

Digital Astrophotography:

Low Cost Imaging for Everybody

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18. April 2003



Digital Cameras

Features:

- **Good sensitivity**
- **High resolution (M-Pixel)**
- **Immediate feedback**
- **No waste of film**
- **Digital image processing**
- **Color**

Digital Cameras

Disadvantages:

- Price for advanced models with high resolution and manual features
- No long time exposures (less than 30sec.)

Digital Cameras

Preferred camera features :

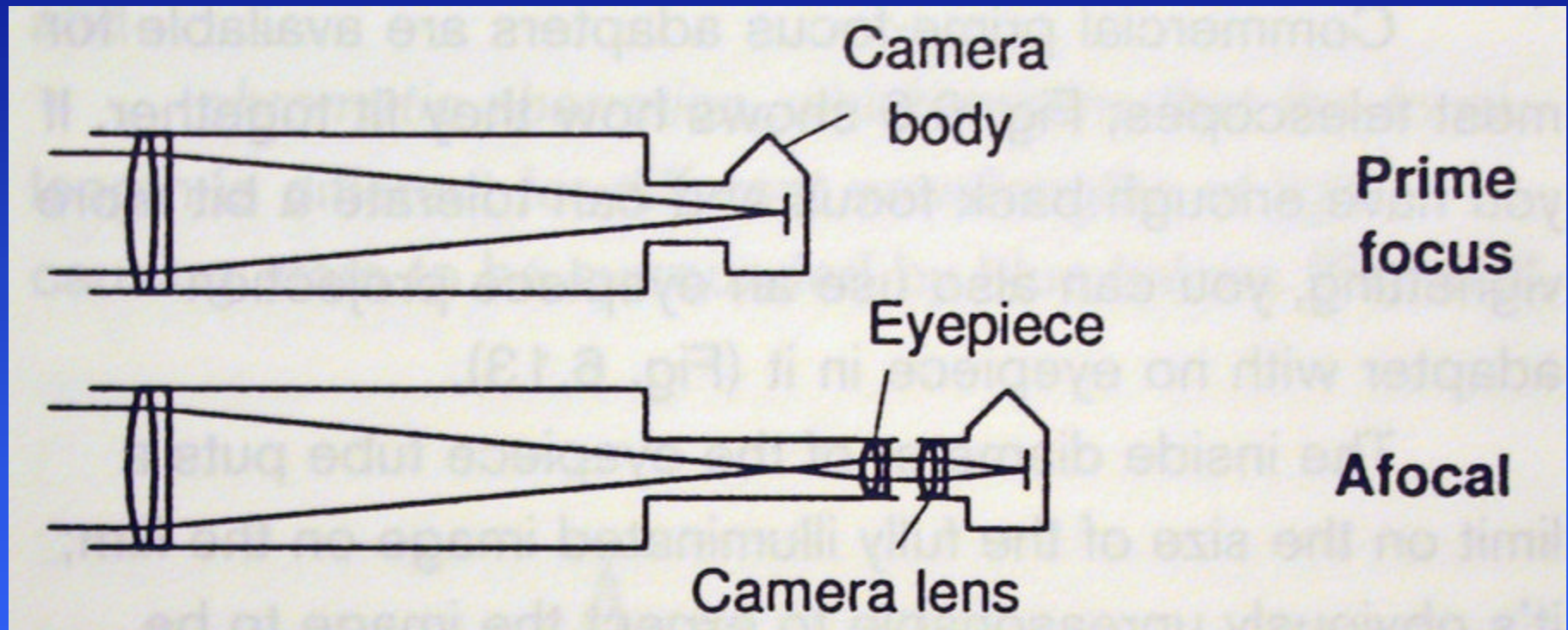
- Manual function control (exposure, f-stop, focus, white balance)
- Remote shutter release (IR, cable)
- Matching eyepieces
- Threaded ring to connect adapters
- A variety of adapter rings

Digital Cameras

Best objects :

- Moon (+ eclipses)
- Sun, (+ eclipses)
- Planets
- Planets / Moon conjunctions

Digital cameras use afocal projection



Nikon Coolpix 950

Specifications:

- 1600 x 1200 pixel resolution
- 2,11 megapixel total
- 3 x optical zoom (1,25 x – 2,5 x) 7 – 21 mm
- f-stop 1:2,6 – 1:4
- Shutter 8 sec – 1/500sec (manual)
- Shutter or aperture manual, focus manual
- Manual flash disable

Canon Powershot G1

Specifications :

- 2048 x 1536 pixel resolution
- 3.34 megapixel total
- 3 x optical zoom 7 – 21 mm (34 – 102 mm)
- f-stop 1:2 – 1:8
- Shutter 8 sec – 1/1000sec (manual)
- Shutter / aperture / focus manual control
- Manual flash disable

Nikon Coolpix 950



Nikon Coolpix 950



Nikon Coolpix 950



Canon Powershot G1



Canon Powershot G1



Canon Powershot G1



Canon Powershot G1



Sibylle Fröhlich, WFS

The Winter Moon with Nikon Coolpix



**At -8°C (!!) = $17,6^{\circ}\text{F}$
11. February 2003 , 22:07
Nikon CoolPix
1/125 sec , f 4,8**

Nikon Coolpix 950 : Moon 17. May 2002



Nikon Coolpix 950 : Moon 17. May 2002



Canon Powershot G1 : Moon 24. Oct.01



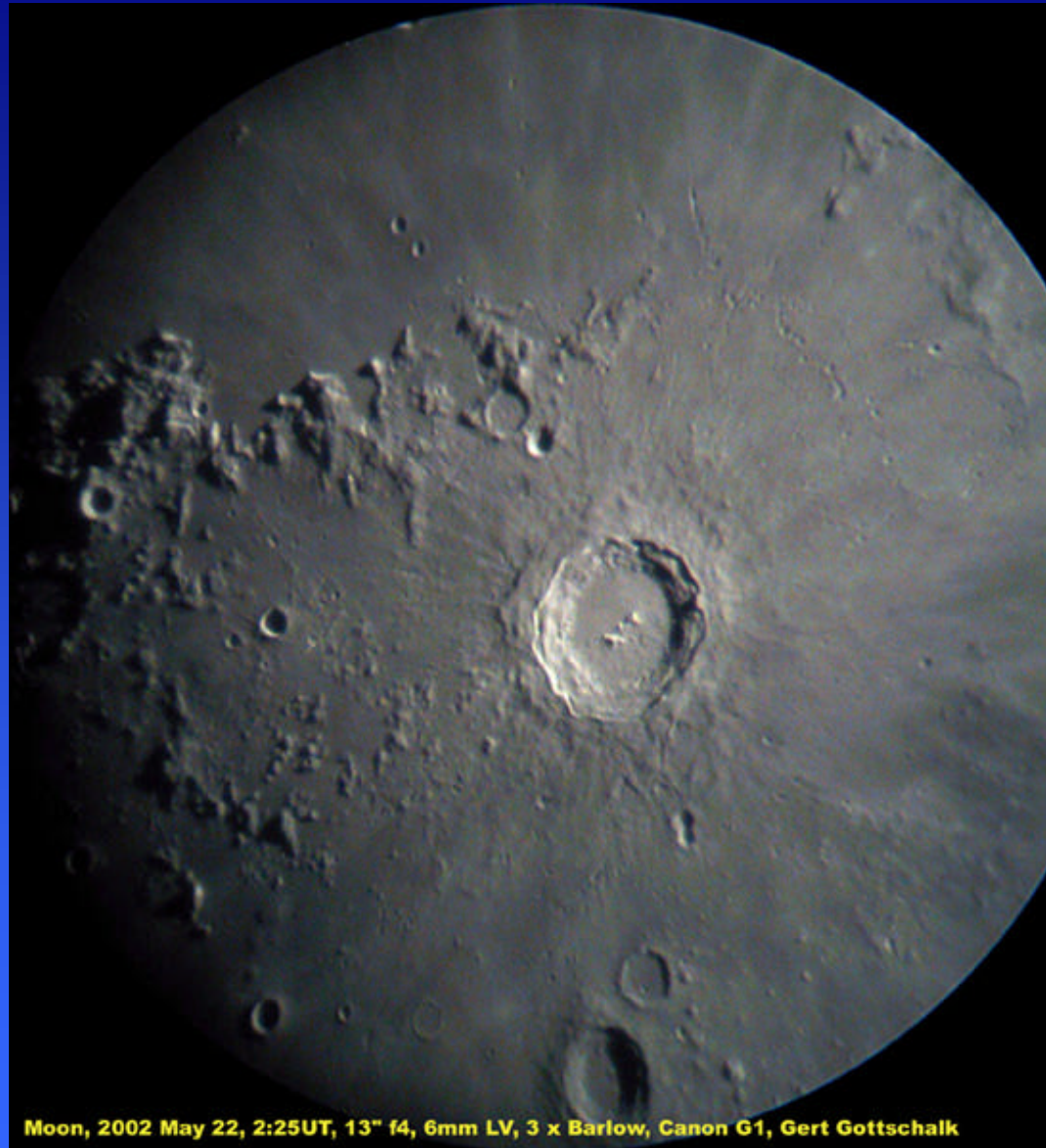
Canon Powershot G1 : Moon 22. May 02



Moon, 2002 May 22, 2:25UT, 13" f4, 6mm LV, 3 x Barlow, Canon G1, Gert Gottschalk



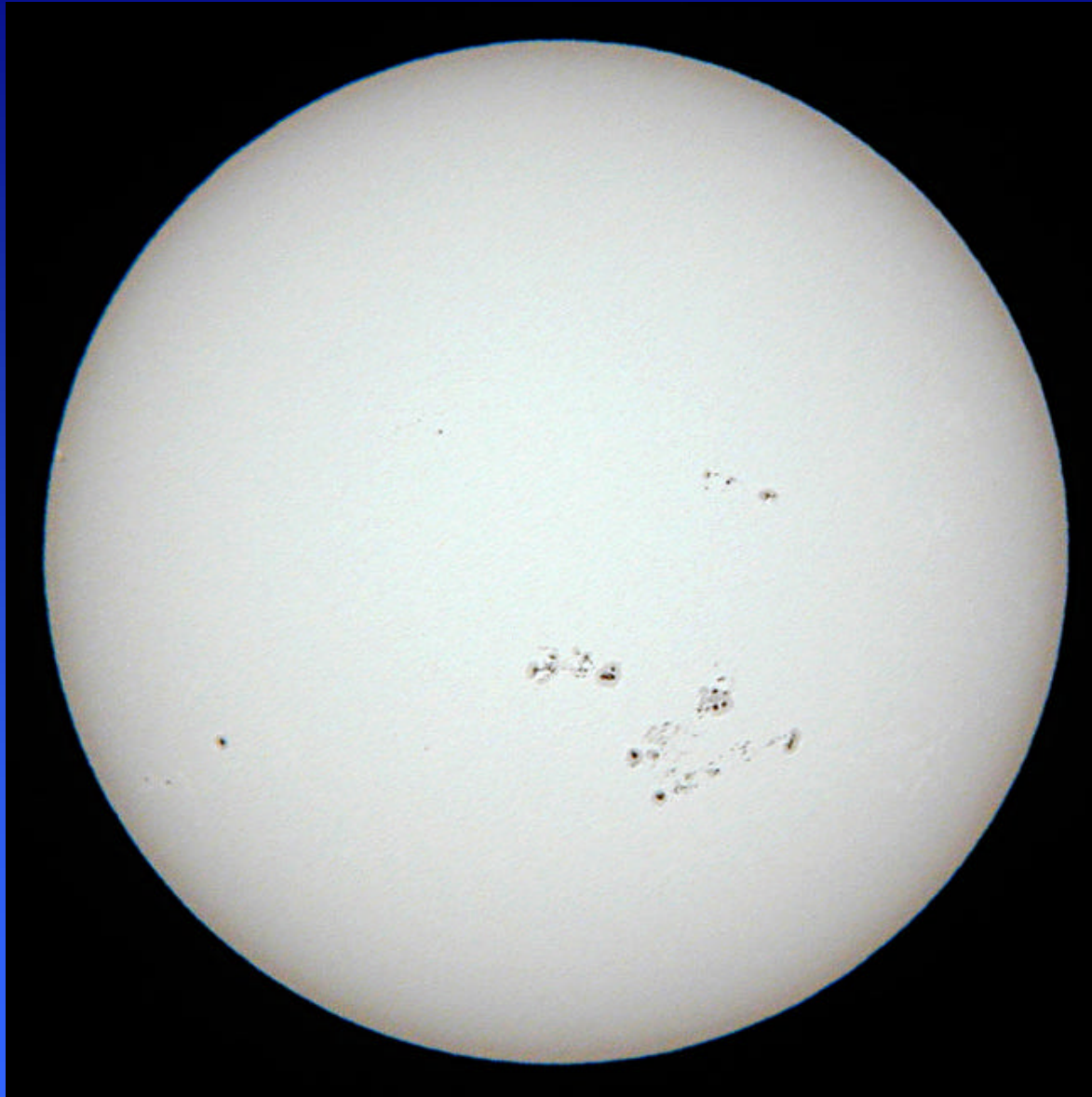
Canon Powershot G1 : Moon 22. May 02



Moon, 2002 May 22, 2:25UT, 13" f4, 6mm LV, 3 x Barlow, Canon G1, Gert Gottschalk



Nikon Coolpix 950 : Sun July 29. 2002



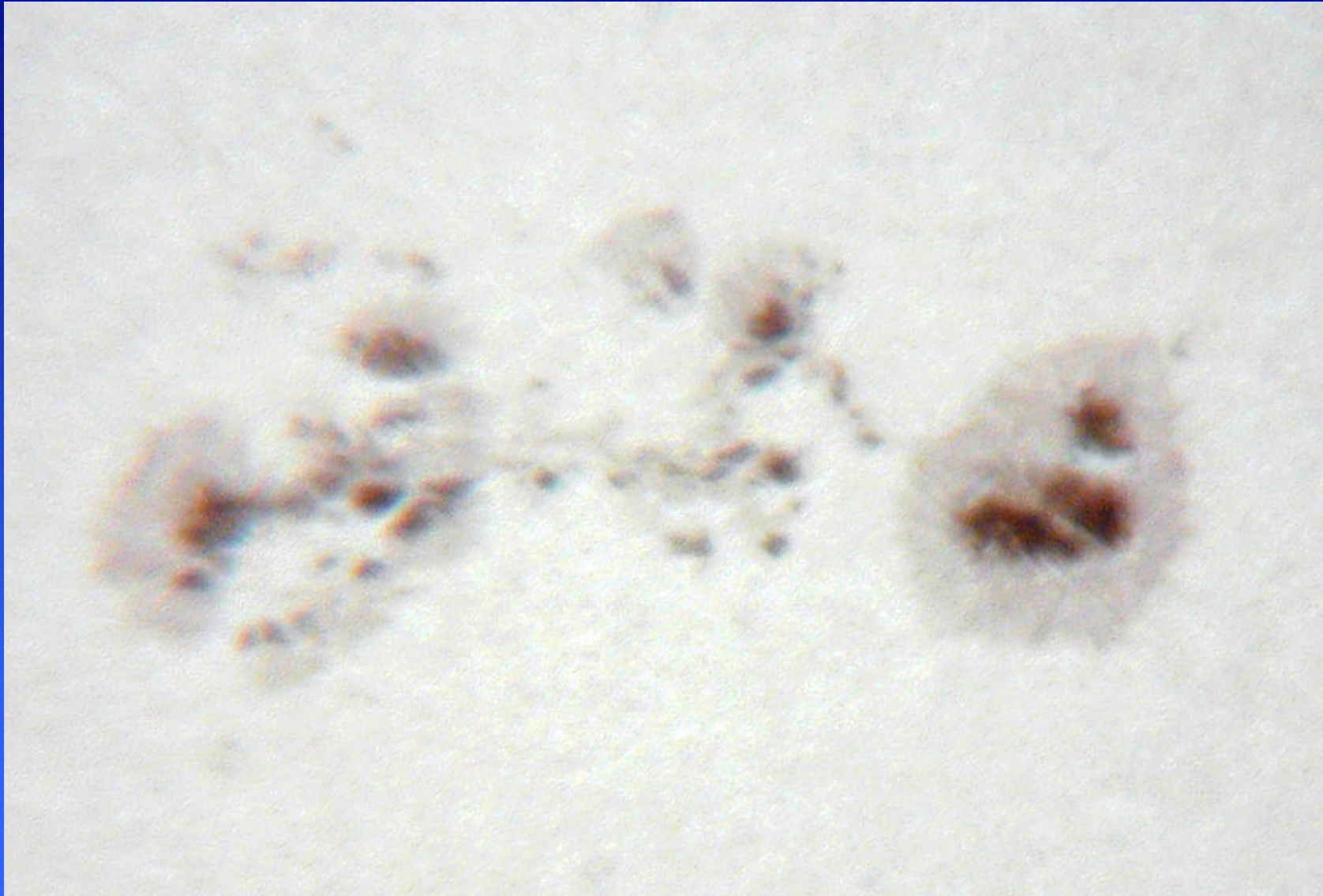
Nikon Coolpix 950 : Sun July 28. 2002



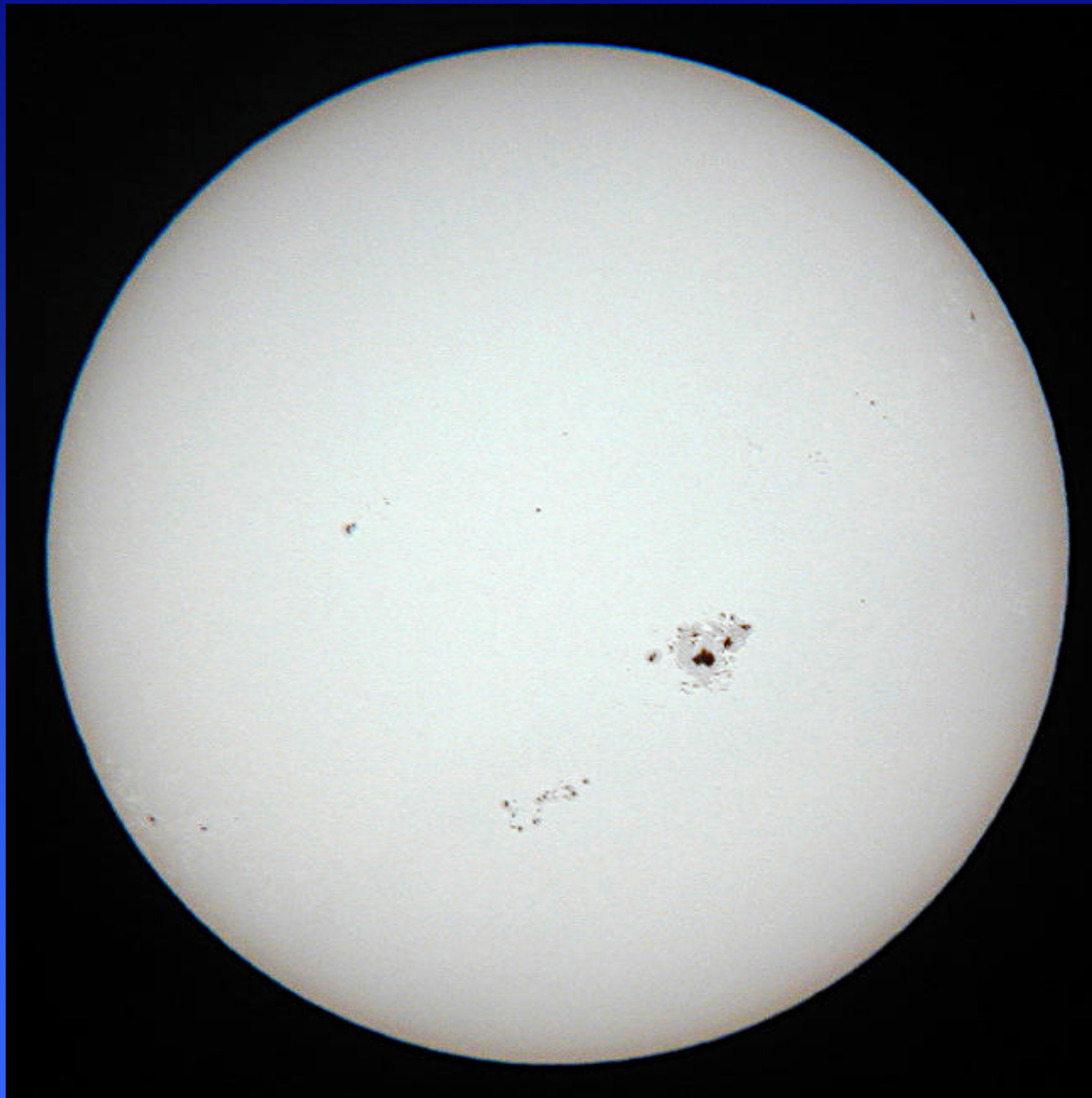
Sonne, 28.7.2002 15:49 UT



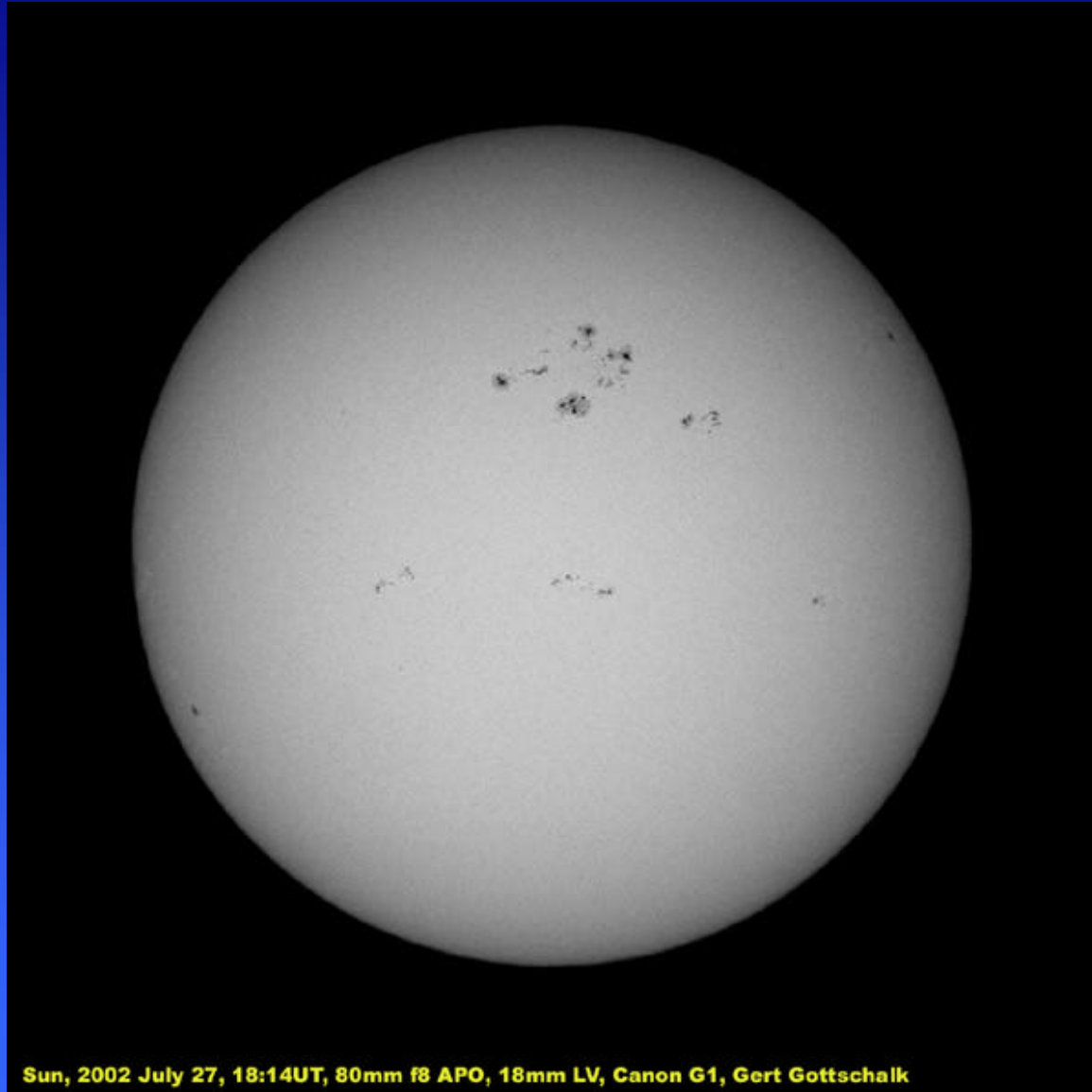
Nikon Coolpix 950 : Sun July 29. 2002



Nikon Coolpix 950 : Sun Aug. 18. 2002



Canon Powershot G1 : Sun



Sun, 2002 July 27, 18:14UT, 80mm f8 APO, 18mm LV, Canon G1, Gert Gottschalk



Nikon Coolpix 950 : Planets May 16. 2002



Moon, Saturn, Jupiter

Sibylle Fröhlich, WFS



Nikon Coolpix 950 : Planets June 4. 2002



Jupiter, Saturn

Sibylle Fröhlich, WFS



Nikon Coolpix 950 : Planets Dec. 2. 2002



Moon, Venus, Mars

Sibylle Fröhlich, WFS



Webcams

Features:

- **Low price (<\$100)**
- **Good sensitivity**
- **Allows averaging lots of images**
- **No waste of film**
- **Digital image processing**
- **Color**

Webcams

Disadvantages :

- **Wiring at the telescope**
- **Power supply, PC, Camera**
- **Big files**
- **No long time exposures (cooling!)**
- **Medium resolution (640 x 480)**

Webcams

Camera / PC features :

- Webcam with CCD chip (vs. CMOS)
- Laptop with USB Port
- Removable camera lens
- IR block filter!
- Telescope adapter
- Free processing software

Webcams

Best Objects:

- Planets
- Sunspots (detail)
- Moon (crater detail)

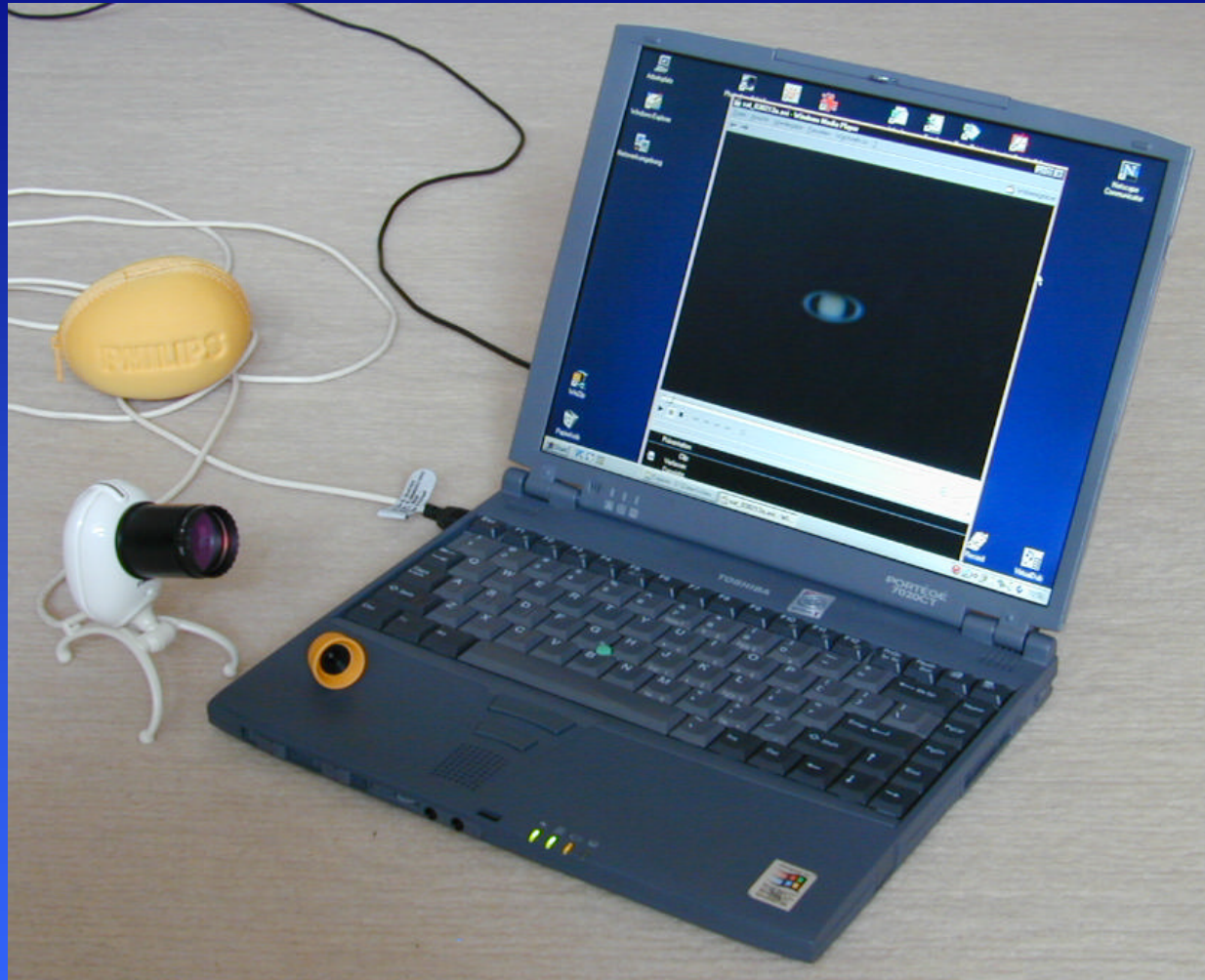
Philips Webcam Selection Table

Manufacturer	Model No.	Name	Sensor Type	Sensitivity	Sensor Model	Sensor Spec.	Modified to SC Spec ?	Rating for Astro work	O/S	
Philips	PCA 635 VC	?	CCD	10 lux	.	512 x 582 pixel	?		WIN98,NT4	
..	PCA 645 VC	?	CCD	?	.		YES		WIN98, LINUX	
..	PCA 646 VC	?	CCD	30 lux	.		YES		WIN98, LINUX	
..	PCVC 655K	Vesta Fun	CMOS	15 lux	.				WIN98,Me	
..	PCVC 675K	Vesta	1/4"CCD	<1 lux	Sony ICX098AK	659 x 494 pixel 5.6x5.6um	YES	AAA	} ALL WIN +	
..	PCVC 680K	Vesta Pro	CCD	<1 lux	Sony ICX098AK		YES	AAAA		} MAC, LINUX
..	PCVC 690K	Vesta Scan	CCD	<1 lux	Sony ICX098AK		YES	AAAA		
..	PCVC 720K	Toucam XS	CMOS	10 lux	.				ALL WIN	
..	PCVC 730K	Toucam Fun	CMOS	10 lux	.				} ALL WIN +	
..	PCVC 740K	Toucam Pro	1/4"CCD	<1 lux	Sony ICX098BQ	659 x 494 pixel 5.6x5.6um	YES	AAAAA	ALL WIN + MAC, LINUX	
..	PCVC 750K	Toucam Pro 3D	CCD	<2 lux	?Sony ICX098BQ		same as 740 ?			ALL WIN- NOT MAC

<http://homepage.ntlworld.com/molyned/web-cameras.htm>



Digital imaging equipment



Best choice for planetary webcam imaging: Philips ToUCam 740k

Digital imaging equipment



Image processing (Registax)



<http://aberrator.astronomy.net/registax/>



Image processing (Registax)

STEP 1: ALIGNMENT

During alignment accurate registration of the images is of the greatest importance. Next to alignment Registax also estimates the quality of the images.

See [alignment page](#)

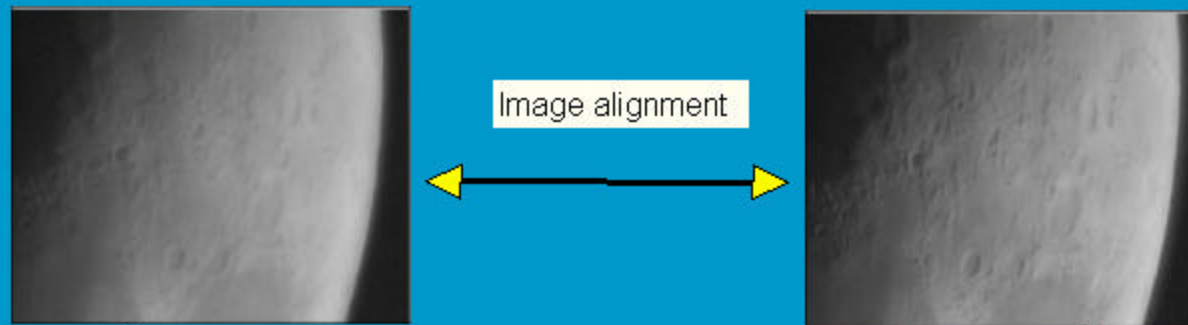


Image stacking

STEP 2: STACKING

During stacking all information of the images is used for final stacked image. The signal to noise ratio is increased.

See [Stacking](#)



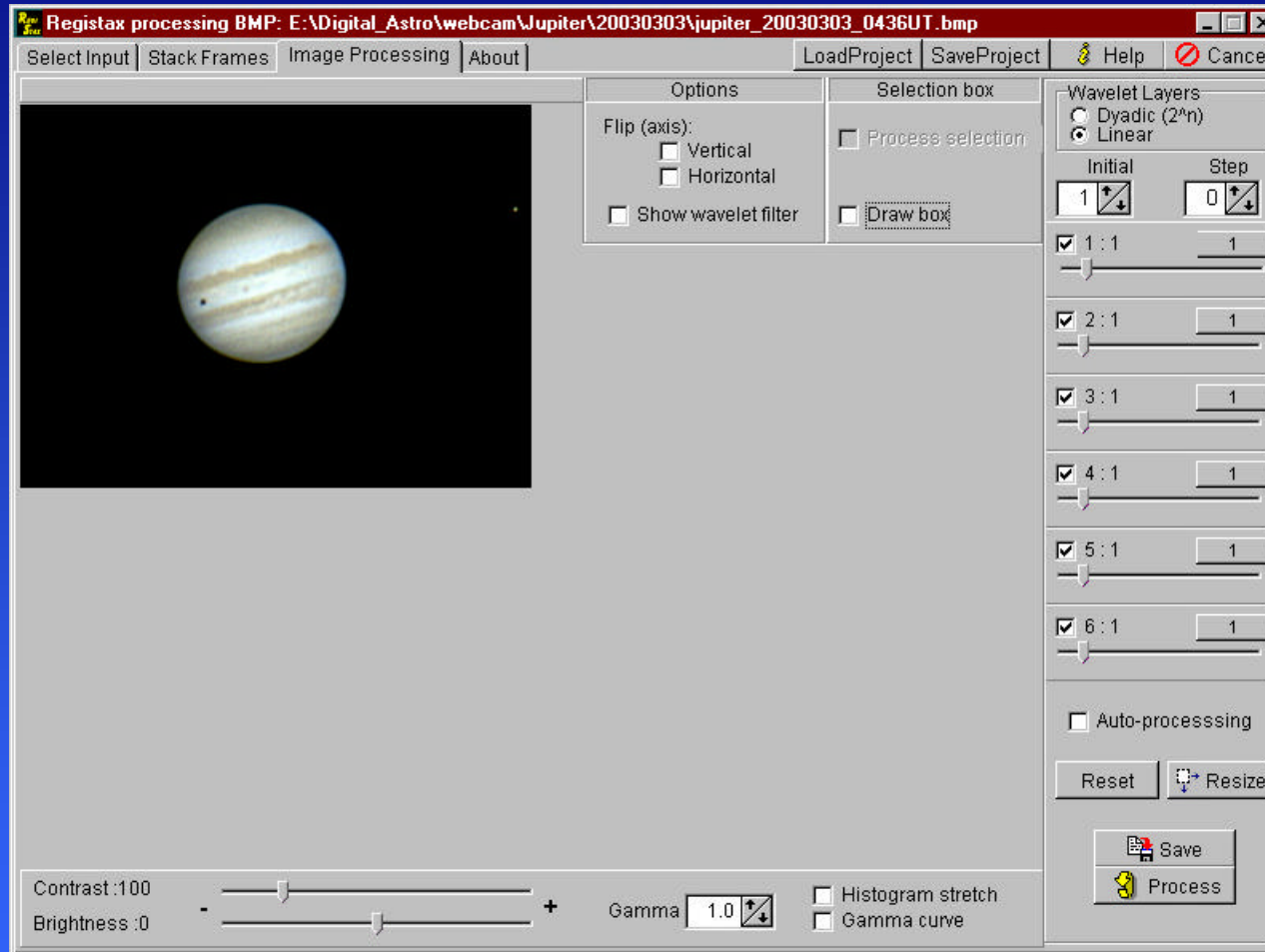
Image processing (Registax)

STEP3: PROCESSING

Using wavelet processing techniques only the lower half of the stacked image was processed in Registax.
See [Processing](#)



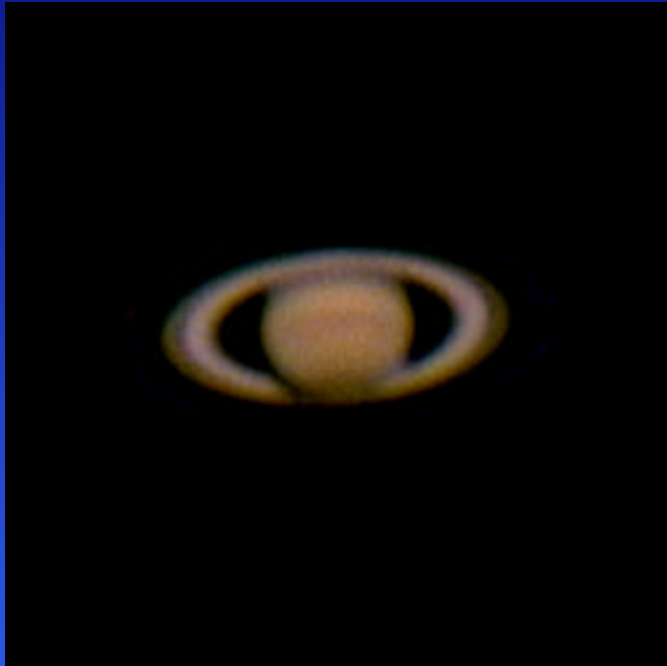
Image processing (Registax)



Stacking of video images and wavelet processing of sum image



Saturn



8. Feb. 2003 , 21:38 UT

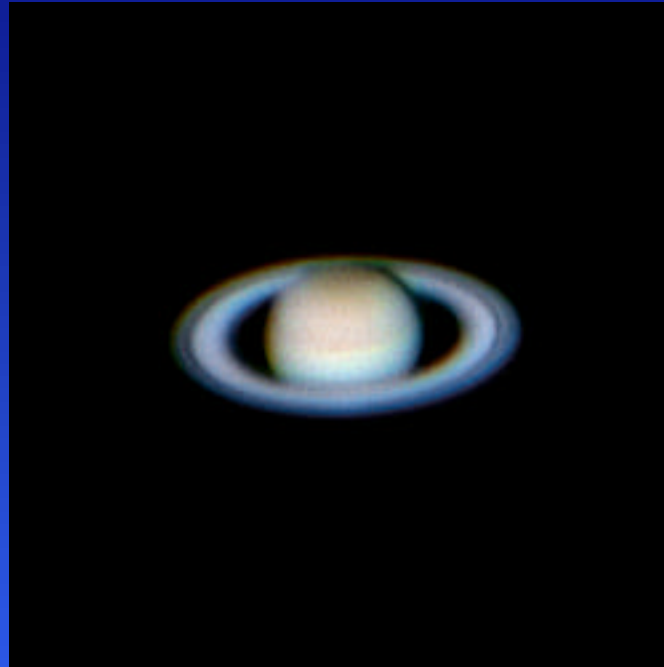


9. Feb. 2003 , 22:41 UT

8" Newton f5, 3 x Barlow, ToUCam + IR, 1/25 sec ,
10 images averaged with 'Giotto' software



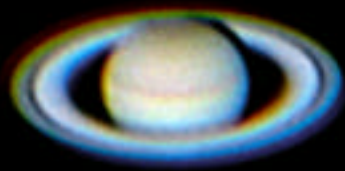
Saturn



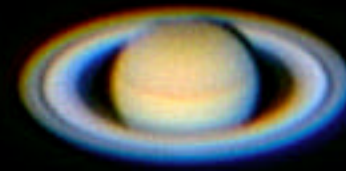
11. Feb. 2003, 22:17UT
8" Newton f5, 3 x Barlow, ToUCam + IR, 1/25 sec ,
43 images averaged / processed with 'Registax'



Saturn



Saturn, 18.03.2003, 21:24 UT
8" Newton f5 , 3 x Barlow, ToUCam, 1/25 sec
Sibylle Fröhlich



Saturn, 22. März 2003, 20:14 UT
8" Newton f5, 3 x Barlow, ToUCam + IR
1/25 sec, Sibylle Fröhlich

ToUCam 1/25 sec

18. Feb. 2003, 21:24UT

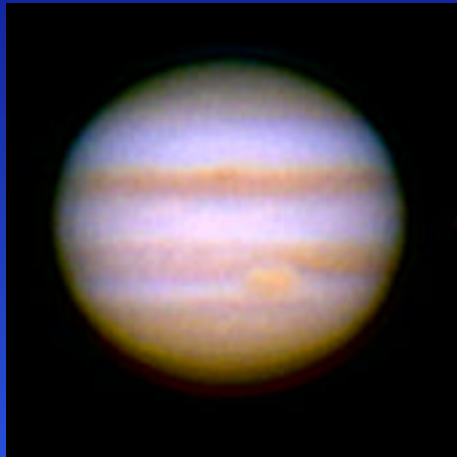
27 images processed with Registax

22. Feb. 2003, 20:14UT

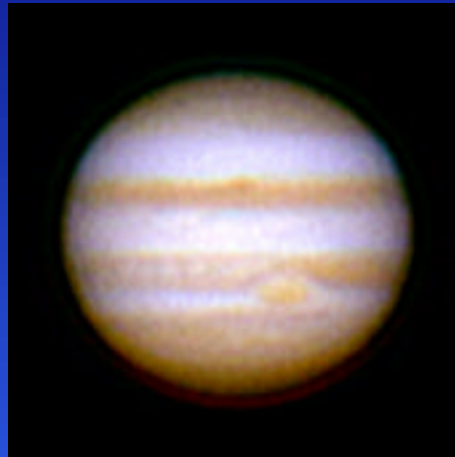
22 images processed with Registax



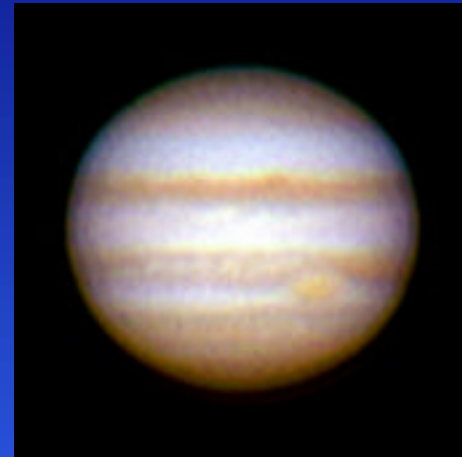
Jupiter



01:07 UT



01:11 UT



01:26 UT

10. Februar 2003

8" Newton f5, 3 x Barlow, ToUCam + IR, 1/50 sec ,
12 images averaged with Giotto



Jupiter 12. Feb. 2003



Europa

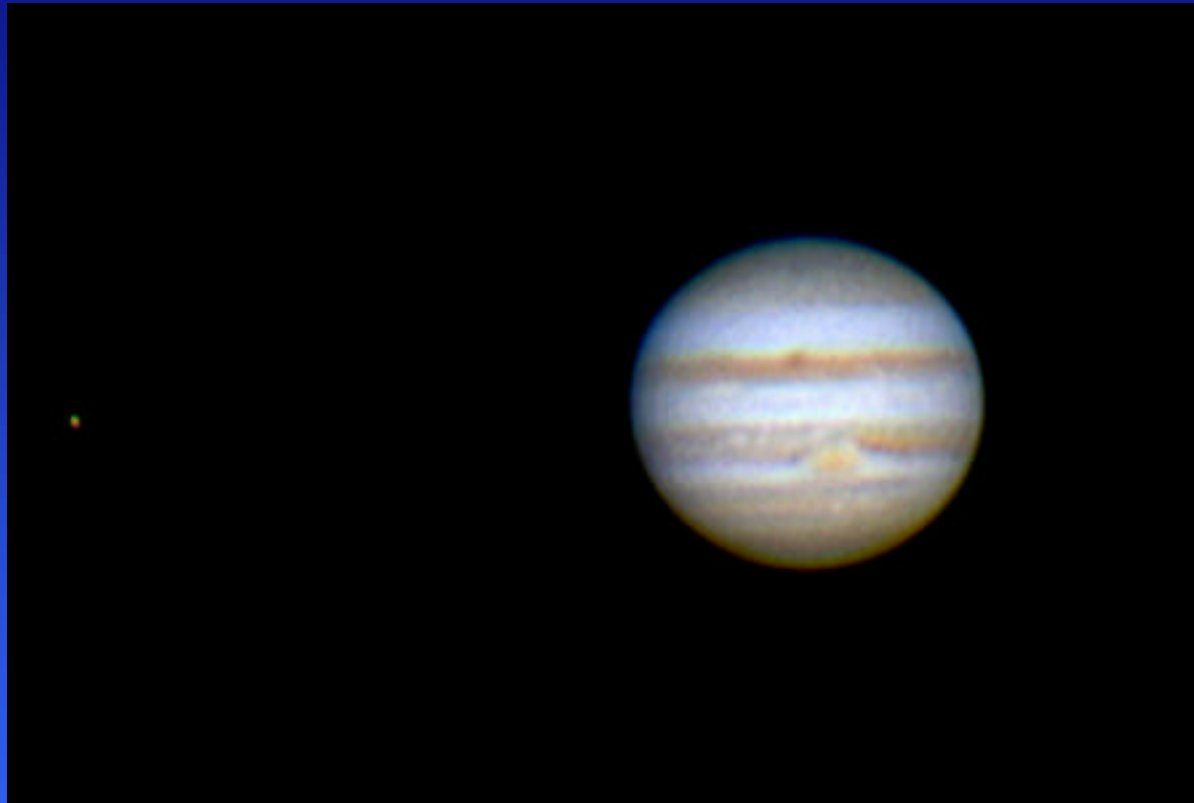
Io

00:58 UT und 01:27 UT

8" Newton f5, 3 x Barlow, ToUCam + IR, 1/33 sec
ca.25 images processed with Registax



Jupiter am 27. Feb. 2003



00:04 UT

**8" Newton f5, 3 x Barlow, ToUCam + IR, 1/33 sec
ca.25 images processed with Registax**



Jupiter am 2. Mar. 2003



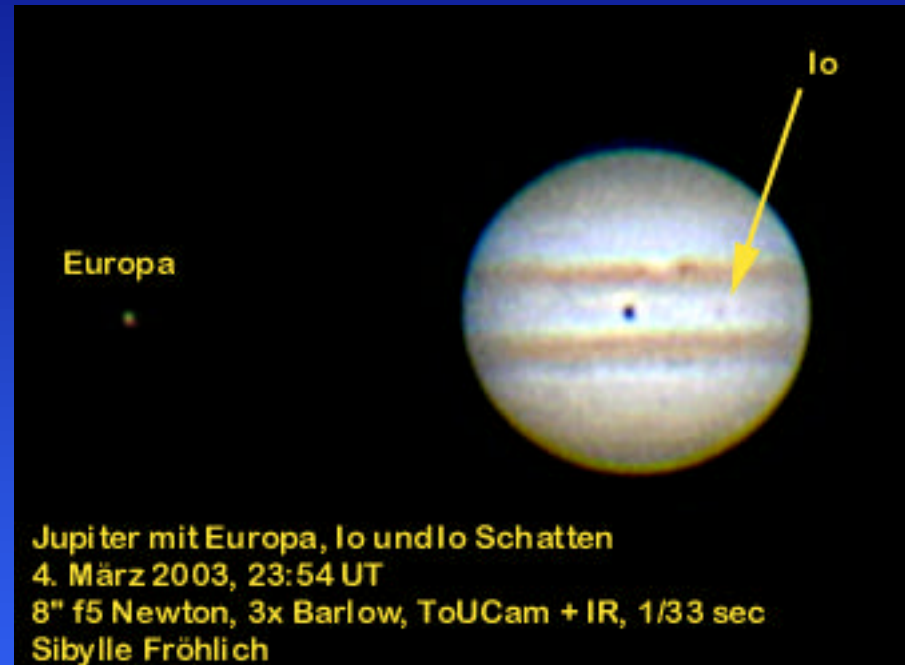
~20 images processed with Registax

Jupiter 3. Mar. 2003



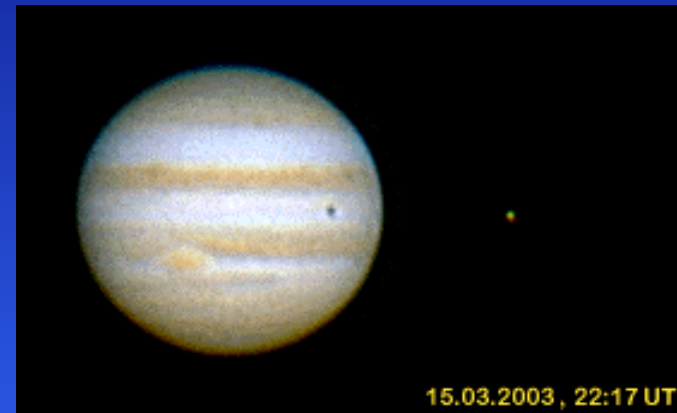
~20 images processed with Registax

Jupiter 4. Mar. 2003



31 images processed with Registax

Jupiter 15. Mar. 2003

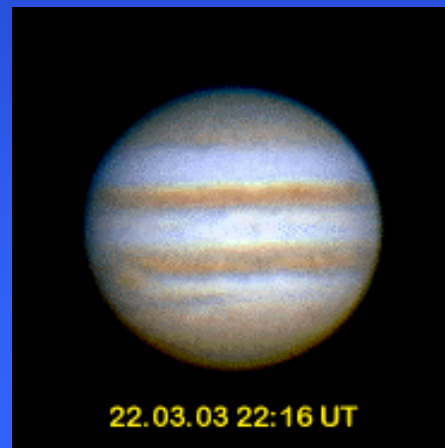


47 images processed with Registax

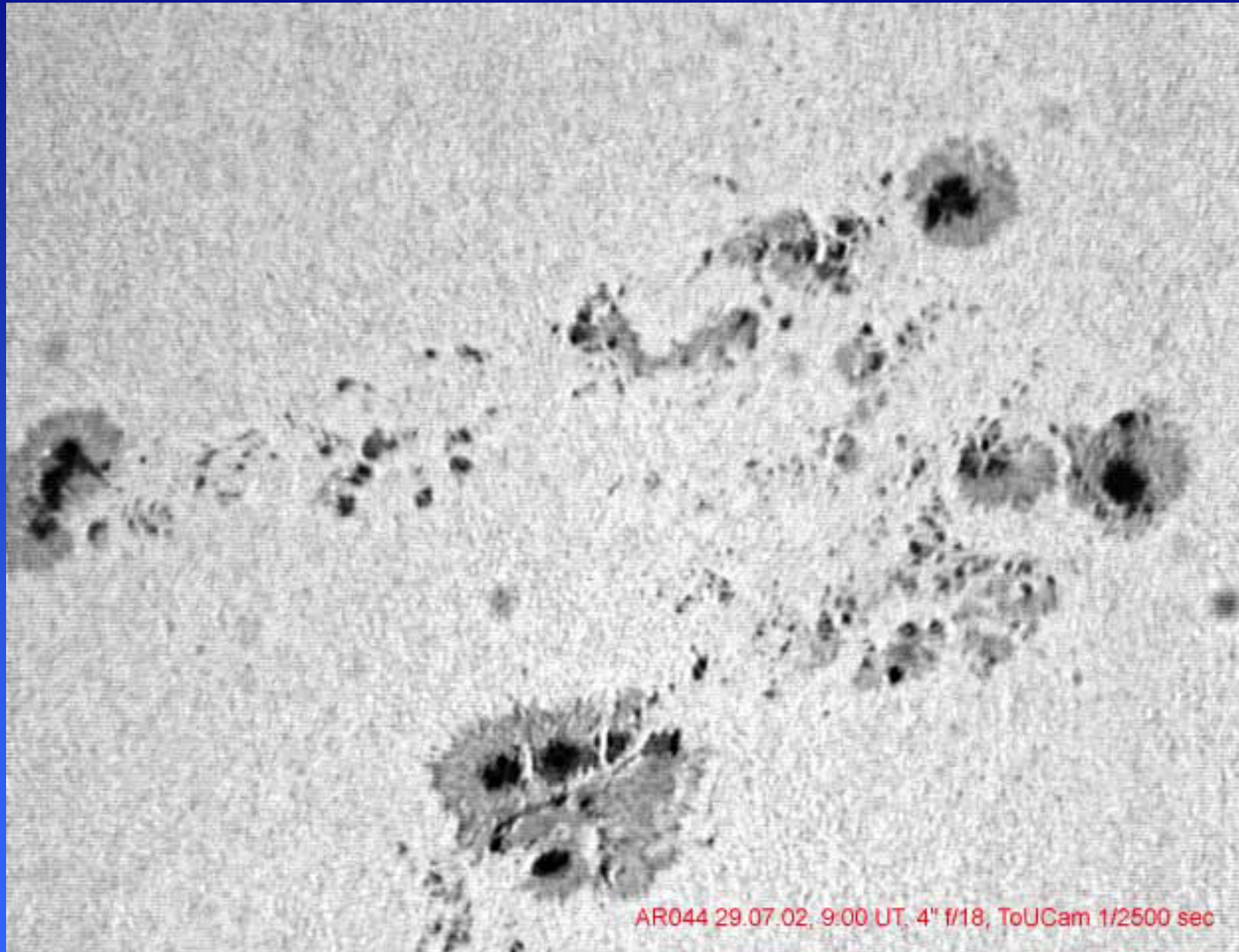
Jupiter Mar. 22. 2003



23, 87, 49 images averaged with Registax



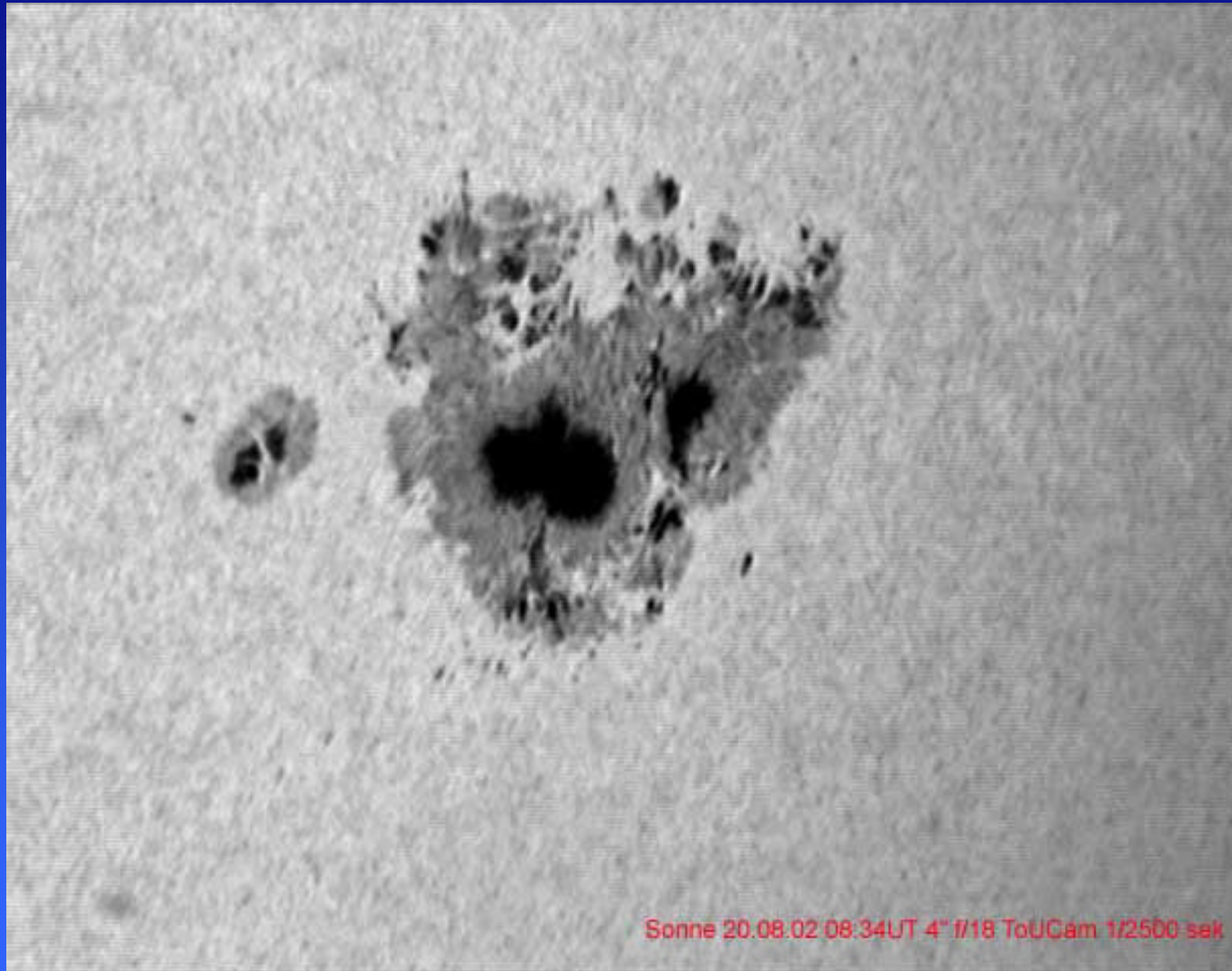
Sunspot July 29. 2002 (by M.Kiehl, WFS)



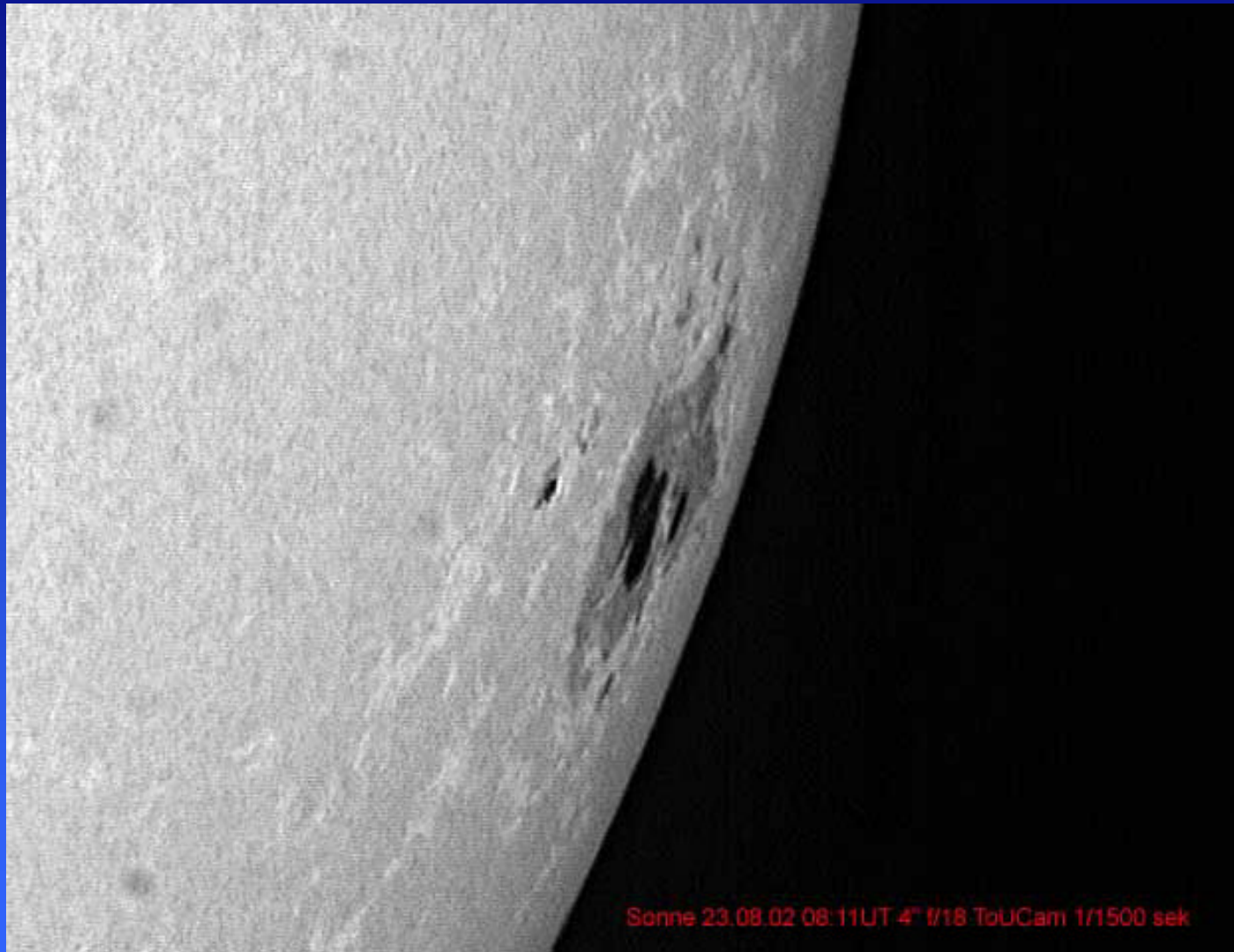
Sunspot July 30. 2002 (by M.Kiehl, WFS)



Sunspot Aug. 20. 2002 (by M.Kiehl, WFS)



Sunspot Aug. 23. 2002 (by M.Kiehl, WFS)



Nikon vs. ToUCam



Nikon 1/60 sec



ToUCam 1/250 sec

Feb .11. 2003



Nikon vs. ToUCam



Nikon 1/60 sec

ToUCam 1/250 sec
Feb. 11. 2003

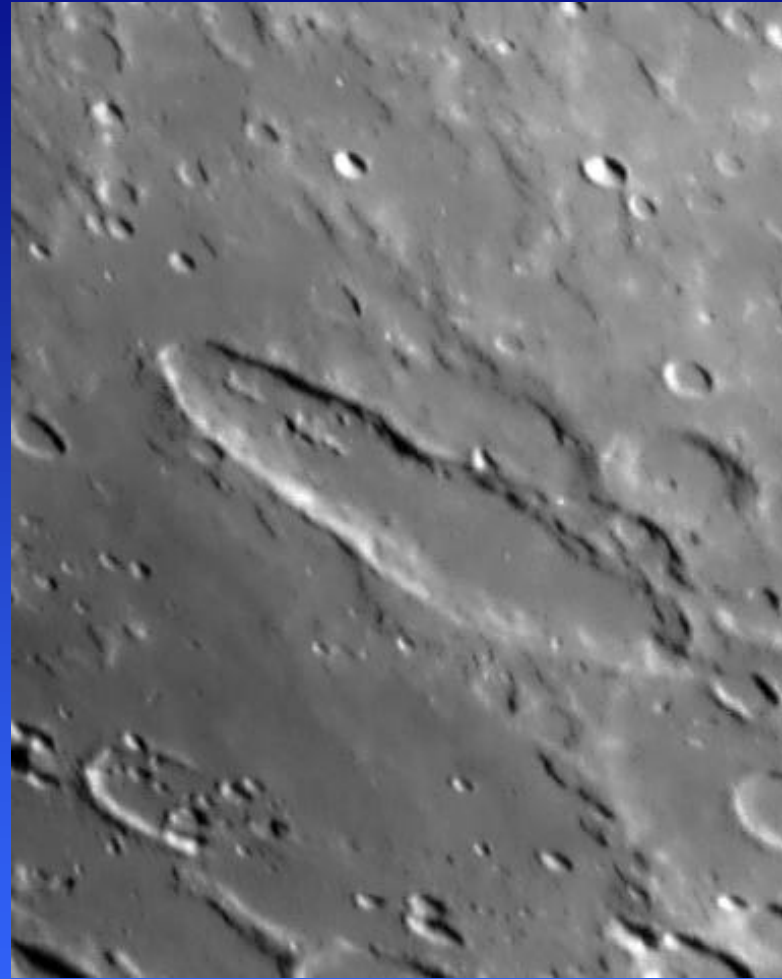


Copernicus



Feb. 11. 2003

Schiller



Mar. 16. 2003

8" Newton f5, 3 x Barlow, ToUCam + IR, 1/100 sec

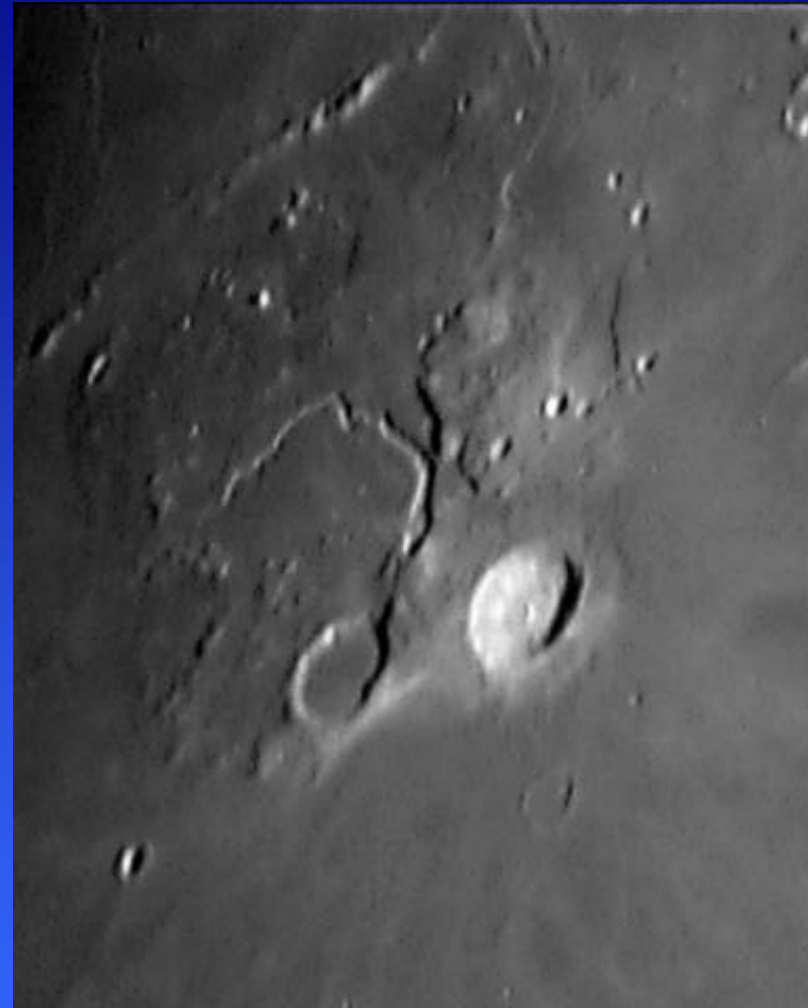
27 images averaged with Registax 6 images averaged with Registax



Gassendi



Vallis Schröteri



Mar. 15. 2003, 8" Newton f5, 3 x Barlow, ToUCam + IR, 1/100 sec

5 images averaged with Registax

6 images averaged with Registax



Plato



**Feb. 11. 2003 , 8" Newton f5, 3 x Barlow, ToUCam + IR, 1/100 sec
6 images average with Registax**



Clavius



**Feb. 11. 2003 , 8" Newton f5, 3 x Barlow, ToUCam + IR, 1/100 sec
6 images average with Registax**



Sibylle Fröhlich, WFS

Thank You!



AG Astrofotografie der Wilhelm Foerster Sternwarte e.V.

<http://www.be.schule.de/schulen/wfs/pages/AGAstrofoto/INDEX.HTM>

