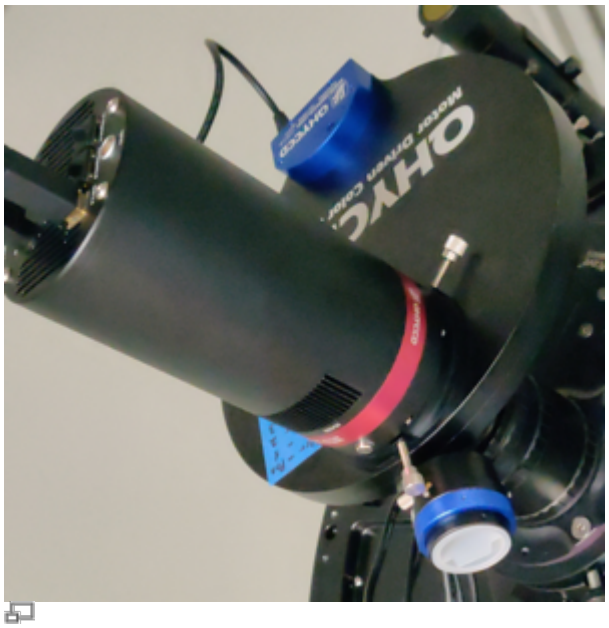
Specialized astro cameras



Our QHY 600M with the filter wheel

CMOS cameras

Our main cameras are CMOS cameras designed specifically for astrophotography. For deep sky imaging we use two QHY 600M, which offer a full frame sensor, very high quantum efficiency, very low readout noise and very low dark current. For these cameras, we also have an off-axis guide, a 9-position filter wheel, and a 7-position filter wheel.

As main camera for our two spectrographs serves a QHY 268M. Furthermore we have a QHY 485C and a ZWO ASI174.

CCD Cameras

Furthermore, four older CCD cameras (ST-7, ST-8, STF-8300M, ST-i) from SBIG (*Santa Barbara Instrument Group*) and one CCD camera (Skyris 445C) from *Celestron* are available.

The ST-7, ST-8, and STF-8300M are deep-sky cameras, but due to their relatively small field of view they are rarely used currently.

The ST-i, the QHY 485C, and the Skyris 445C are „planetary cameras“ which allow very short exposure times. They are mainly used for solar observations or as guiding cameras (see e.g. here or here) in connection with the QHY 600M and the spectrographs.

All cameras can be controlled via Maxim DL. For the SBIG cameras CCDOPS is also available as control software. We have dedicated a separate article to the assembly of some cameras.

Basic data

Main cameras

Our QHY 268

	QHY 600M (2x)	QHY 268M
Model number	QHY 600M PRO-L & QHY 600M PH	QHY 268M-PH
pixel size	3.76 μm x 3.76 μm	3.76 μm x 3.76 μm
Number of pixels	9576 x 6388	6280 x 4210
Total size of the chip	36 mm x 24 mm	23.45 mm x 15.7 mm
Field of view with the CDK20	35.8’ x 23.4’	23.3’ x 15.6’
Sampling	4.5 Pixel per arcsec	4.5 Pixel per arcsec

Planetary/Guiding cameras

Our QHY 485C

	Skyris 445	QHY 485C	ST-i	ZWO ASI174
Model number	Skyris 445C	QHY-5-III-485C	ST-i monochrome	ZWO ASI174MM Mini
pixel size	3.75 μm x 3.75 μm	2.9 μm x 2.9 μm	7.4 μm x 7.4 μm	5.86 μm x 5.86 μm
Number of pixels	1280 x 960	3864 x 2180	648 x 486	1936 x 1216
Total size of the chip	6.26 mm x 5.01 mm	11.2 mm x 6.3 mm	4.8 mm x 3.6 mm	11.3 mm x 7.1 mm
Field of view with the CDK20	6.2’ x 5.0’	11.2’ x 6.3’	4.8’ x 3.6’	11.2’ x 7.1’

Sampling	3.4 Pixel per arcsec	5.8 Pixel per arcsec	2.3 Pixel per arcsec	2.9 Pixel per arcsec

Cameras that are no longer in daily use

Our SBIG ST-8

	ST-7	ST-8	STF-8300
Model number	ST-7XME-D	ST-8XME	STF-8300M
pixel size	9 μm x 9 μm	9 μm x 9 μm	5.4 μm x 5.4 μm
Number of pixels	765 x 510	1530 x 1020	3326 x 2504
Total size of the chip	6.9 mm x 4.6 mm	13.8 mm x 9.2 mm	17.96 mm x 13.52 mm
Field of view with the CDK20	6.9’ x 4.6’	13.7’ x 9.2’	17.9’ x 13.5’
Sampling	1.9 Pixel per arcsec	1.9 Pixel per arcsec	3.1 Pixel per arcsec

Filter wheels

QHY 600M

We have two filter wheels for the QHY 600Ms. The first is a QHY CFW3-XL with the following Bessel filters:

Filter position	1	2	3	4	5	6	7	8	9
Filter	H_alpha	OIII	SII	U	B	V	R	I	Clear
Comment	Narrowband	Narrowband	Narrowband	Broadband	Broadband	Broadband	Broadband	Broadband	

The transmission curves of the UBVRI filters can be found on the website of *Baader Planetarium*: Filter Transmission. The filter curves of the bandpass filters are similar to those of the STF-8300.

The second is a QHY CFW3-L with the following SLOAN/SDSS filters:

Filter position	1	2	3	4	5	6	7
Filter	u'	g'	r'	i'	z-s'	y'	Clear
Comment	Wideband	Wideband	Wideband	Wideband	Wideband	Wideband	

The transmission curves of the ugriz' filters can be found on the website of *Baader Planetarium*: Filter Transmission.

ST-7 & ST-8

A filter wheel with the following filters can be attached to the ST-7 and ST-8:

Filter position	1	2	3	4	5	6	7	8	9	10
Filter	U	B	V	R	I	H_beta	H_alpha	SII	OIII	EMPTY
Comment	broad band	broad band	broad band	broad band	broad band	narrow band	narrow band	narrow band	narrow band	

The transmission curves of the UBVRI filters can be found at the web page of *Baader Planetarium*: Filter transmission. The transmission curves of the narrow band filter are similar to those of the STF8300.

STF-8300

For the STF-8300 a filter wheel with the following filters is available:

Filter position	1	2	3	4	5	6	7	8
Filter	Block-UV/IR (L)	Blue	Green	Red	H_alpha	OIII	V	B
Comment	luminance	broad band	broad band	broad band	narrow band	narrow band	broad band	broad band

The transmission curves of the new filters can be found at the web page of *Baader Planetarium*: Filter transmission.

The transmission curves of the V and B filters are identical with the V and B filters used in the ST-7.

Features

- For the ST-7 and ST-8 we have an adaptive optics module, the AO-7, which can be used for guiding and to optimize the exposure quality (see e.g. here).
- The ST-7 and ST-8 contain an additional guiding chip in addition to the normal CCD chip, which can be used to automatically track an object (see e.g. here), while the main CCD can be used to take the actual image.
- The Off Axis Guides of the STF-8300 and the QHY 600M have the advantage that they are placed in front of the respective filter wheel and therefore the guiding is independent of the brightness of the guide star in the respective filter. For this reason, these cameras can make use of fainter guide stars/objects in comparison to the ST-7 and ST-8.

Maintenance

Every 12 months (or before) the desiccant cartouches of the cameras need to be regenerated (baked), otherwise there's the possibility that the cooled CCD sensors can suffer from icing due to moisture in the cameras. The desiccant cartouches of the ST-7 and ST-8 can be found at the bottom of the camera and can easily be released from the camera case with a screw driver. This procedure is even easier for the STF-8300, where the desiccant cartouche (located at one side of the camera) can be unscrew with two fingers. Attention! The connection between the camera cases and desiccant cartouches are secured by sealing rings that can easily fall off the cartouches and vanish inside the camera cases. To prevent water (vapor) from getting into the camera during the regeneration of its desiccant cartouche, remove the desiccant cartouche in a dry environment and replace it with one of the dummies, which can be found in the room 2.009. It takes about four hours at 170°C in a common oven (without the sealing ring!) to regenerate the desiccant in the cartouche, so that the camera can work for another year without icing.

DSLR

For short time exposures and lucky imaging there is the digital (single) reflex camera (DSLR): Canon EOS 700D. It has been optimized for amateur astronomers by *Baader Planetarium* by changing the used filters. The transmission properties of the original Canon filters in comparison to the optimized ones can be found at the Baader web page click to view the image.

Basic data

Our DSLR (Canon EOS 700D)

	EOS 700D
Image sensor	CMOS sensor
Size of the pixels	4.3 μm x 4.3 μm
Number of pixels	5,184 x 3,456
Total size of the chip	APS-C 22.3 mm x 14.9 mm
Format factor and Axe ratio	1.6 and 3:2

Field of view with the Celestron C14	19.6’ x 13.1’
Field of view with the Celestron C11	27.4' x 18.3'
Field of view with the Celestron C11 + F/6.3 focal reducer	43.5' x 29.0'
Field of view with the Celestron C8	37.7' x 25.2'
Field of view with the Celestron C8 + F/6.3 focal reducer	59.9' x 40.0'
Exposure times	30-1/4,000 s (halves or thirds of steps)
ISO-Sensitivity	100–12,800 (can be expanded up to 25,600)

Furthermore, one can take full-HD videos with an ISO sensitivity of max. 6,400 (can be expanded up to 12,800). The camera can be controlled by a rotatable and slewable 7,7 cm LCD touchscreen or by a computer interface. Exposure series can be taken at a maximum speed of approx. 5 images per second, which can be maintained for about 22 exposures (JPEG format) or 6 exposures (RAW format).

It is also possible to remotely control the camera by a computer.