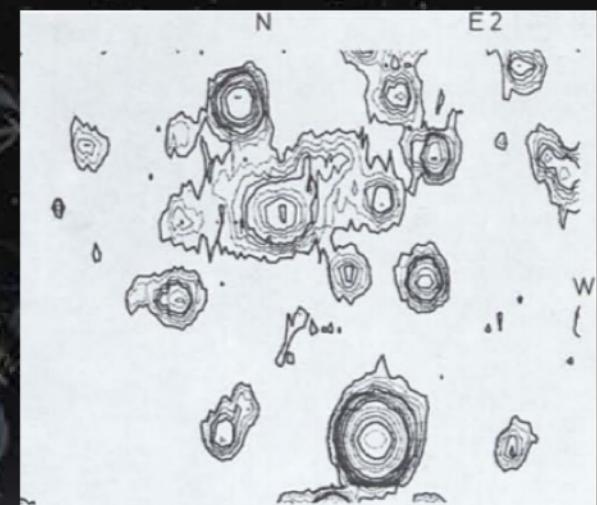
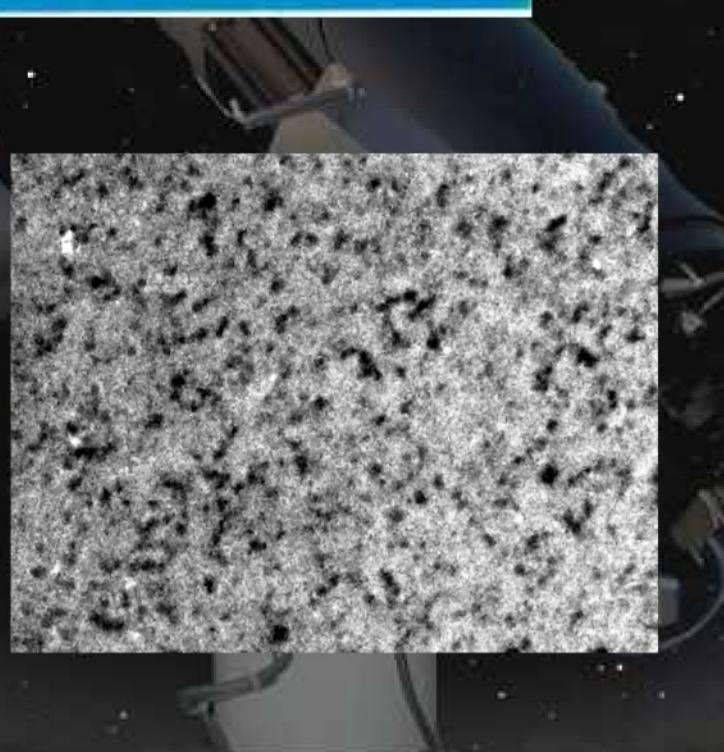
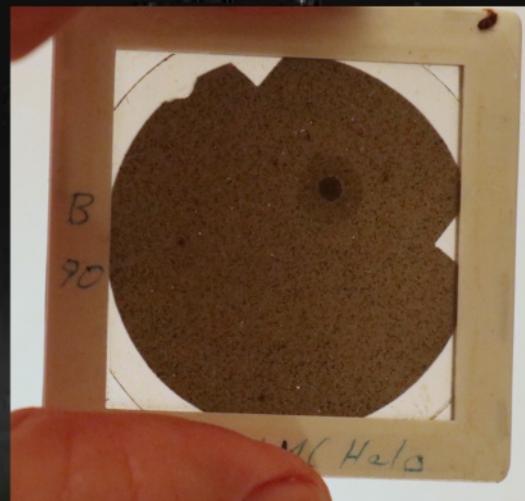
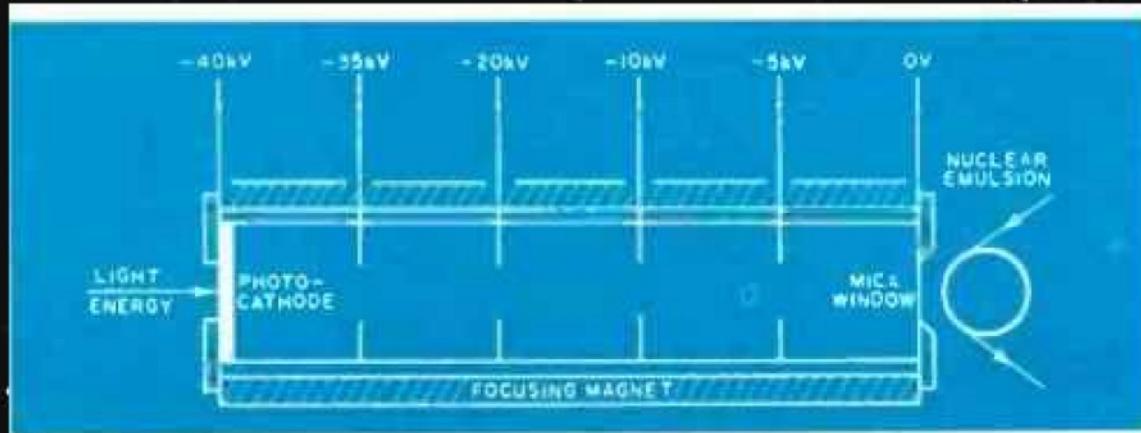


1970-talet: Elektronografi



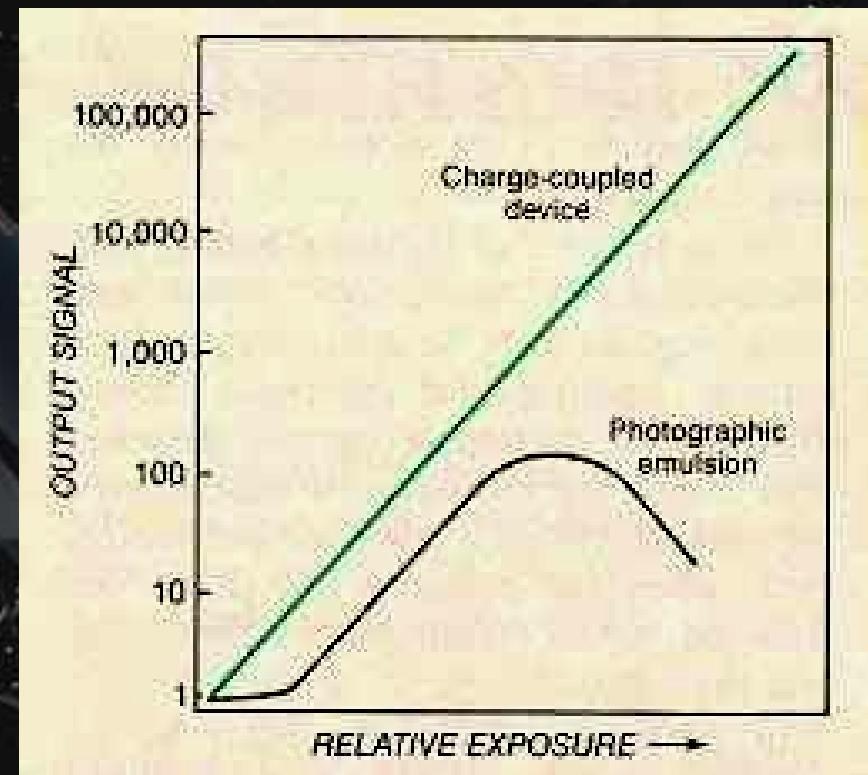
CCD: Lite historia

- 1969: Willard Boyle och George Smith vid Bell Labs konstruerade den första CCD-kameran
- De fick nobelpriset i fysik 2009
- Användes mycket tidigt inom professionell astronomi

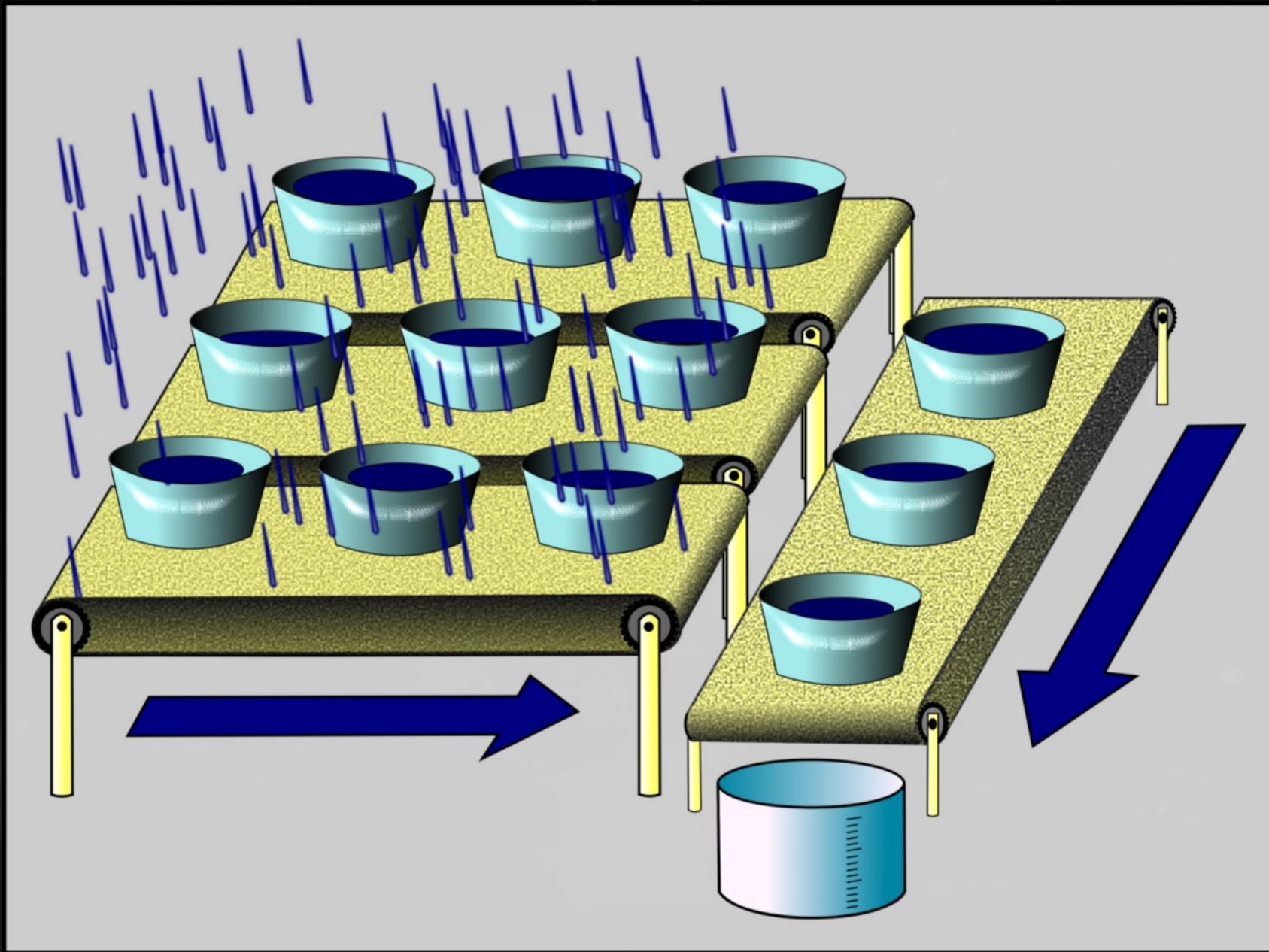


CCD innebar en revolution

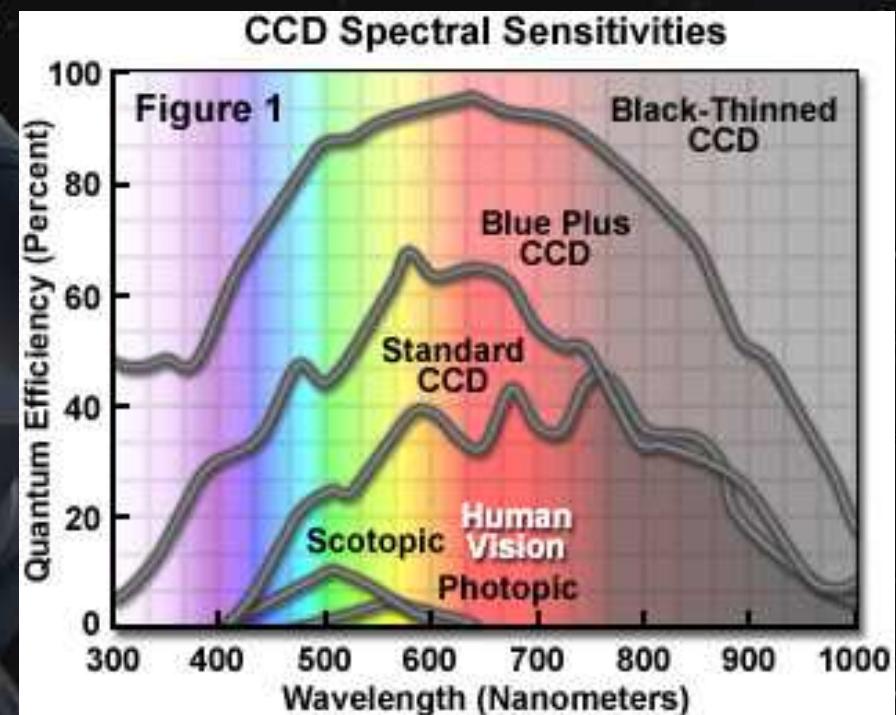
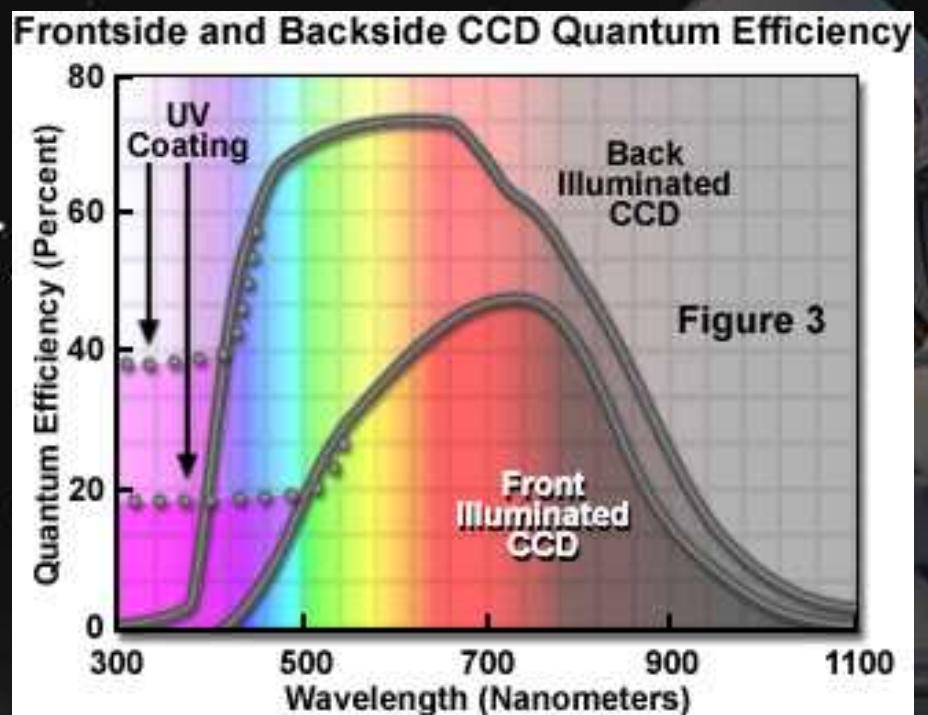
- CCD ~ 100 gånger känsligare än fotografisk film
- CCD ~ 100 gånger bättre dynamiskt omfång
- CCD: Linjäritet: Registering proportionell mot exponering
- Digital hantering naturlig



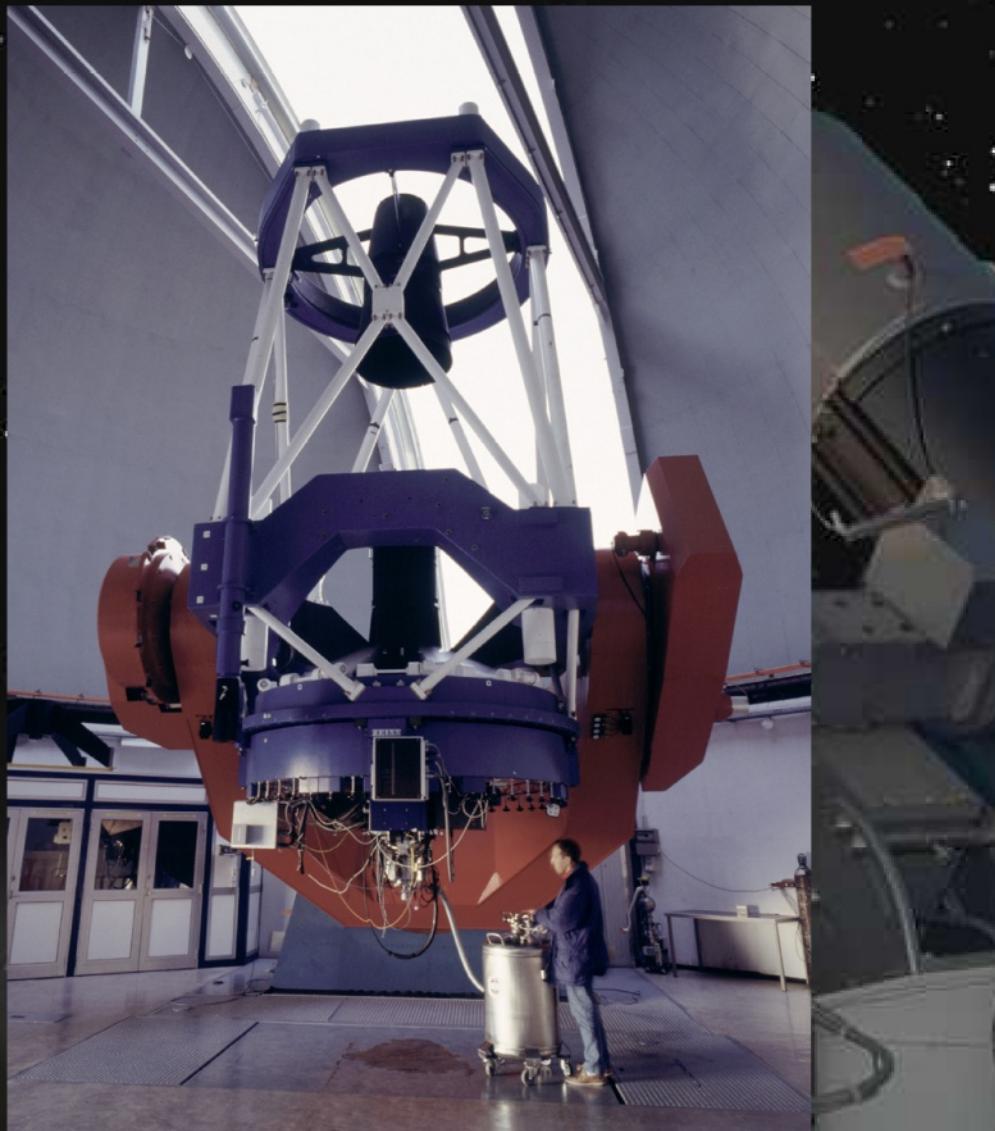
Hur fungerar en CCD?



CCD kvanteffektivitet (QE)

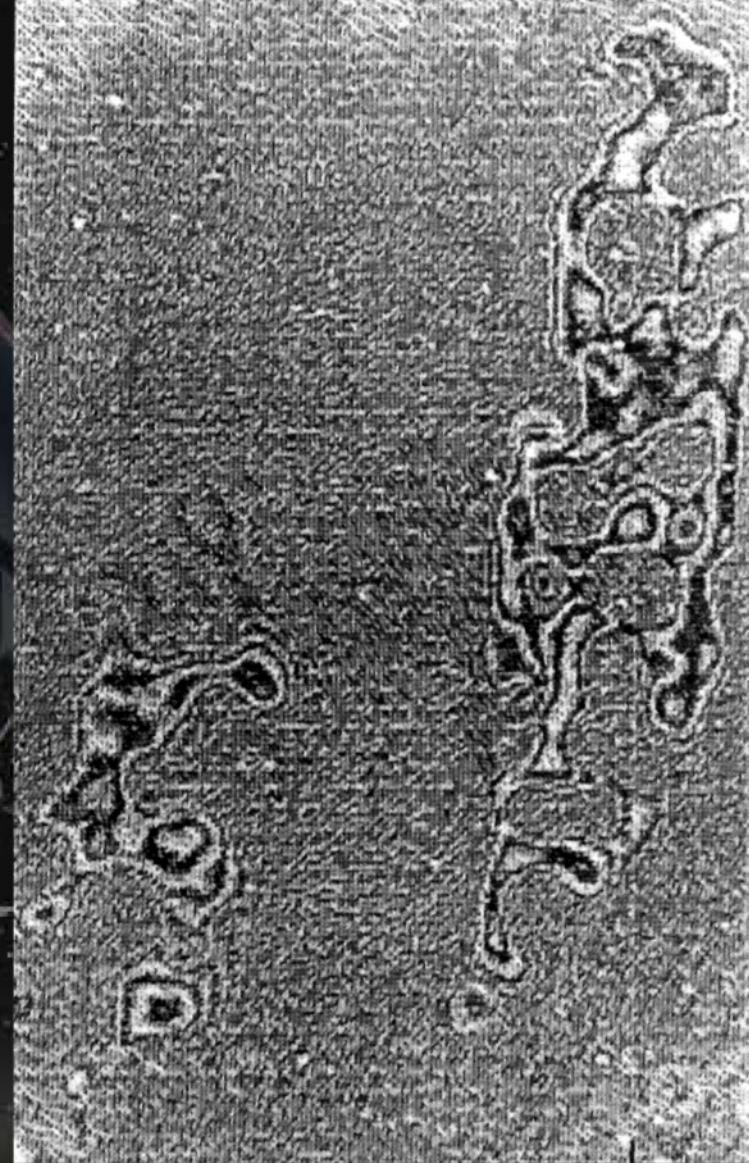
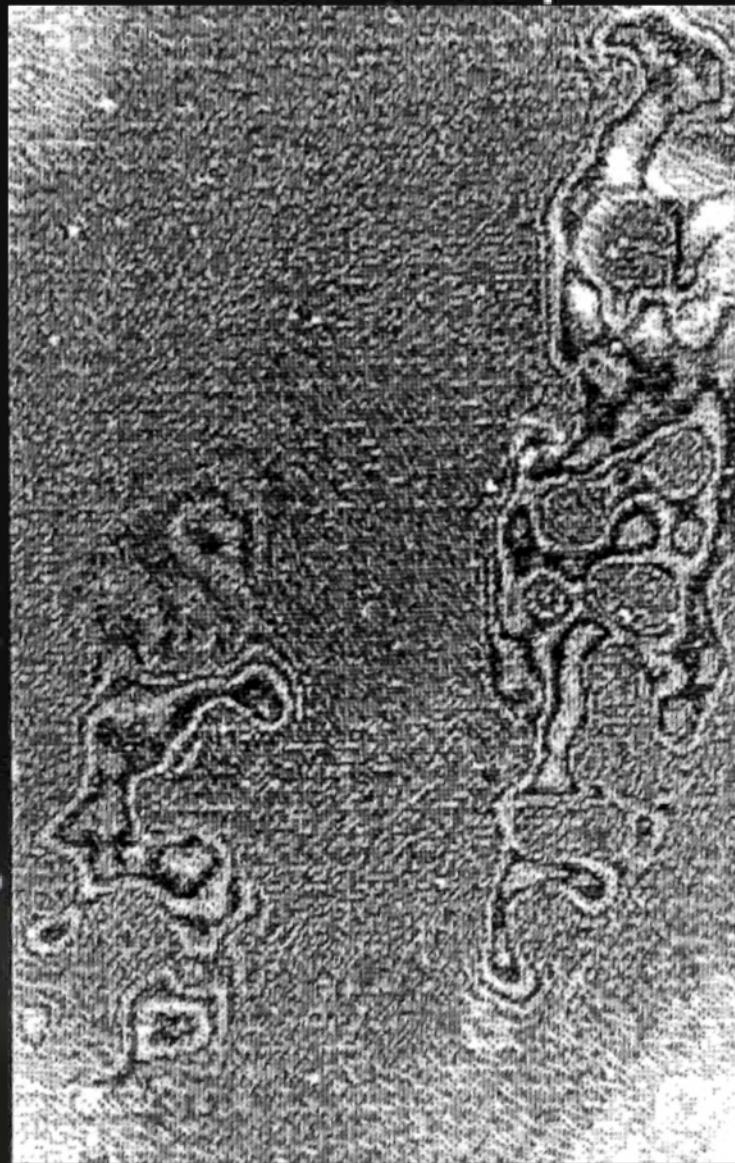


ESO Camera No. 5



CCD Camera No.	5
Chip manufacturer	RCA
Image format (pixels)	512*320
Image area (mm²)	15.6*9.8
Pixel area (microns²)	30*30
Electrons/ADU at gain level	11 G30
Read-out noise (RMS) (electrons)	38 (3.5 ADU)
Relative Quantum Efficiency	75 % between 550 - 650 nm
Dark current (electrons/pixel/hour)	150 (14 ADU) at 150 K
Full well capacity (electrons)	900 000

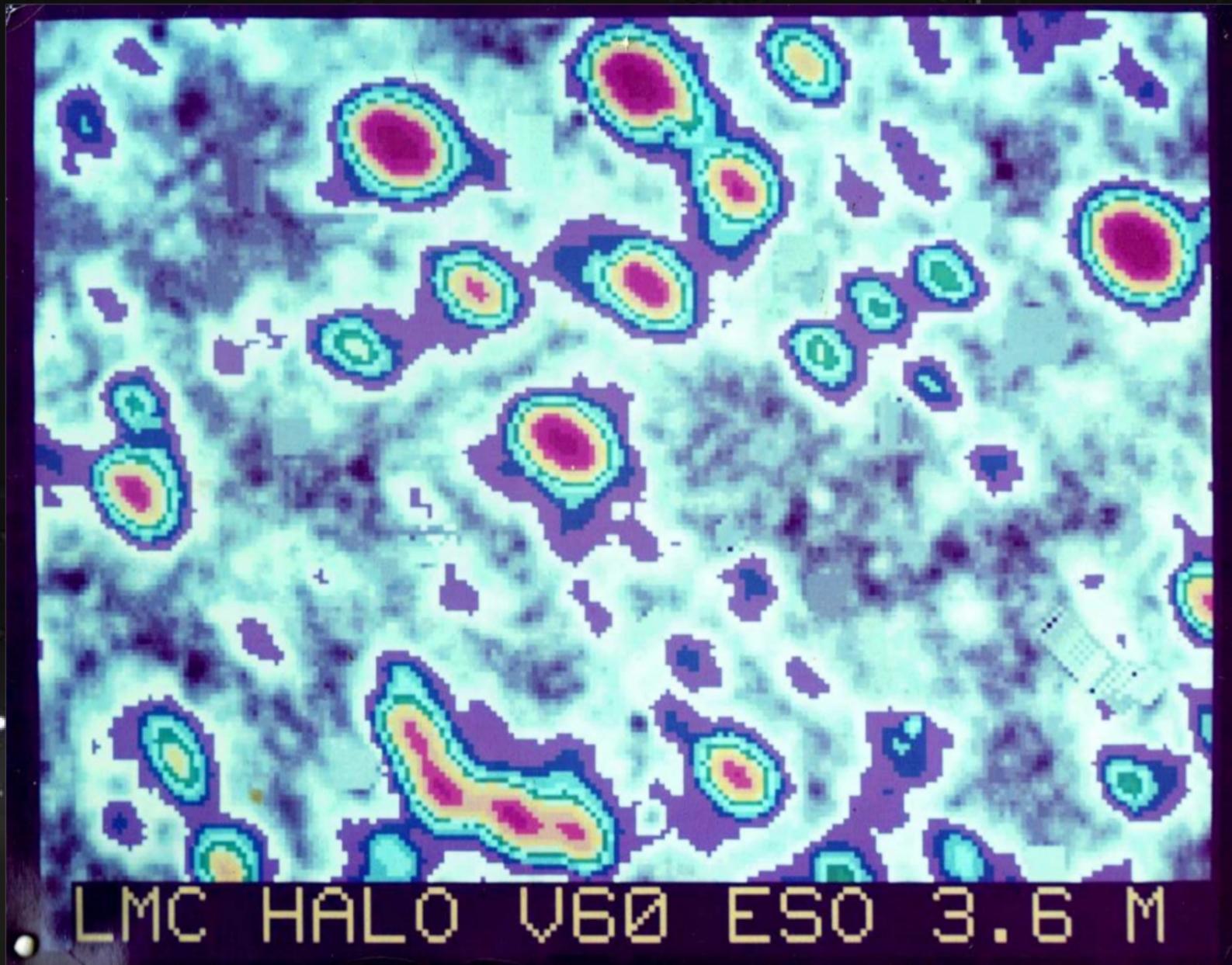
ESO CCD No. 5 Flatfält



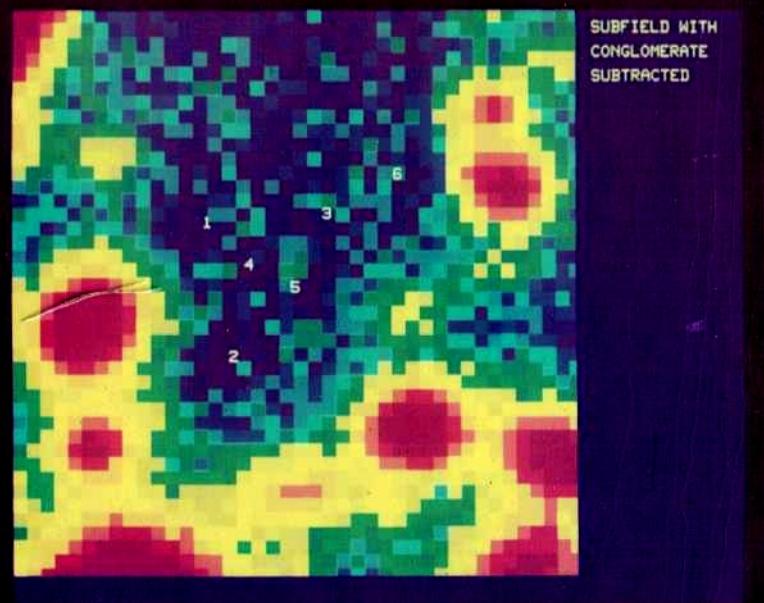
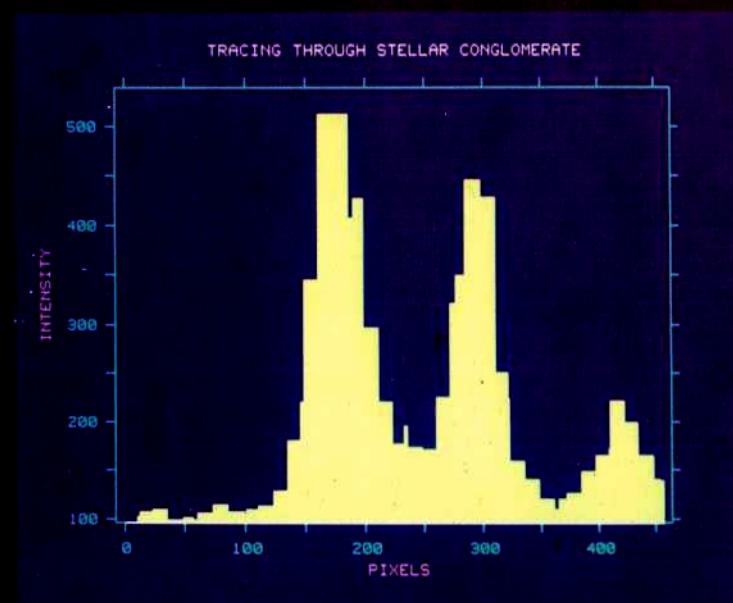
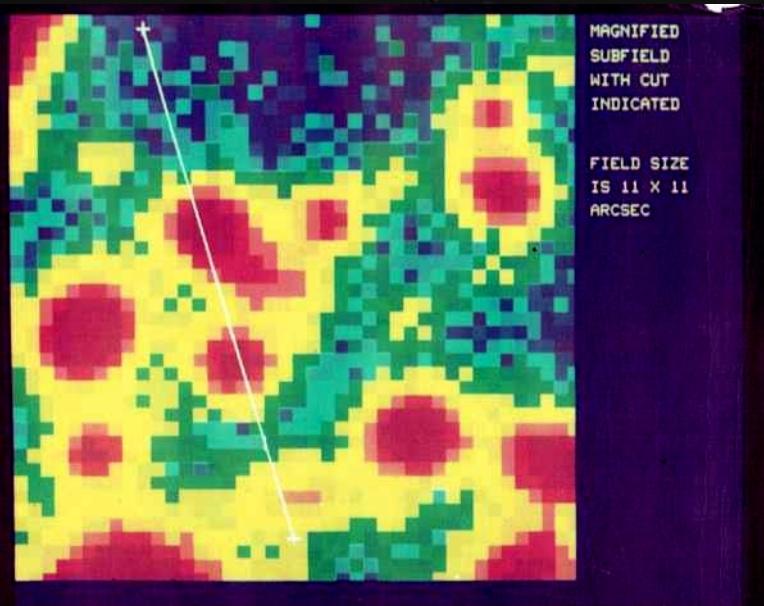
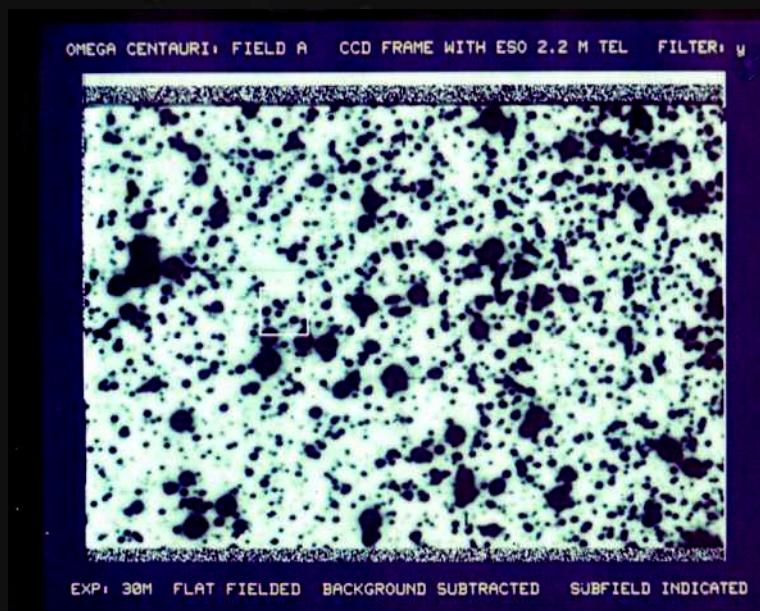
Stora Magellanska Molnet



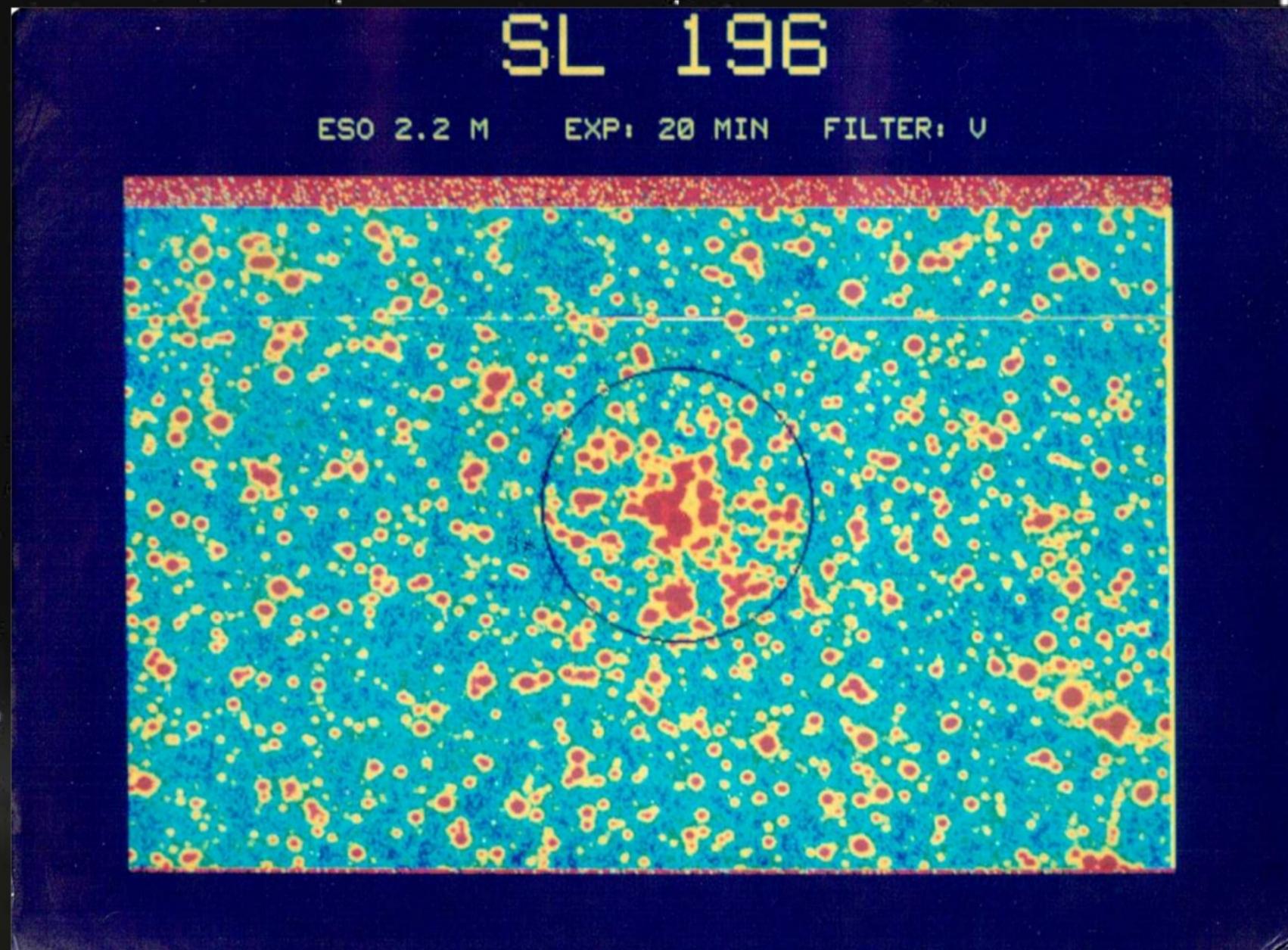
ESO observationer



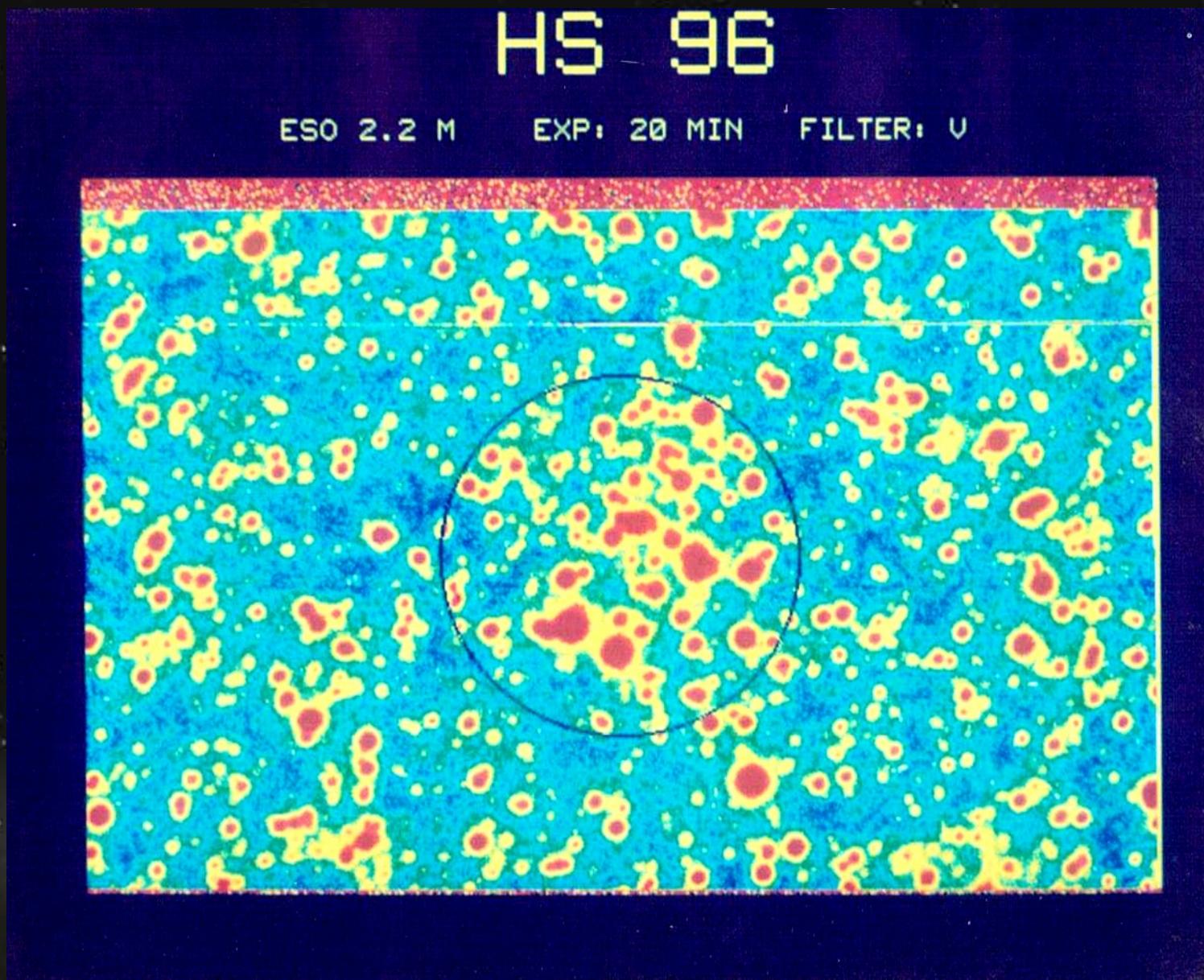
Tätfältsfotometri



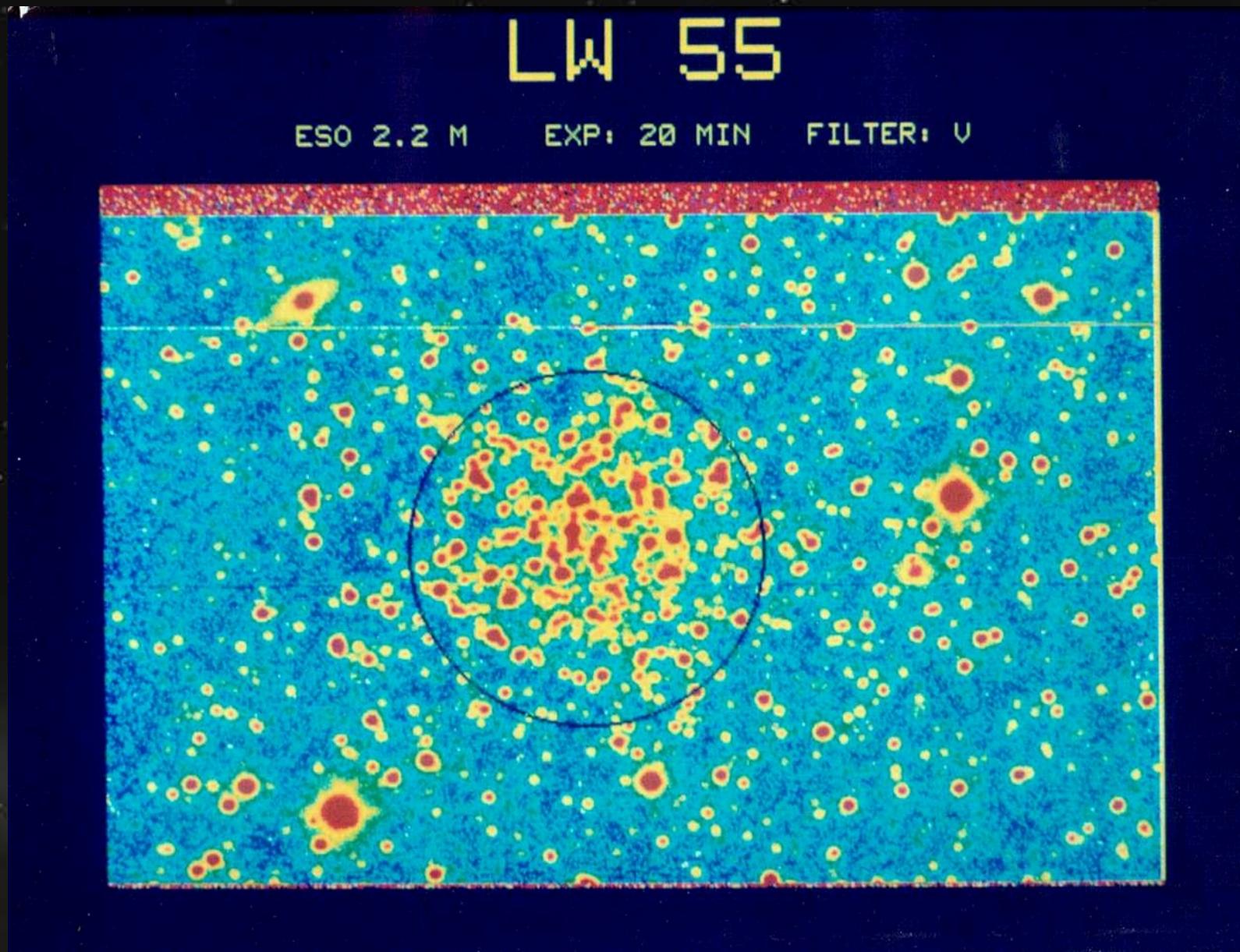
ESO: Stjärnhop i LMC

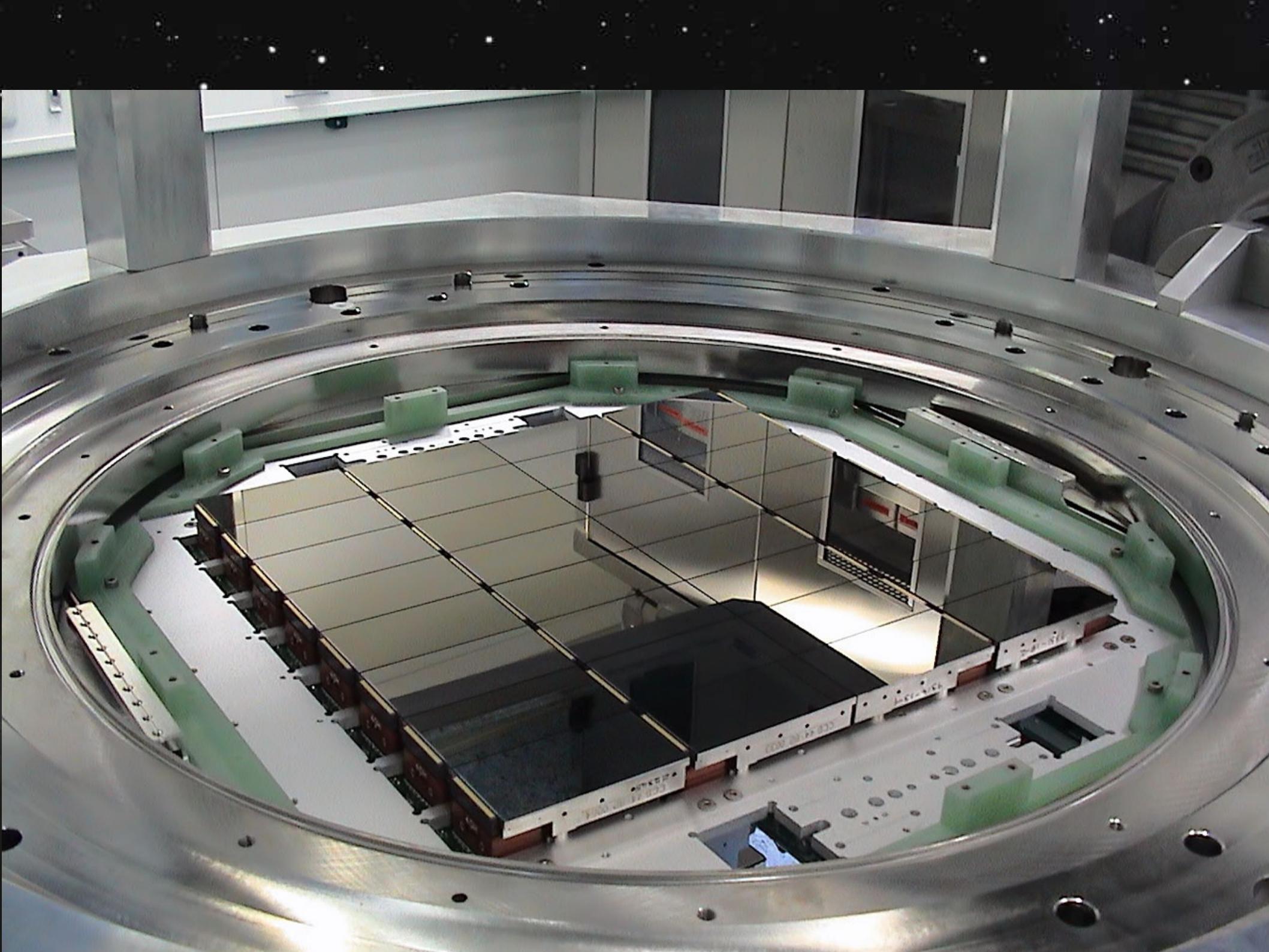


ESO: Stjärnhop i LMC



ESO: Stjärnhop i LMC



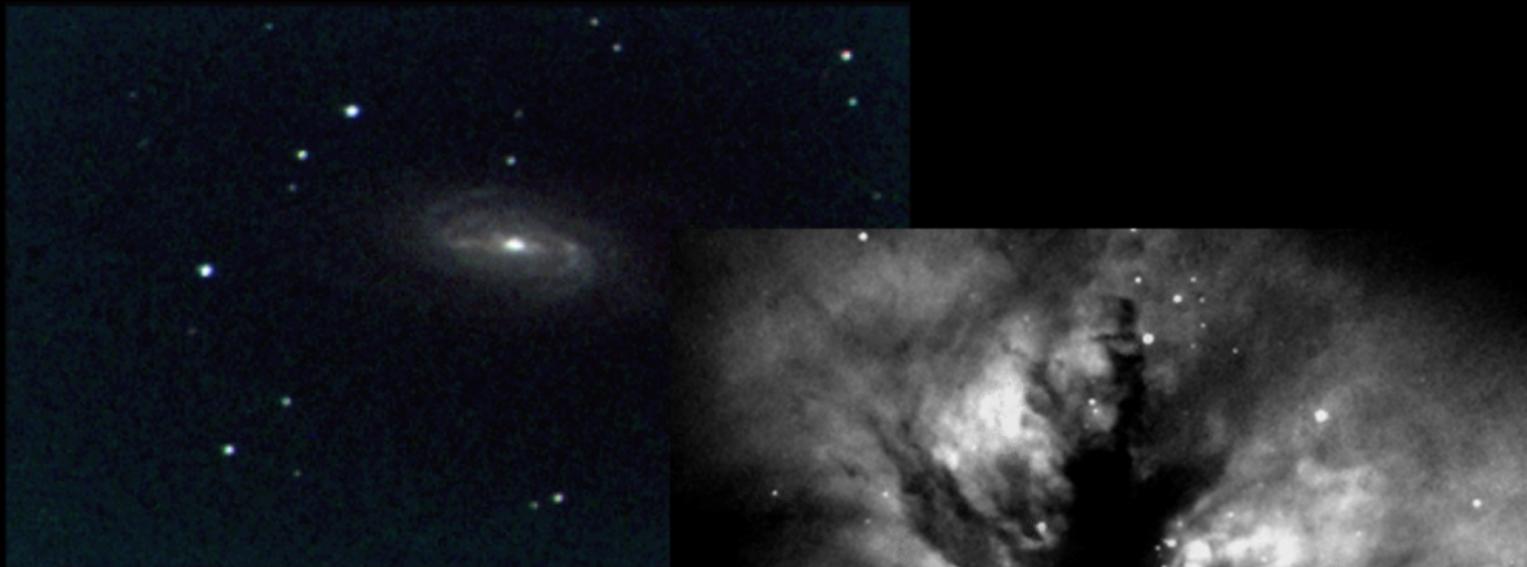


TBO 1992: SBIG ST-6 C CD

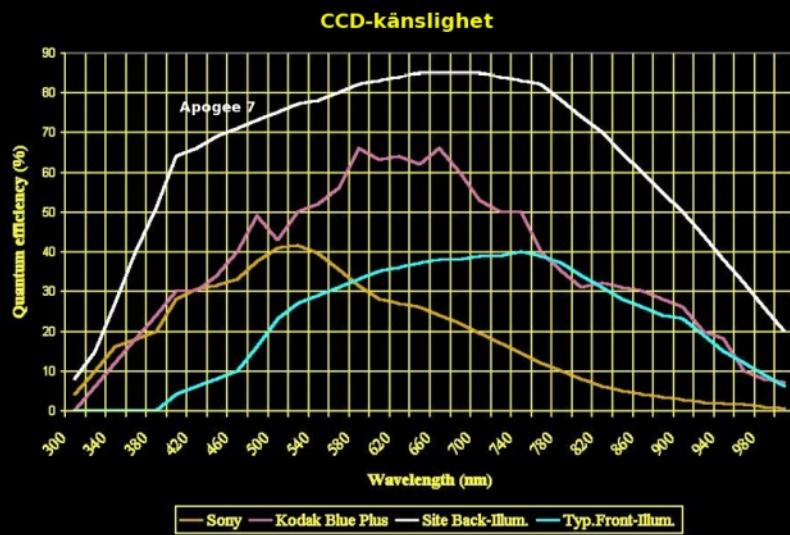
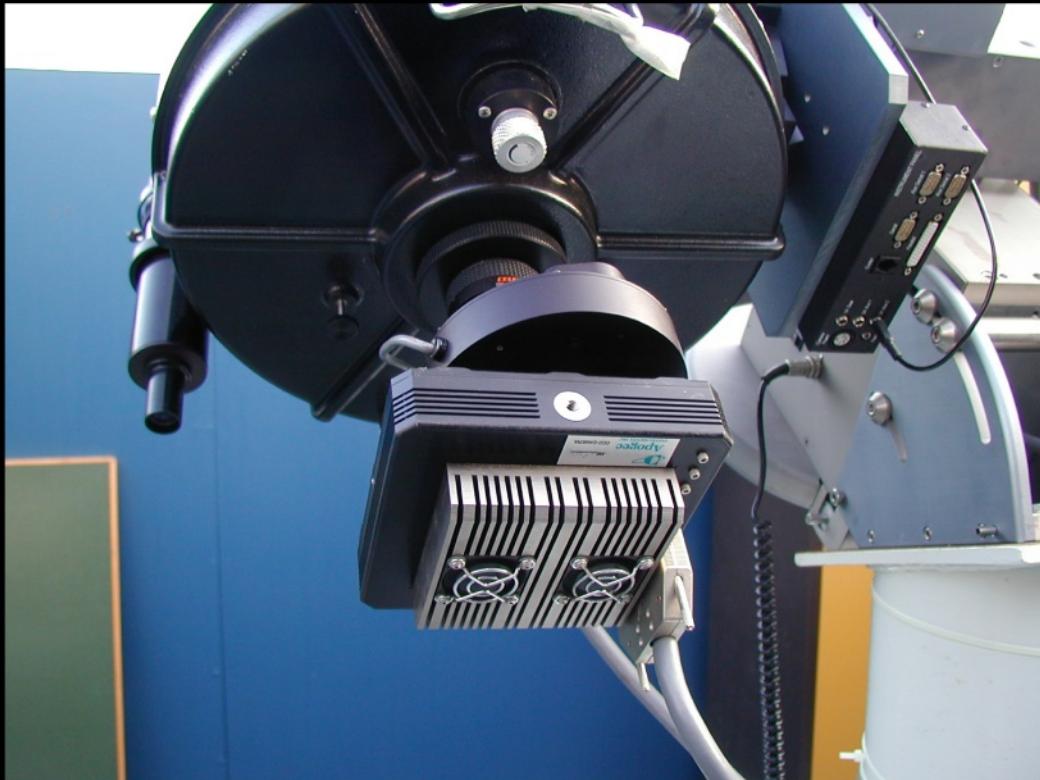
- Bildupplösning: 375 x 242 pixel
- Pixelstorlek: 23 x 27 mikron
- Chipstorlek: 8.6mm x 6.5mm



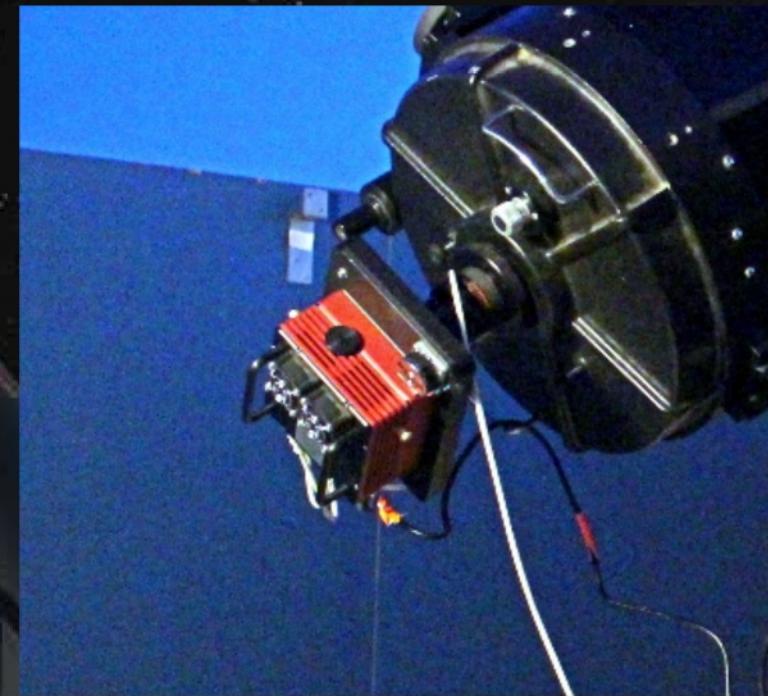
Revolution i Oxie också!



Nästa: Apogee AP7



Nuvarande: SBIG ST 8300



SBIG ST8300: Flatfältsbild



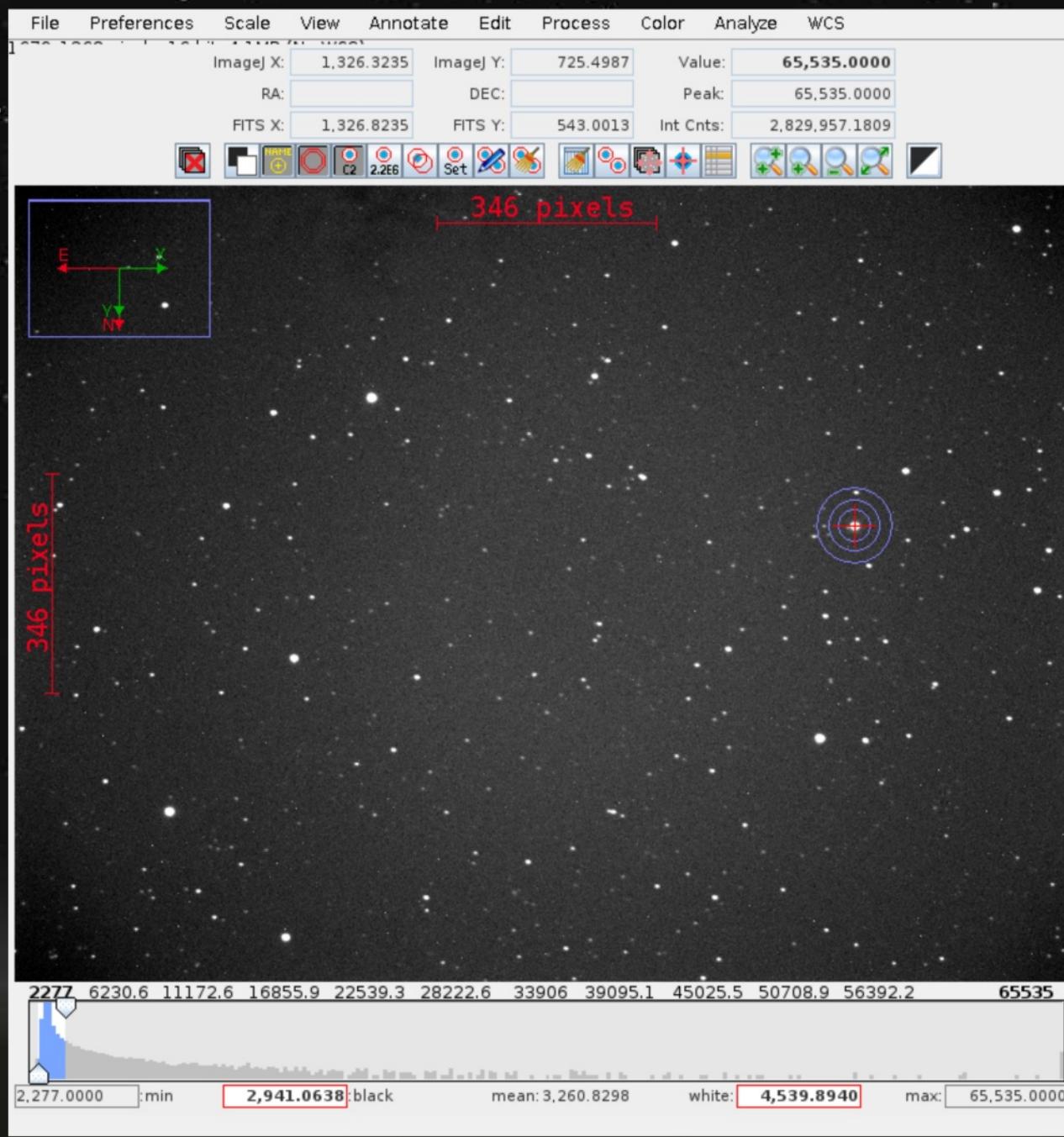
Specifikationer SBIG ST8300

	TBO SBIG ST8300	ESO Camera No.5
Pixeldimension	3326 x 2504 pixels	512x320
CCD storlek	18.0 x 13.5 mm	15.6 x 9.8
Totalt antal pixels	8.3 miljoner	164 000
Pixelstorlek	5.4 x 5.4 mikron	30x30
"Full Well"	~25,500 e-	900 000
Mörkström	~70e-/pixel/tim -15C	150 vid -120C
Max kvanteffektivitet	56%	75%
Utläsningsbrus	~9.3e- rms	38.

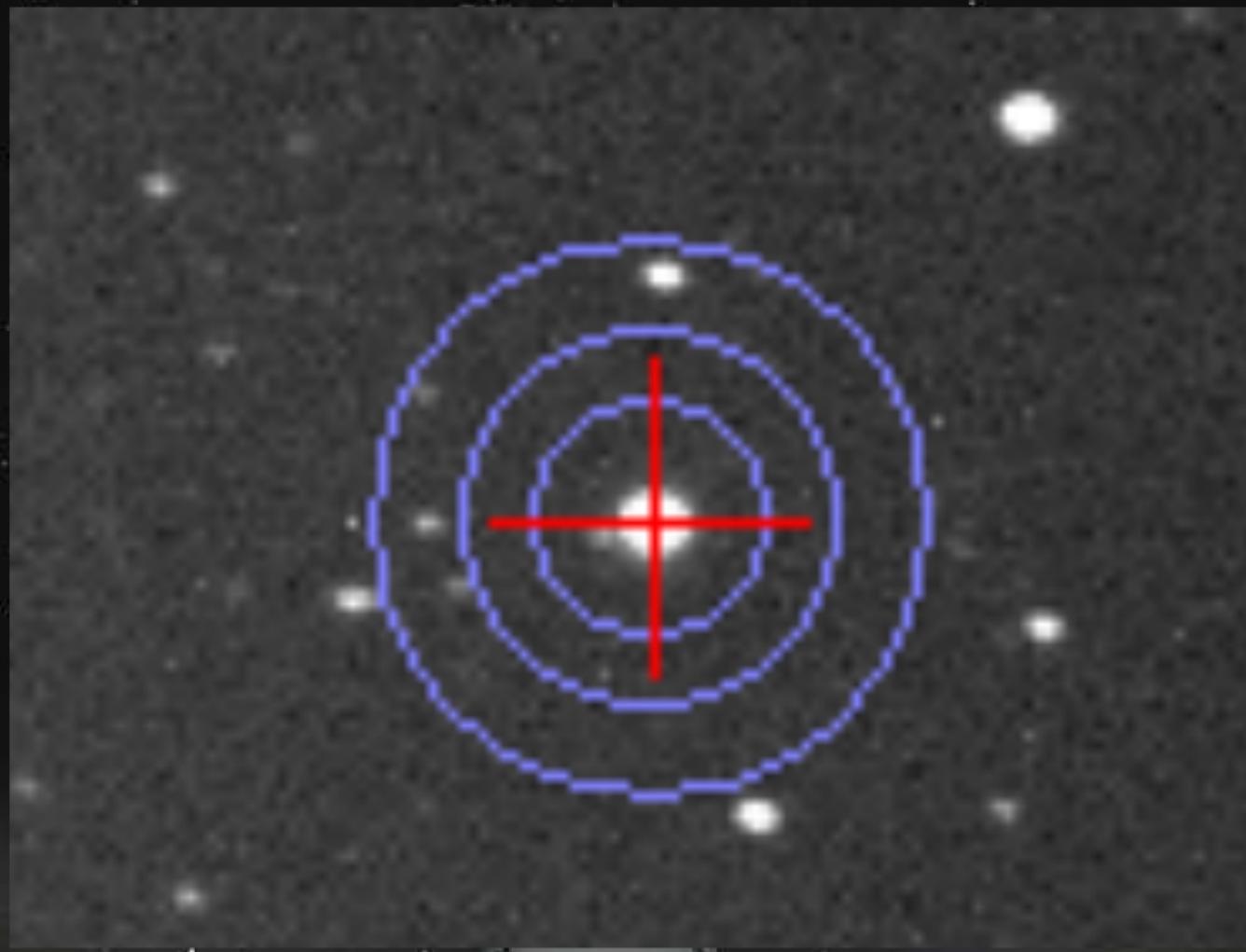
Twin quasar: Q0957+561



Fotometri: AstroimageJ



Aperturfotometri



Eclipsing binary V380 Dra

