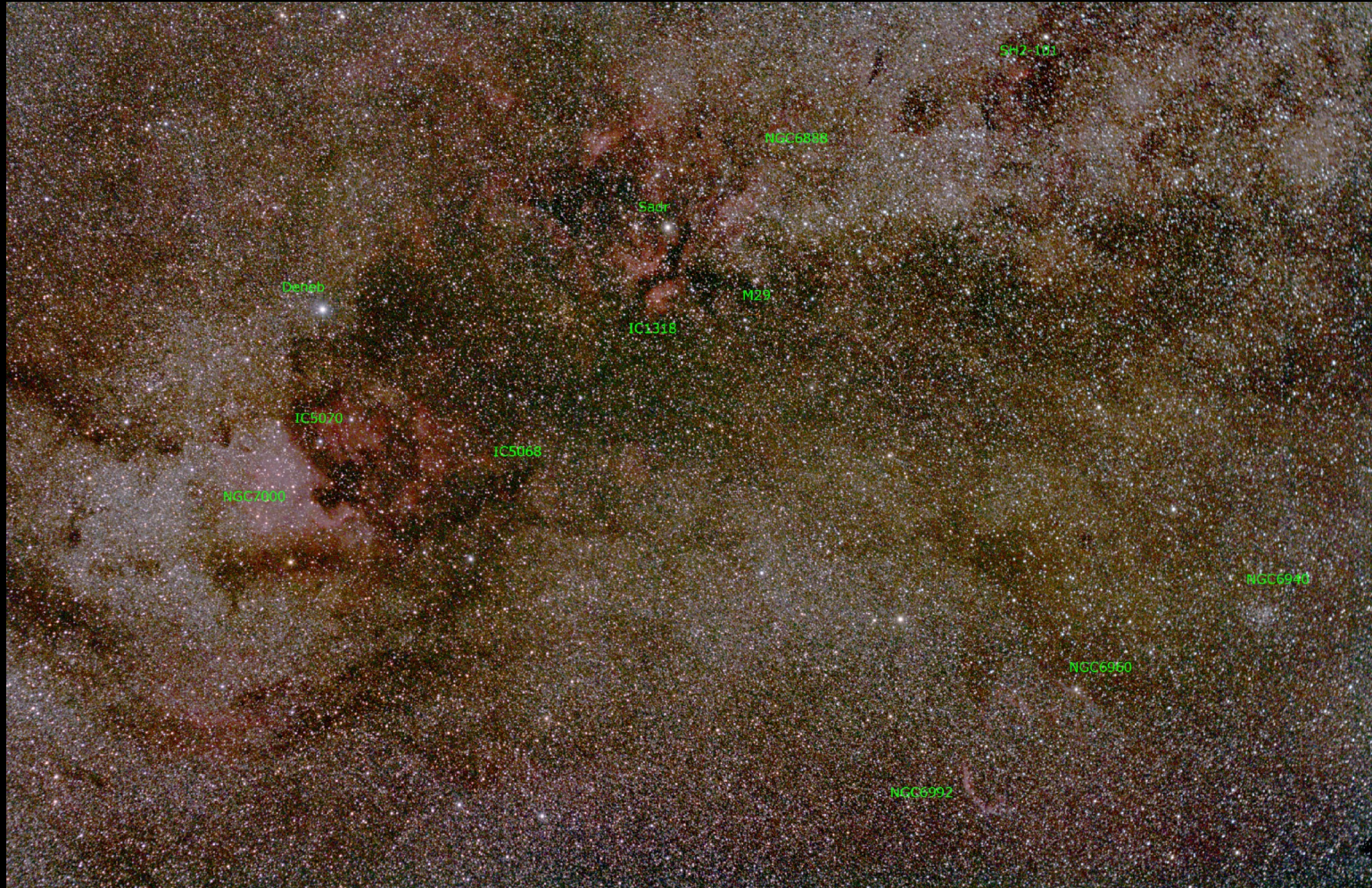
ISO3200, f/4

# Milky Way & Scorpio head



Site: Lanzarote  
7Dii  
17-55 @31  
StarAdventurer  
38x 30s  
ISO1600, f/4

# Cygnus 2020-09-11



450Da  
50mm  
Star Adventurer  
62x 60s  
ISO1600 f/4  
DSS  
Fitswork  
GIMP

# Practical issues (1)

- It's cold at night!
- Use RAW rather than JPG – 12/14 bit vs. 8
- Avoid all vibrations
  - Tighten all screws / clamps
  - Settings: manual focus, no stabilizer, mirror lock
- Do one target properly rather than trying many



# Practical issues (2)

- Keep the optics clean
- Choose a target that's high over the horizon
- Avoid stray lights
- Take your time to do the setup properly
- Do use flats!
- During post-processing, use a format that won't lose data (e.g. TIFF, FITS)!

# Tracking vs guiding

- Tracking only compensates earth rotation, will allow for exposures of maybe 1-4 minutes (depends on focal length, quality of setup)
- Go even longer with guiding: guider “looks at star” and sends correction commands to mount, compensating for imperfect setup
  - Autoguider Lacerta MGEN3 (730 EUR)
  - Laptop PHD + guiding cam e.g. ASI120MM Mini (180 EUR)
  - Guiding scope or OAG (off-axis guider)

# Way forward: Telescope

- Telescope depending on target and mount
  - Careful, never overload your mount! Deepsky-brothers.de
  - Refractor for wide-field, nebulae
  - Newton for mid-range, galaxies, nebulae, clusters
  - Schmidt-Cassegrain, Maksutov: Planets, small nebulae

# Way forward: Camera

- Astronomic camera
  - Color or monochrome
  - Cooled (less noise, deep sky) / uncooled (moon, planets, sun)
  - Speed (planetary cam needs high frame rates)
  - Filters
    - Anti-light-pollution, RGB, narrow-band
  - Sensor size depending on target, telescope
    - Small sensor → increase magnification, small objects
    - Large sensor → mostly equivalent to DSLR

# Links (1)

- RawTherapee  
<https://www.rawtherapee.com/downloads/>
- Deep Sky Stacker DSS  
<http://deepskystacker.free.fr/english/download.htm>
- Siril  
<https://siril.org/download/>
- Regim  
<https://www.andreasroerig.de/regim/regim.xhtml>
- GIMP GNU Image Manipulation Program  
<https://www.gimp.org/downloads/>

# Links (2)

- Fitswork  
<https://www.fitswork.de/software/>
- SharpCap  
<https://www.sharpcap.co.uk/sharpcap/downloads>
- FireCapture  
<http://www.firecapture.de/>
- AutoStakkert  
<https://www.autostakkert.com/wp/download/>
- Registax  
<http://www.astronomie.be/registax/download.html>
- PIPP Planetary Imaging PreProcessor  
<https://sites.google.com/site/astropipp/downloads>

# YouTube videos

- Frank Sackenheim

<https://www.youtube.com/user/astrophotocologne>

- Daniel Nimmervoll

<https://www.youtube.com/c/DanielNimmervoll>

- ...

# Questions



**Amateur Astronomen**  
Lëtzebuerg

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# Citations, Copyright notice

- polar alignment diagram

[https://www.researchgate.net/figure/Polar-axis-alignment-process\\_fig3\\_272493348](https://www.researchgate.net/figure/Polar-axis-alignment-process_fig3_272493348)

- kochab method diagram

<https://www.pinterest.com/pin/243053711117950351/>

- SkyWatcher StarAdventurer polar finder

<http://skywatcher.com>

- AAL Logo

<http://www.aal.lu>

- All other pictures: (c) Eric Dondelinger

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