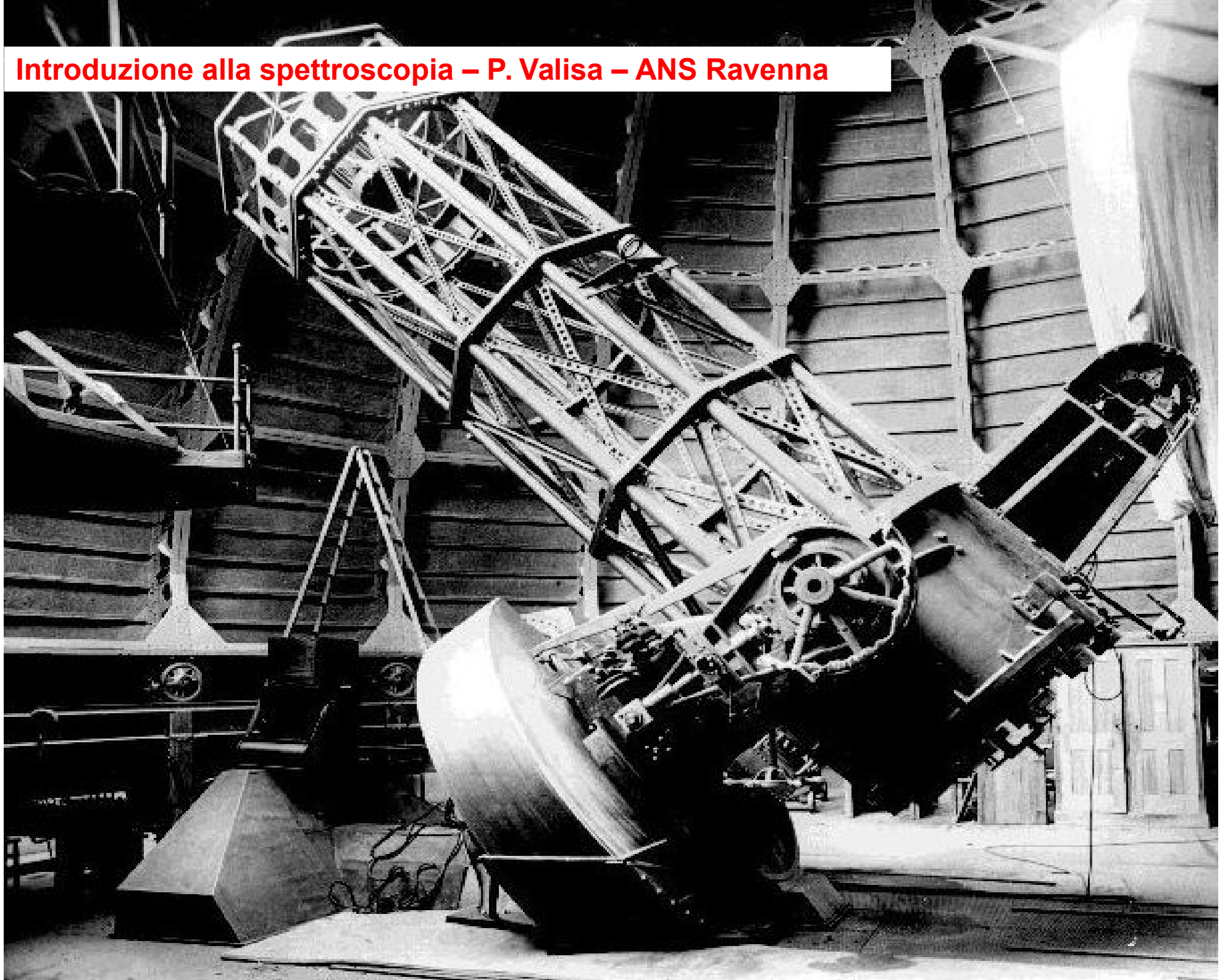
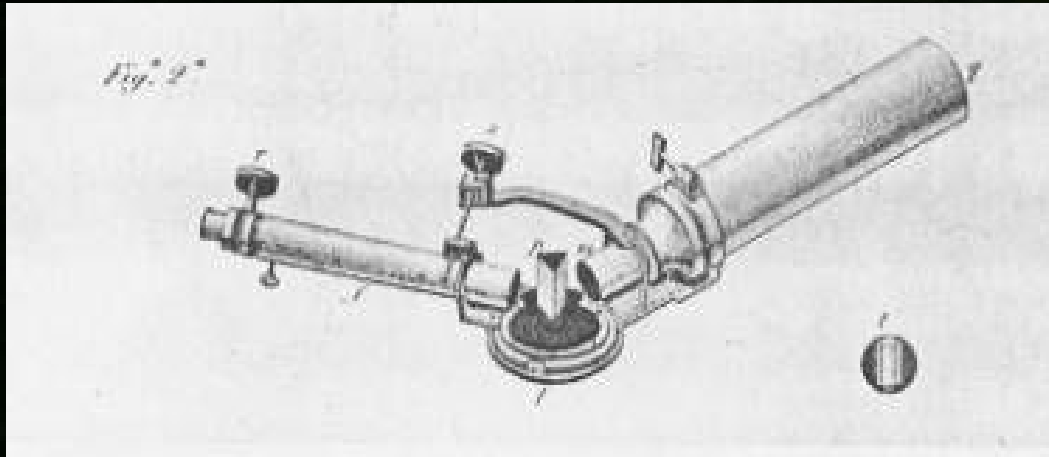
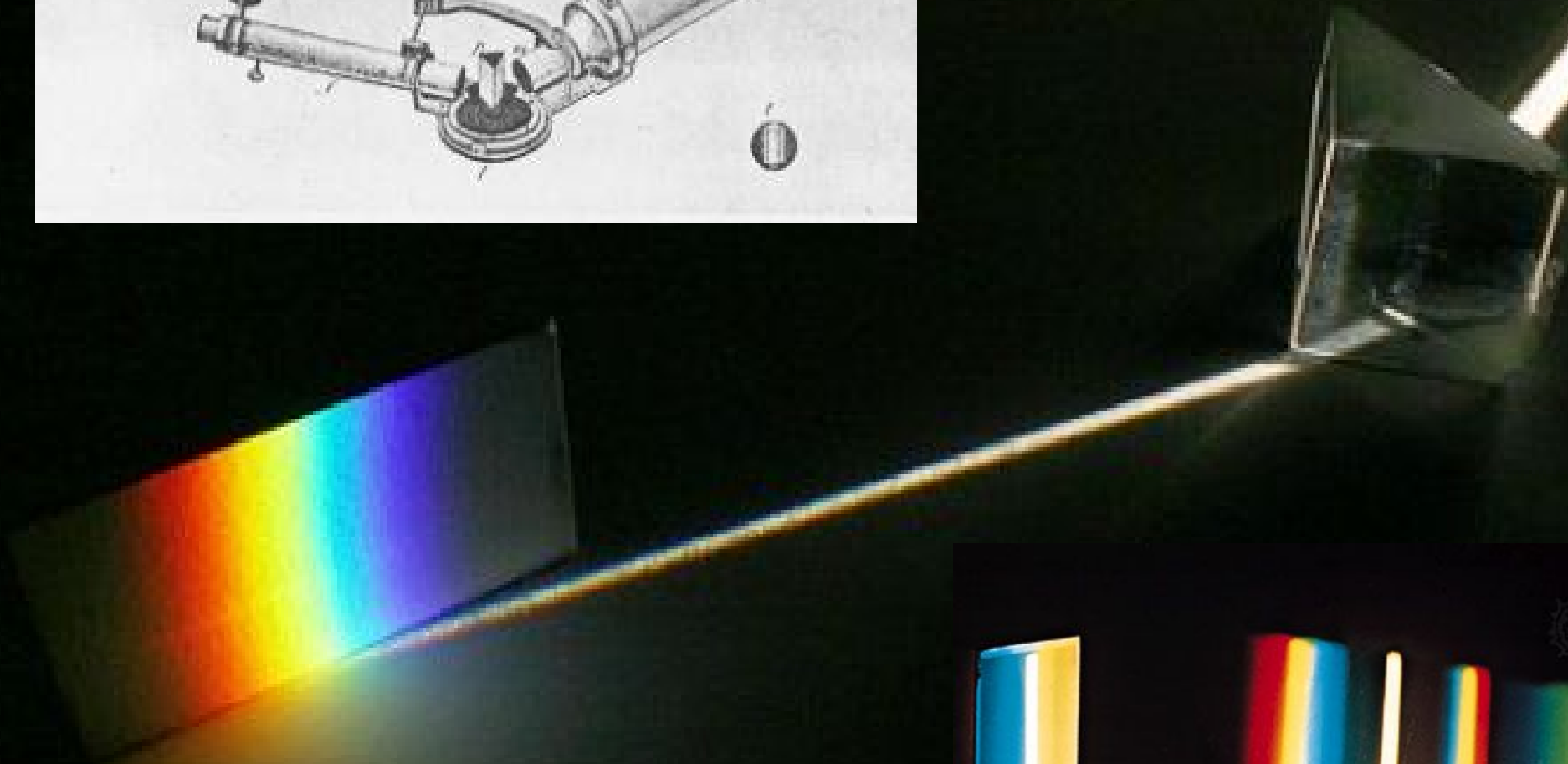


Introduzione alla spettroscopia – P. Valisa – ANS Ravenna

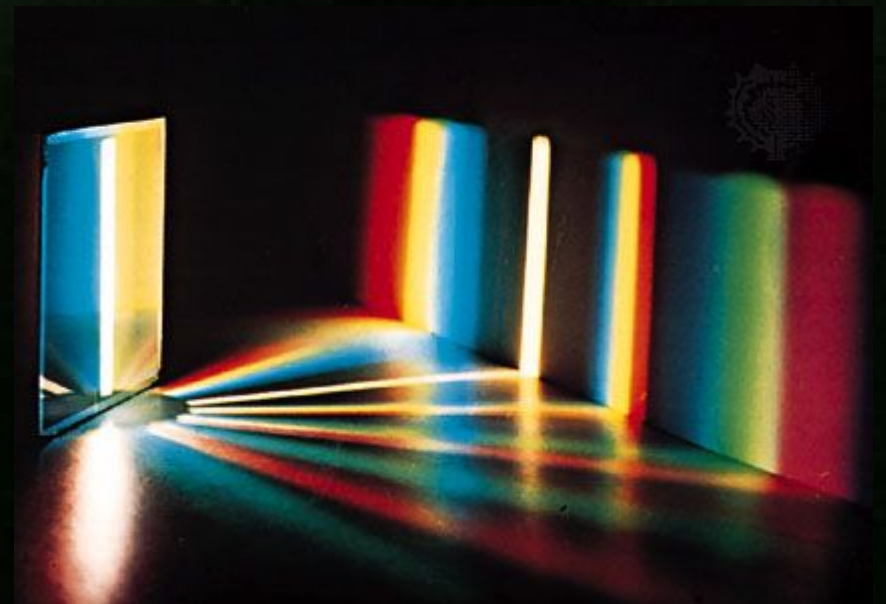




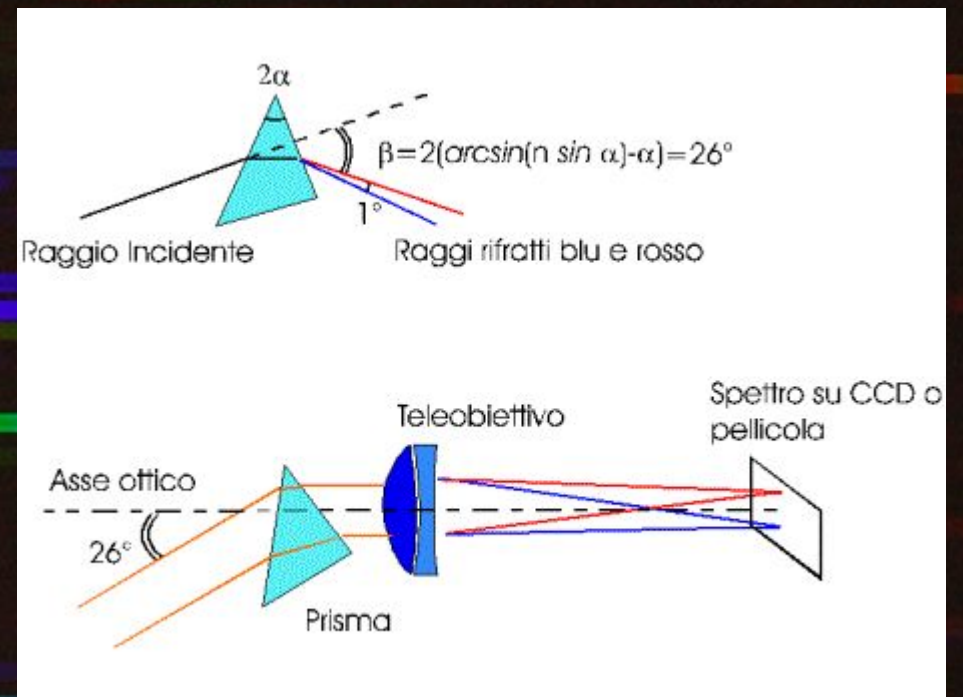
Prisma



Reticolo



Prisma obiettivo e dispersione del prisma



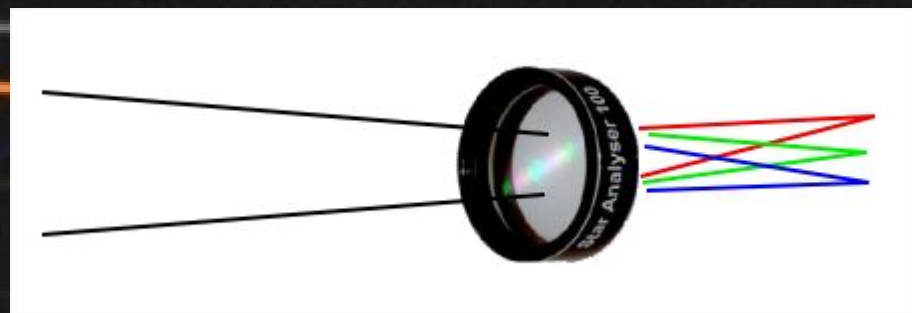
Star Analyzer

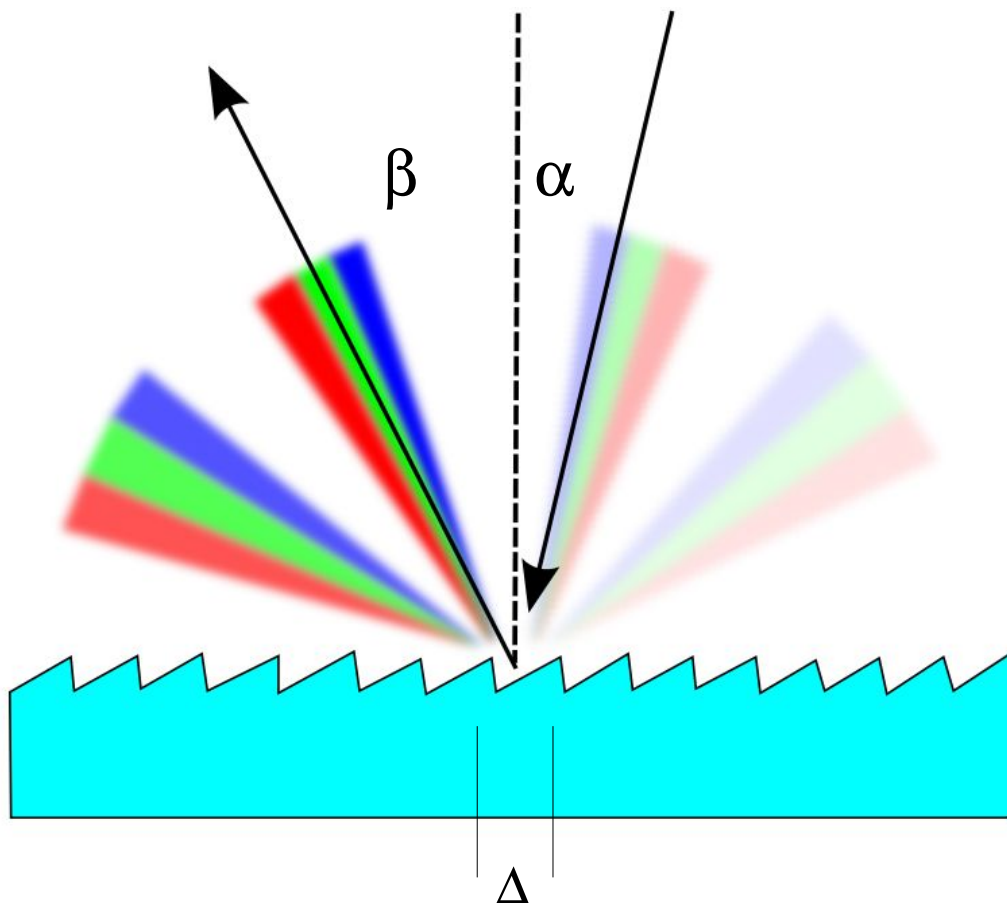
W Per
M4.5lab

BD+56 727
B5e

Wolf-Rayet 5

Halpha





Il reticolo di diffrazione

Dispersione

$$\Delta(\sin \alpha + \sin \beta) = m\lambda$$

$$\frac{d\beta}{d\lambda} = \frac{m}{\Delta \cos \beta}$$

300 l/mm

1,7°/1000 Å
3 mm f=100mm

1800 l/mm

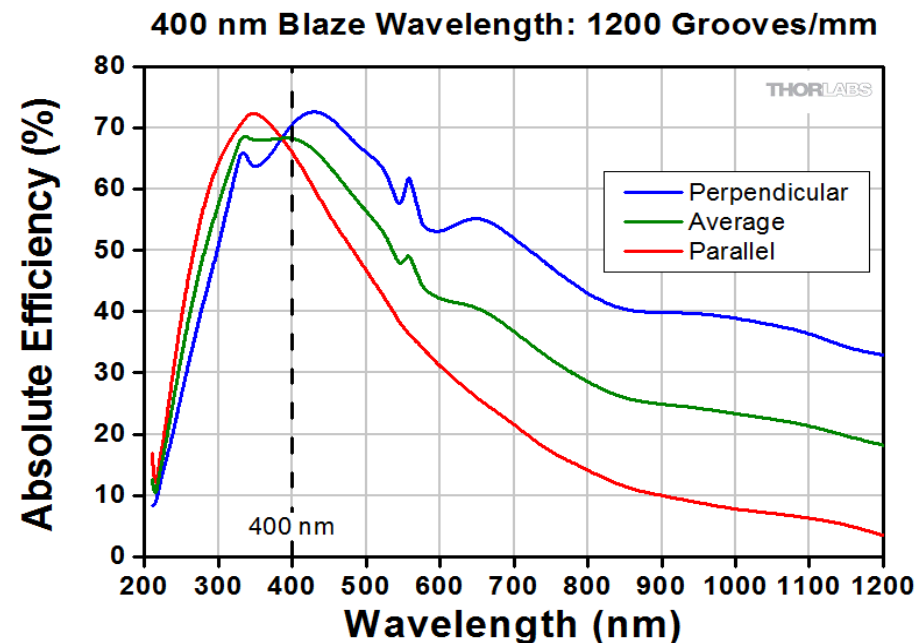
6,7°/1000 Å
12 mm f=100mm

Risoluzione spettrale

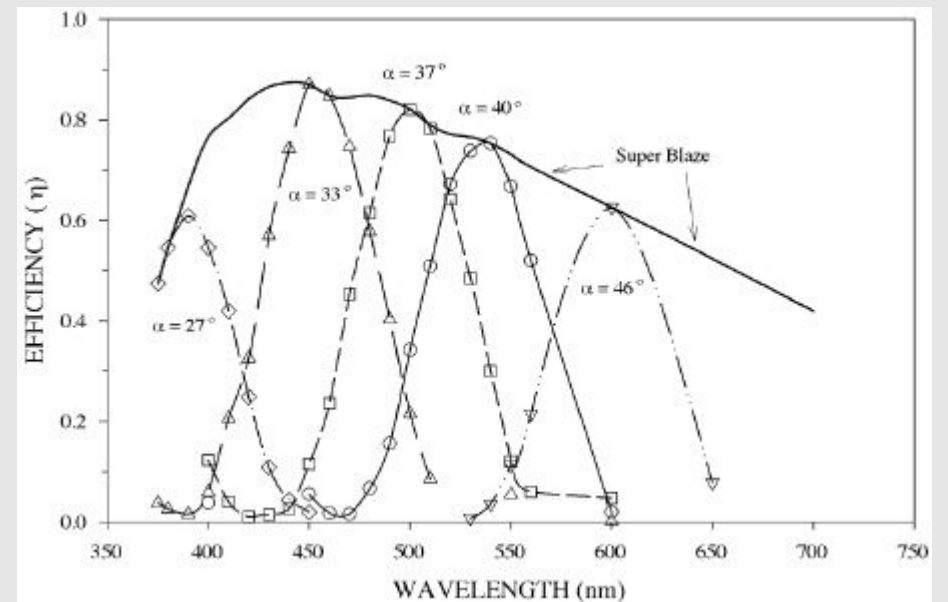
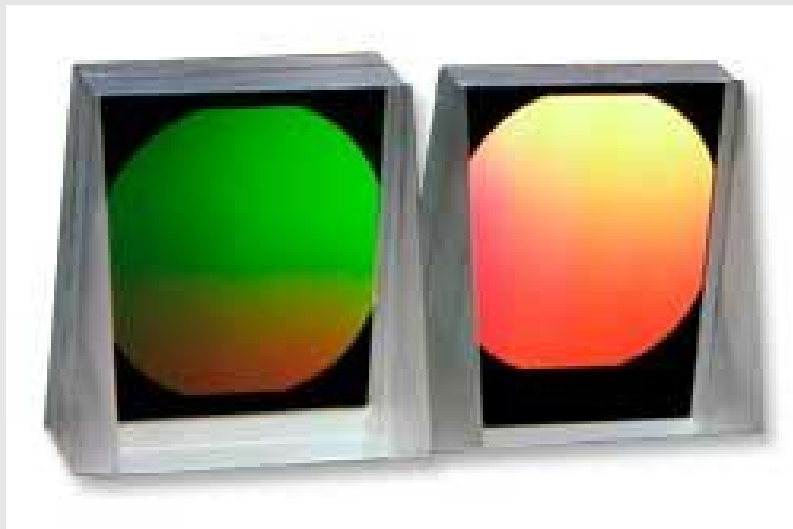
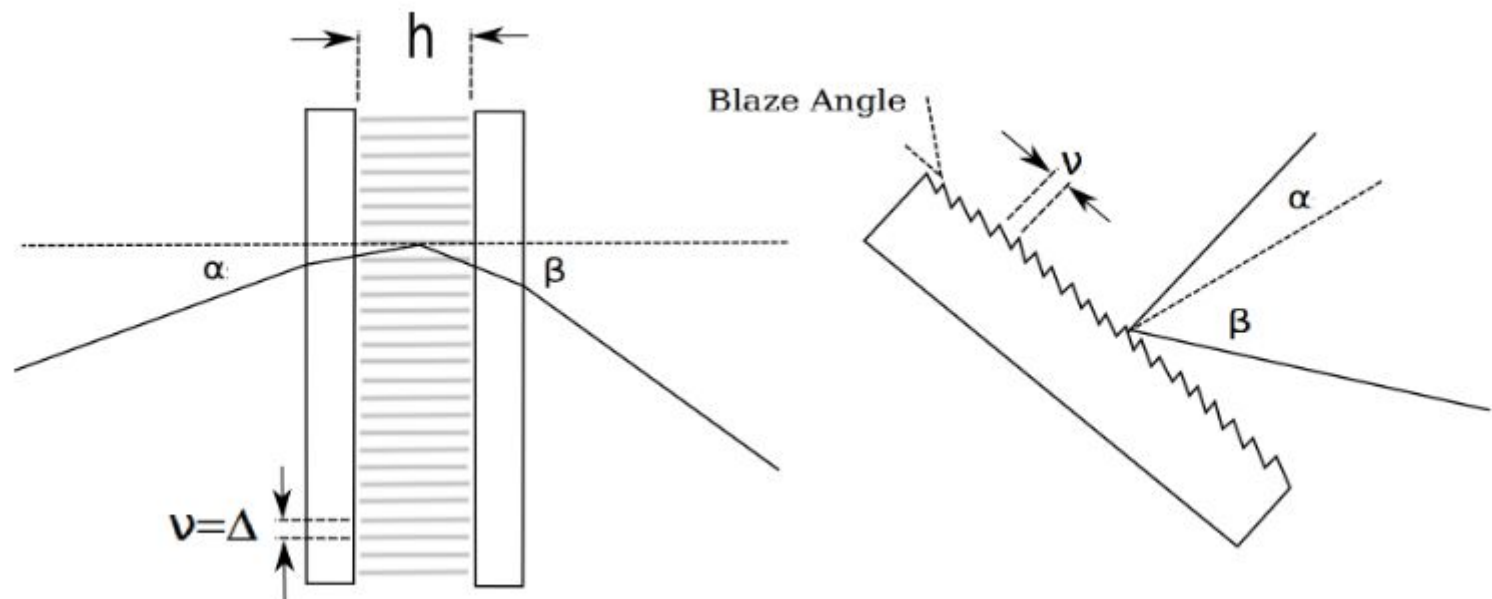
$$R = \lambda / \Delta\lambda$$

Risoluzione teorica = N nel fascio ottico

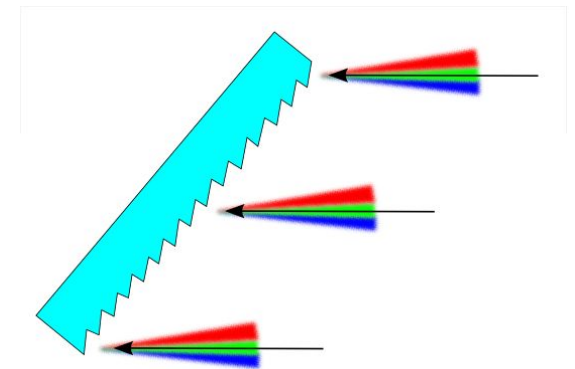
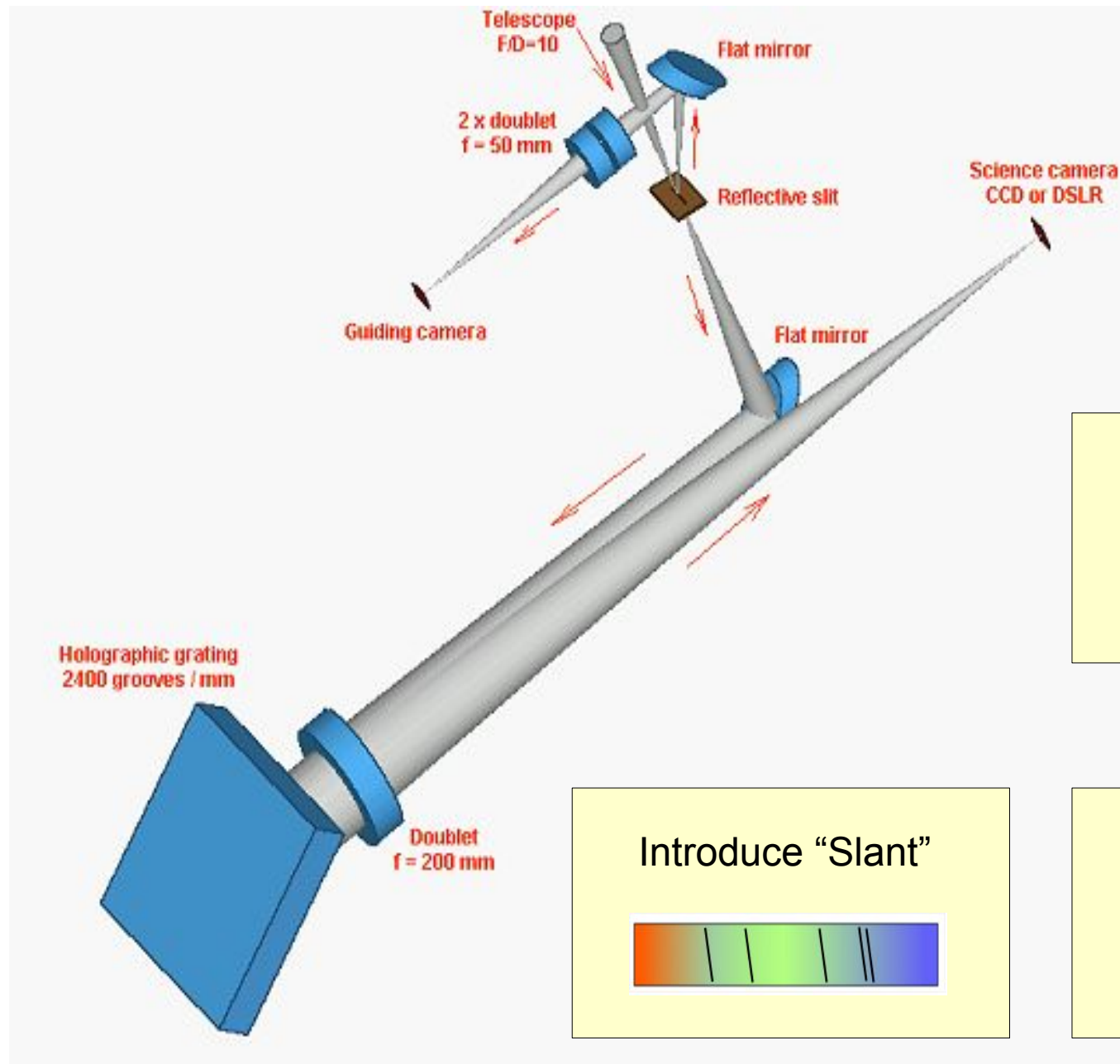
Quindi **1200 l/mm** con fascio 20 mm
Ha risoluzione teorica 20x1200=**24000**.



Volume
Phase
Holographic
Gratings



Configurazione Littrow per piccoli strumenti



Littrow

$$\beta = \alpha, \quad 2\Delta(\sin \beta) = m\lambda$$

Introduce "Slant"



Collimatore = Camera

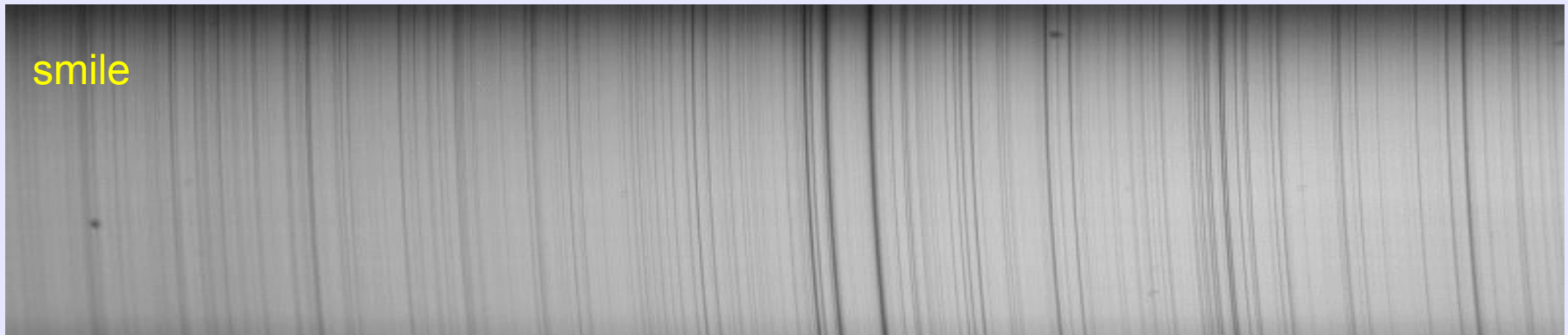
La fenditura = pix CCD

Deformazioni delle righe spettrali

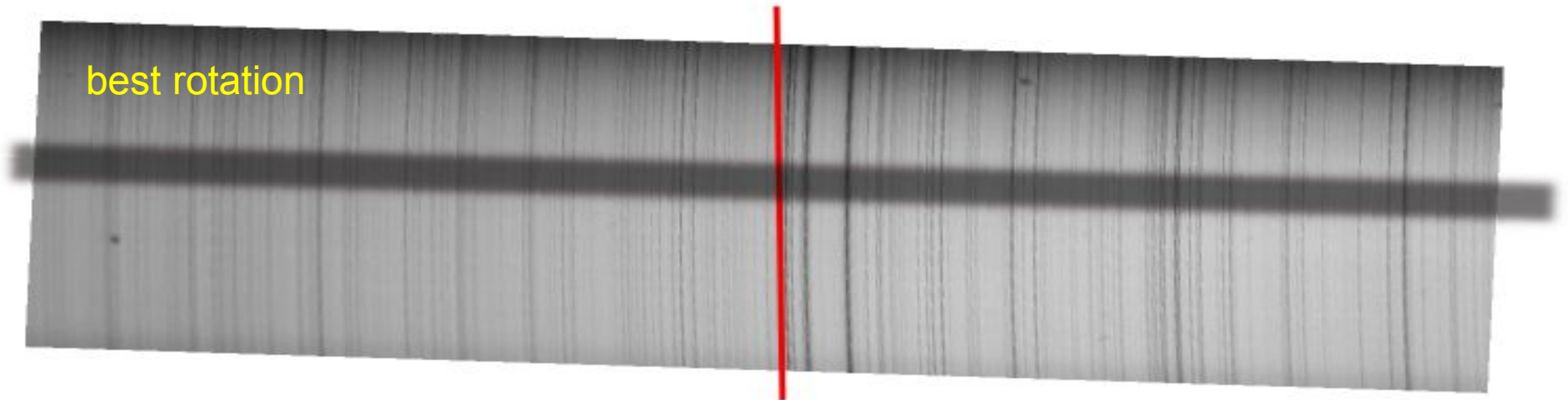
slant



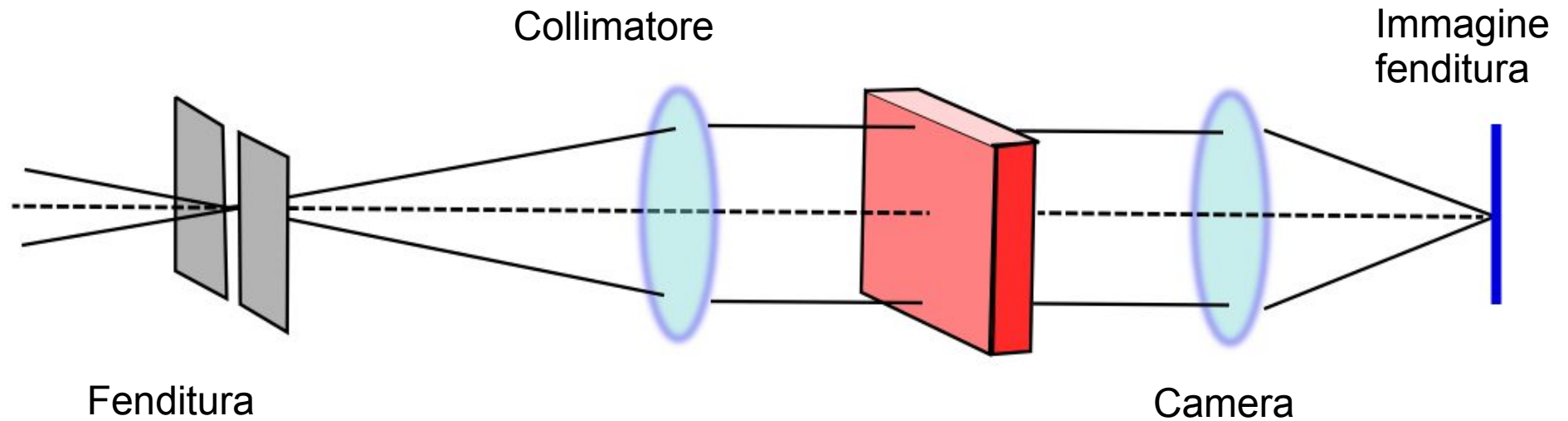
smile



best rotation



Ottica di uno spettrografo. Ruolo della fenditura.

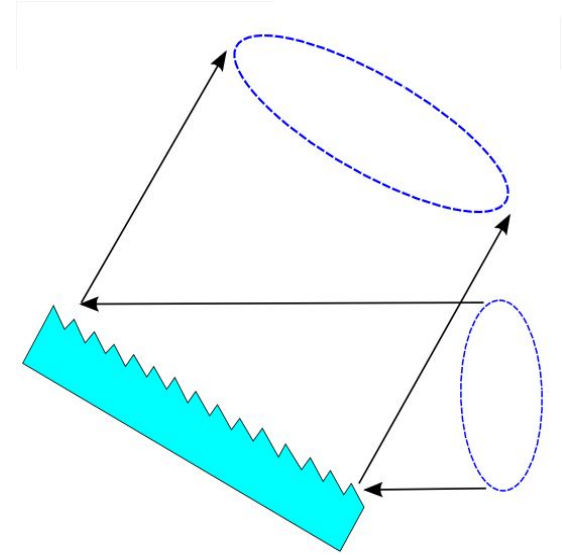
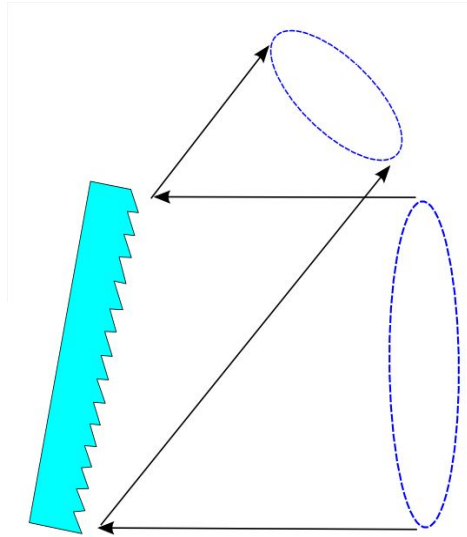
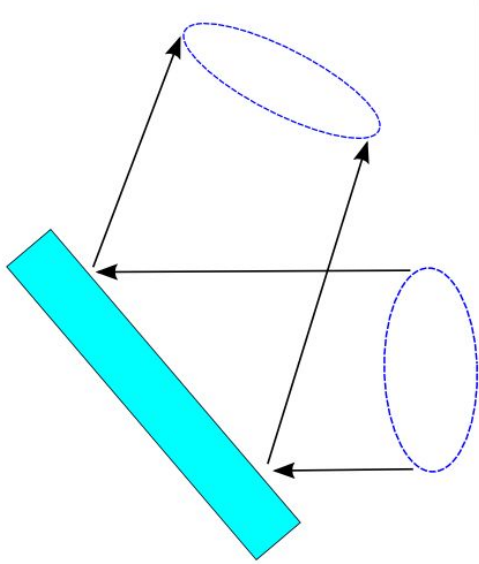


Il rapporto tra le focali di **collimatore** e **camera** determina la dimensione della fenditura sul rivelatore e quindi la risoluzione. Per telescopi grandi, $F_{\text{camera}} < F_{\text{collimatore}}$ ma per mantenere la stessa risoluzione, tutto lo spettrometro deve diventare più grande e costoso.

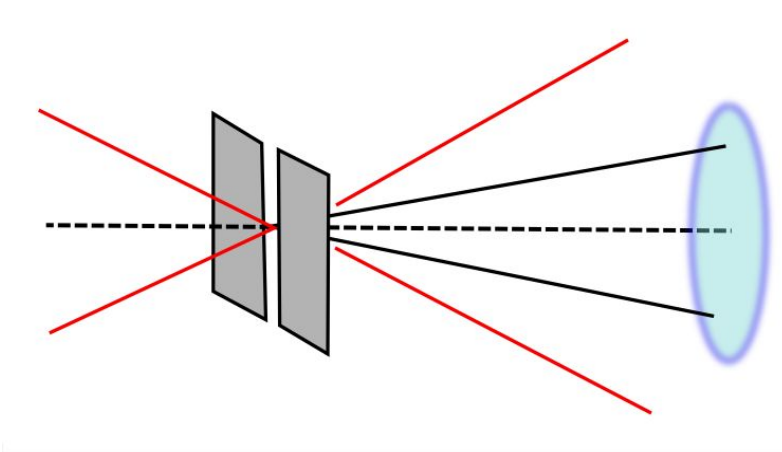


Anche il reticolo può produrre ingrandimento/riduzione della fenditura.

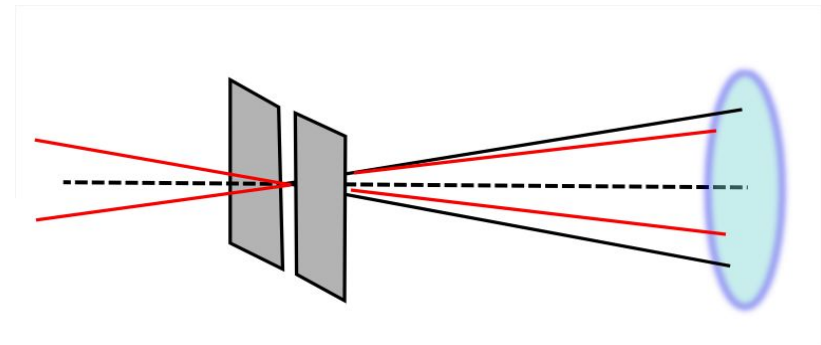
Equivalente a collimatore con focale più lunga



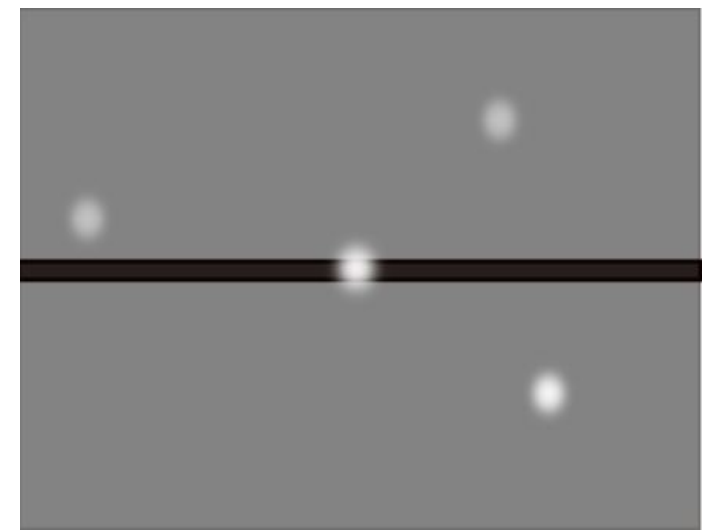
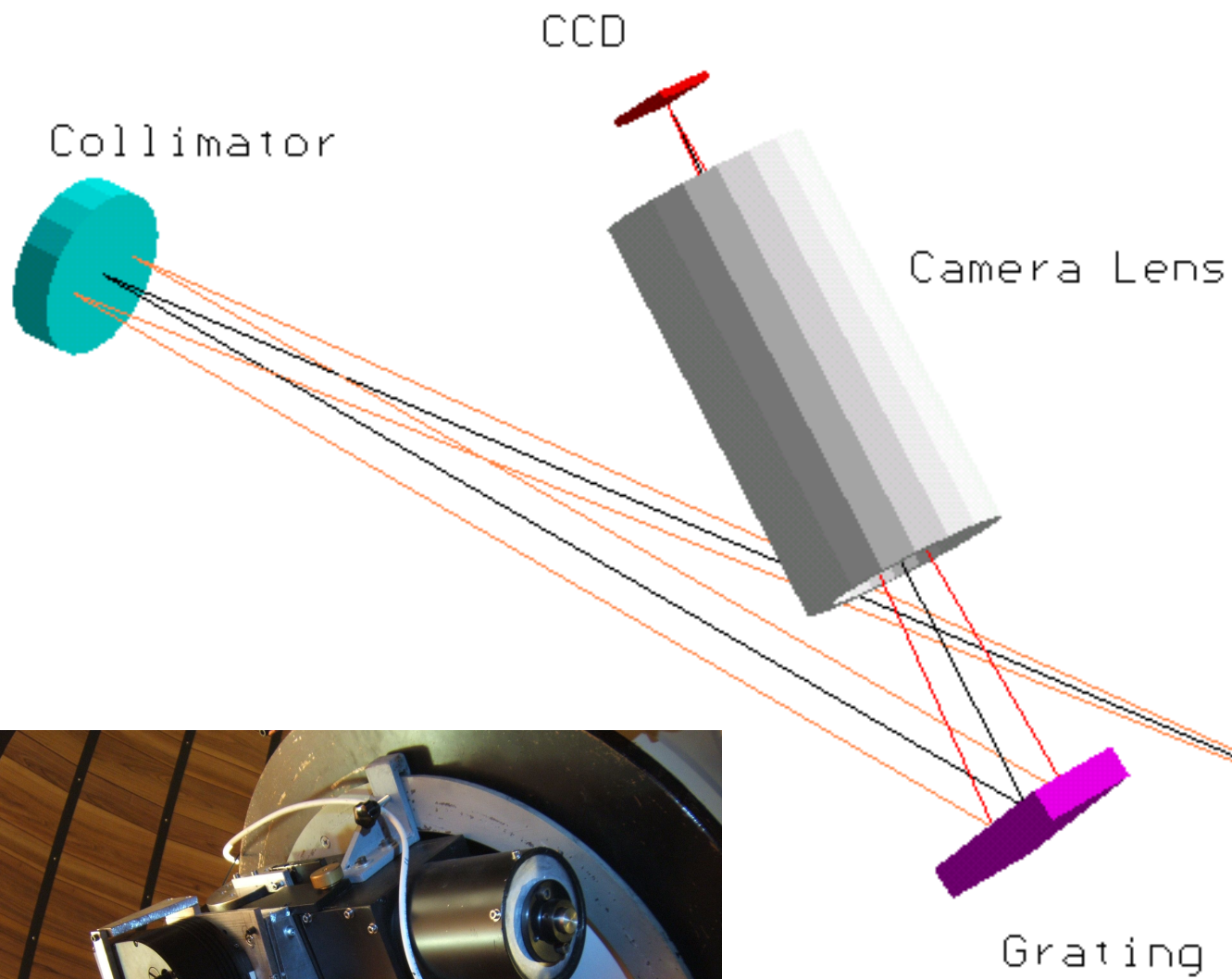
Aperture matching tra spettrografo e telescopio



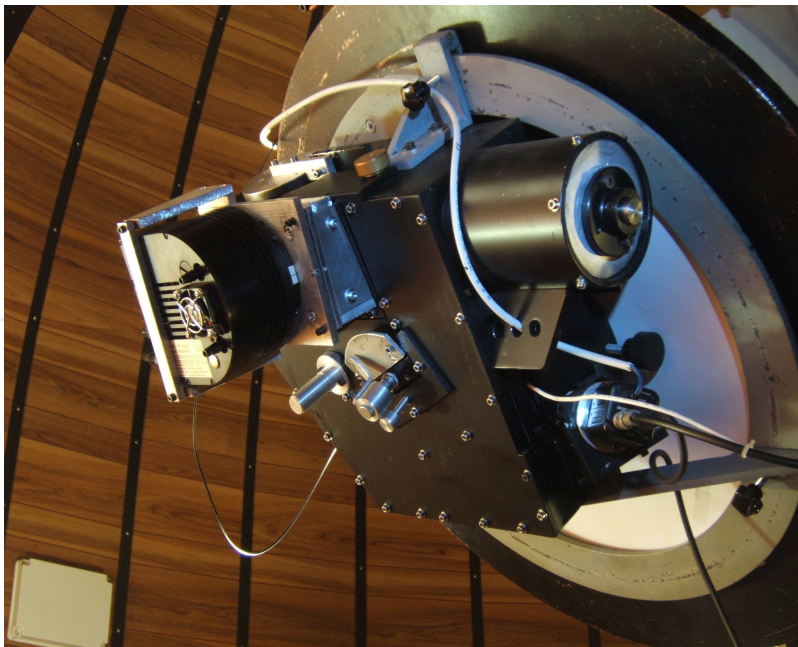
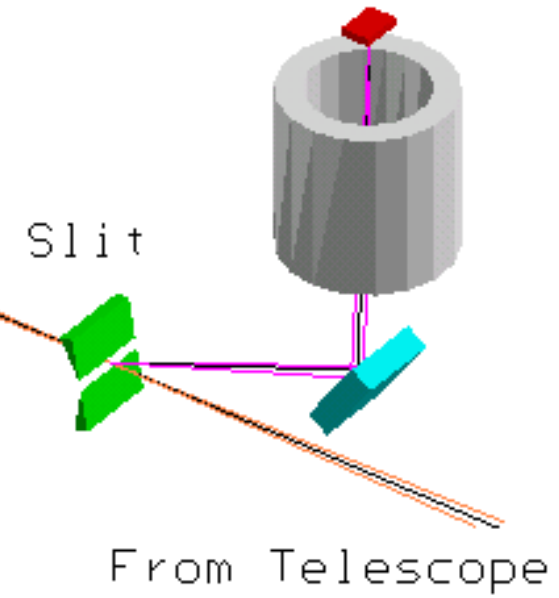
Overfilling

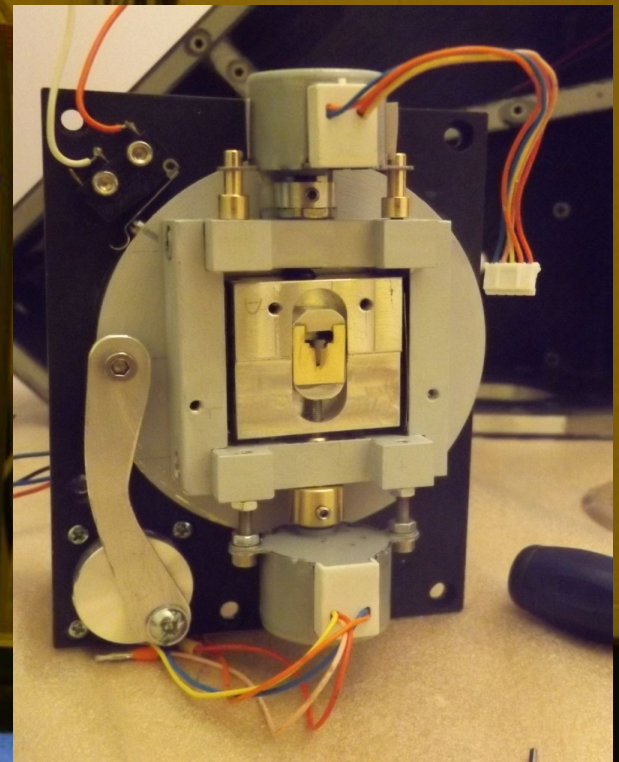
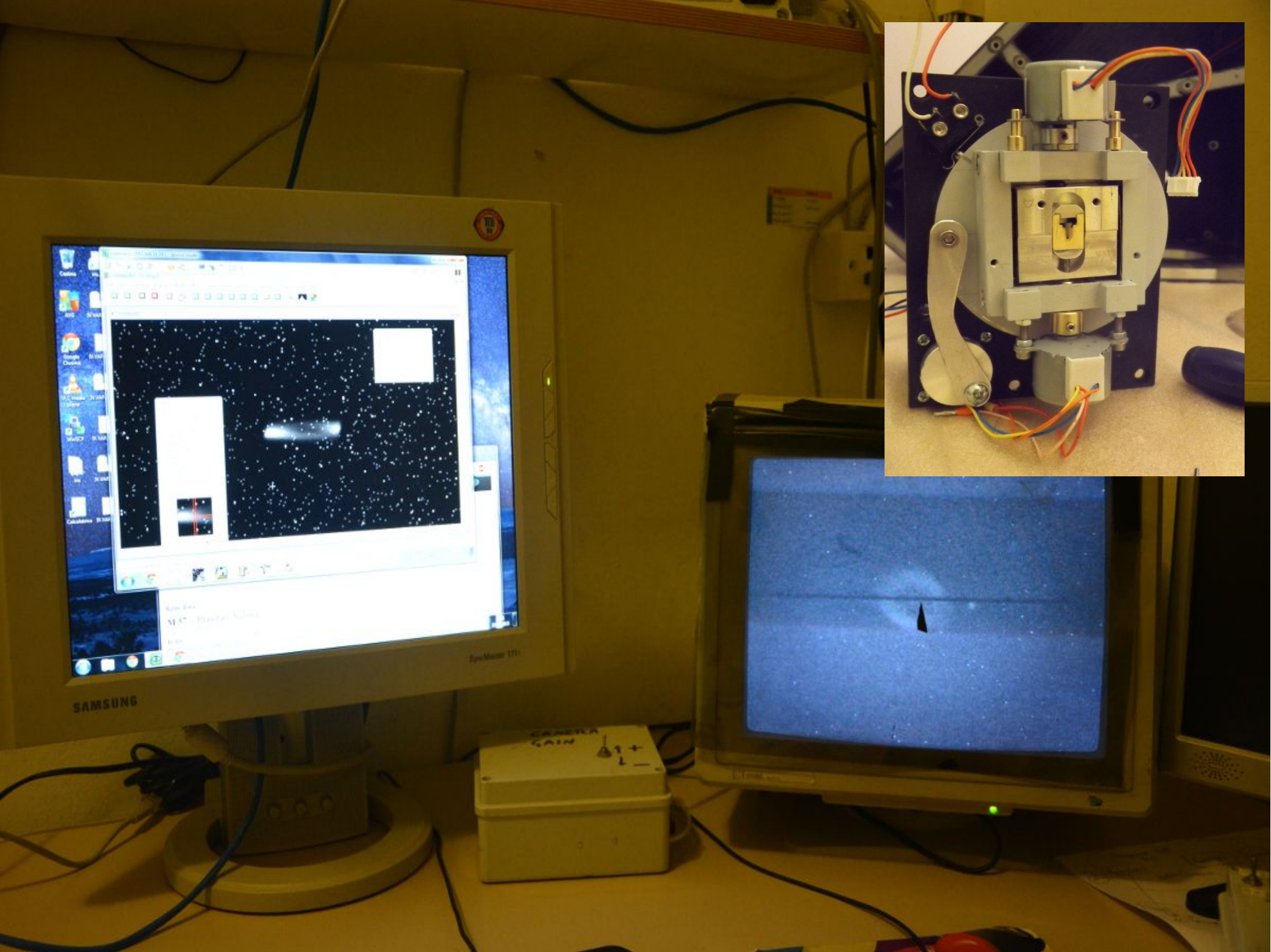


Spot inutilmente grande



Guide Camera





Lo spettrografo più grande di ANS



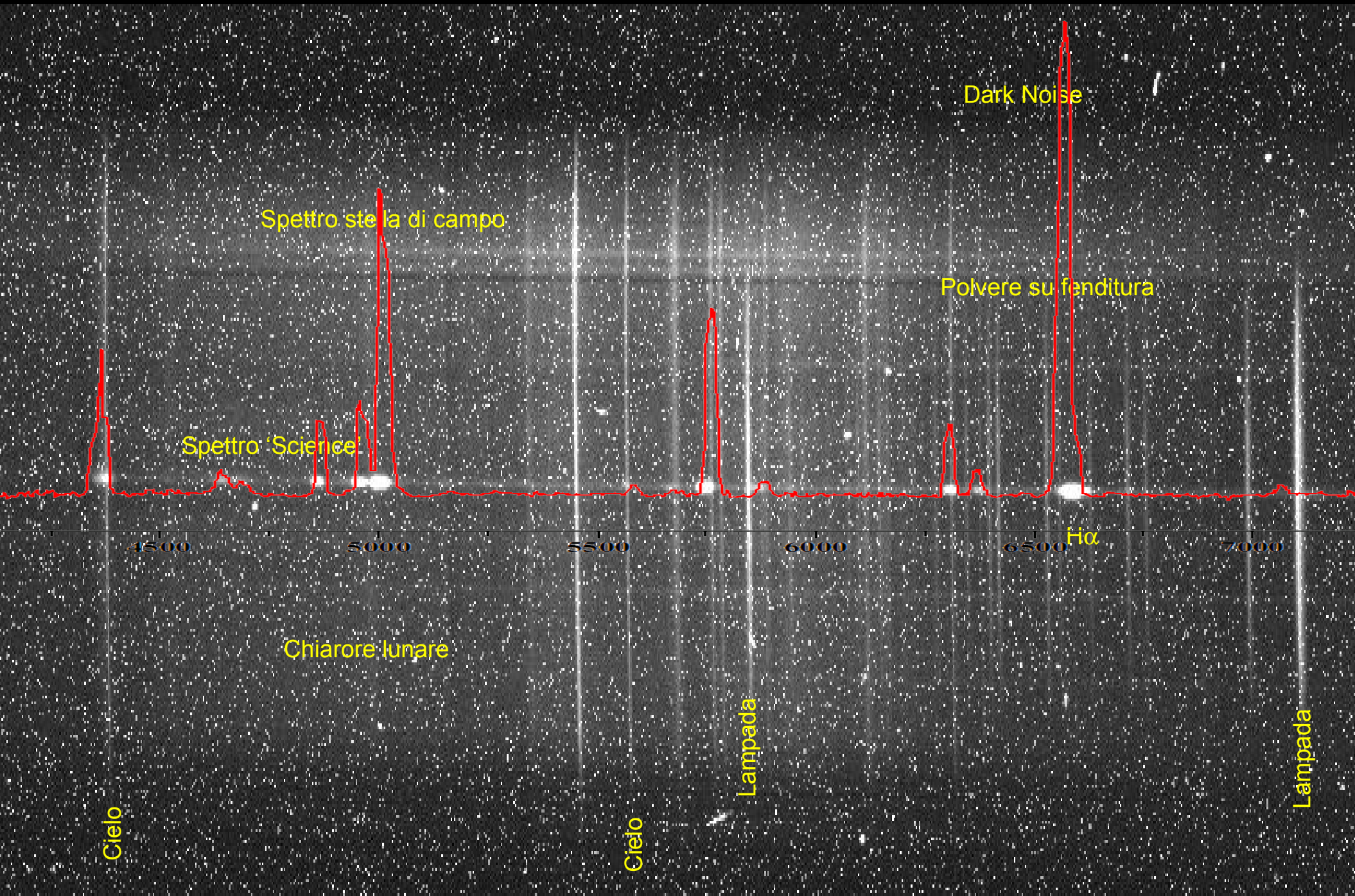
Spettrografi commerciali:

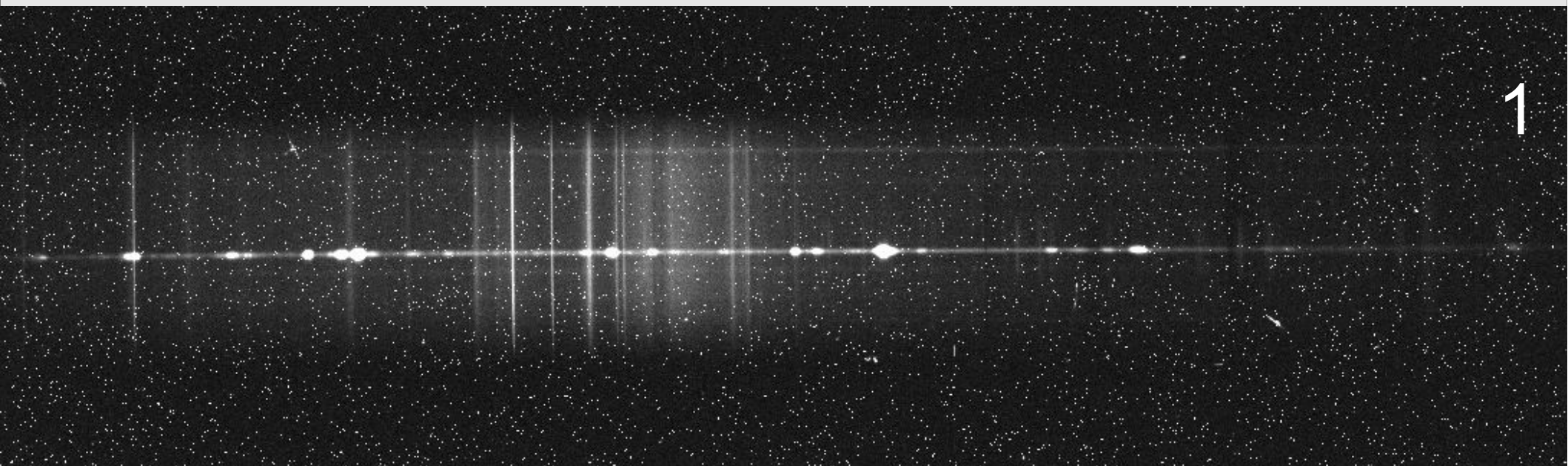


Lhires, Alpy,
Dados

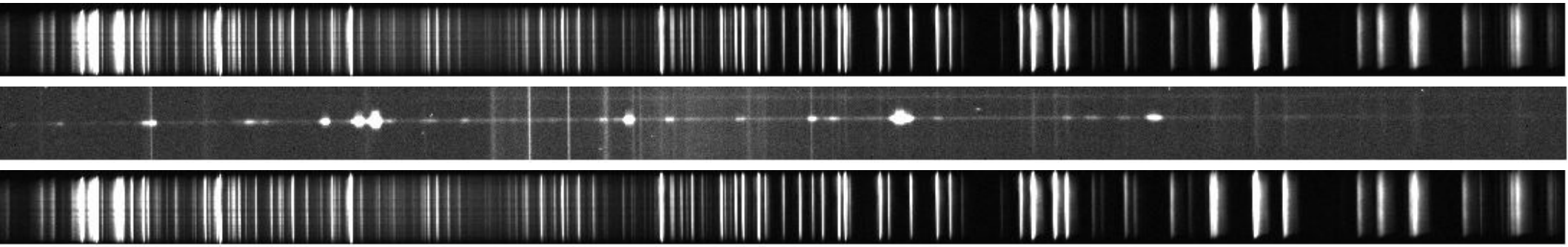


Guida essenziale all'estrazione di uno spettro dall'immagine CCD

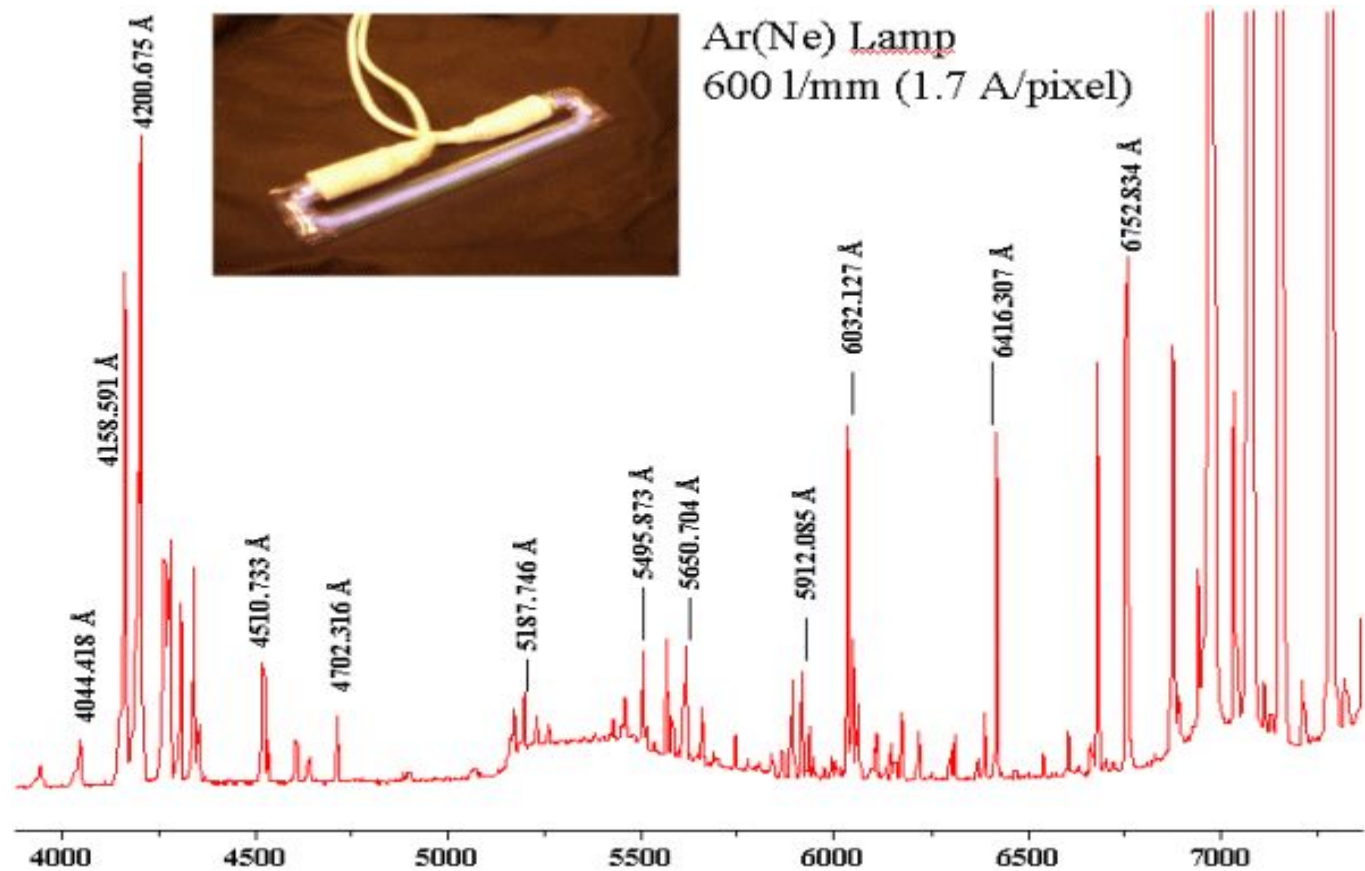




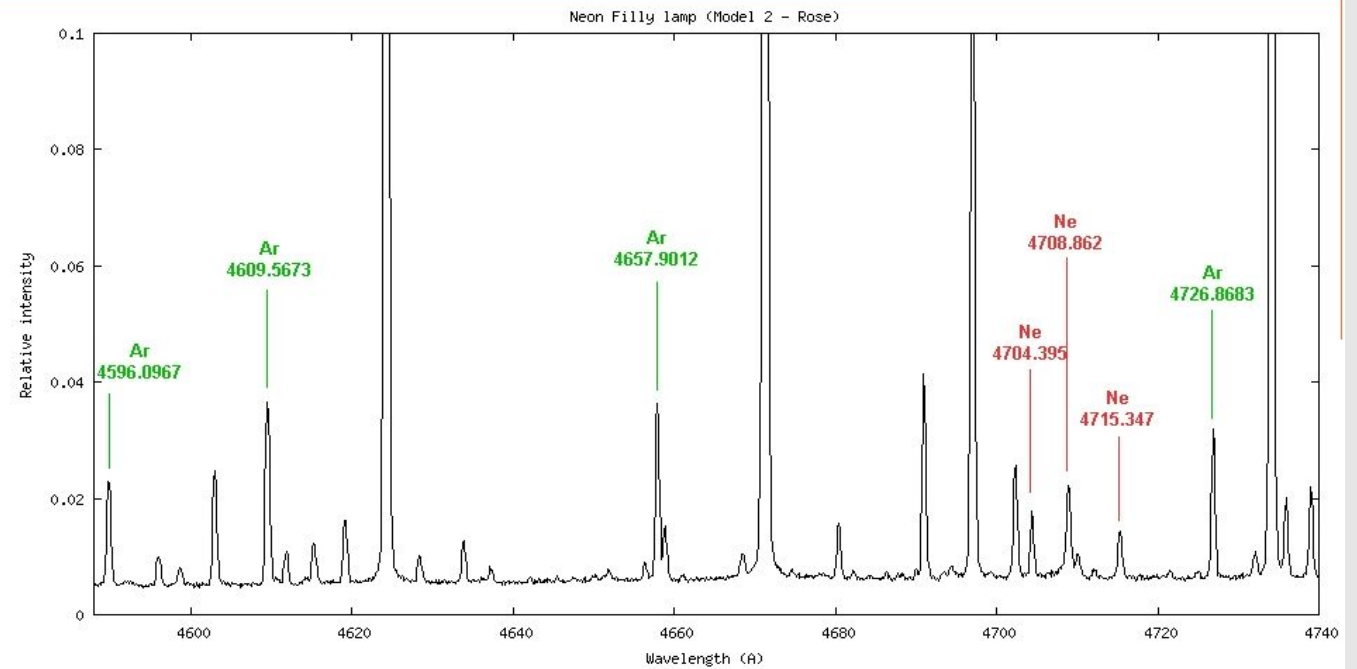
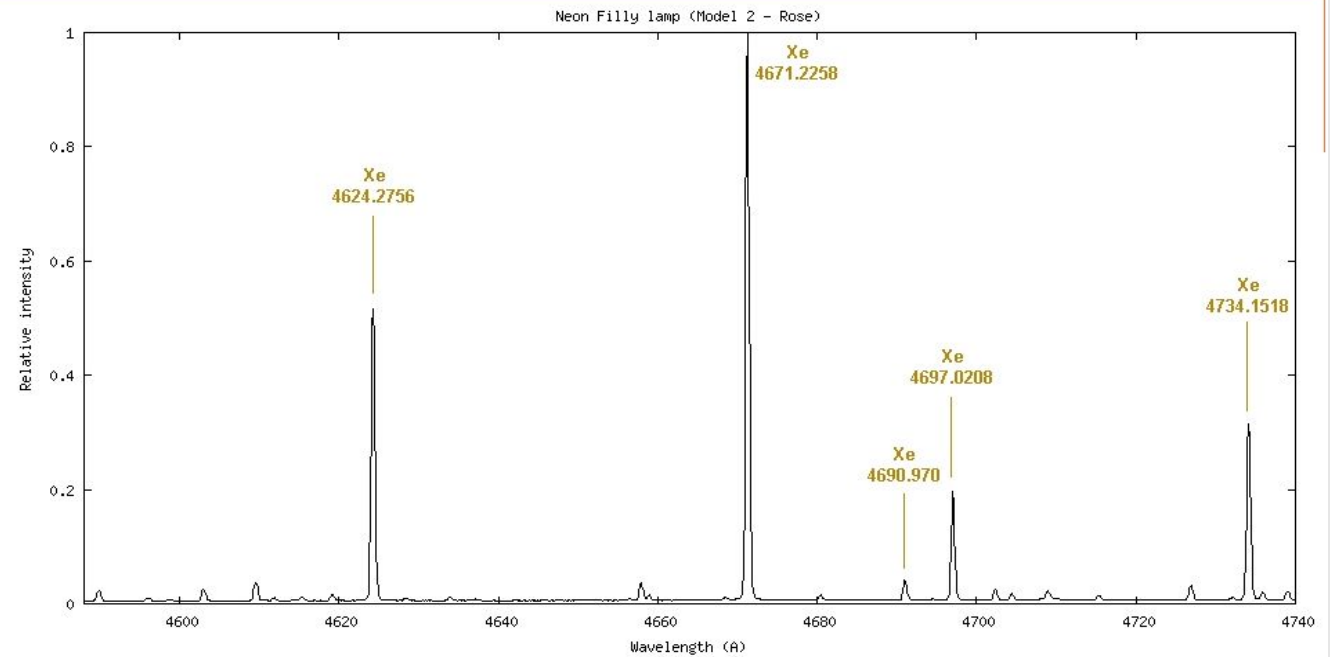
Le pose sul target vengono intercalate con quelle sulla lampada di calibrazione



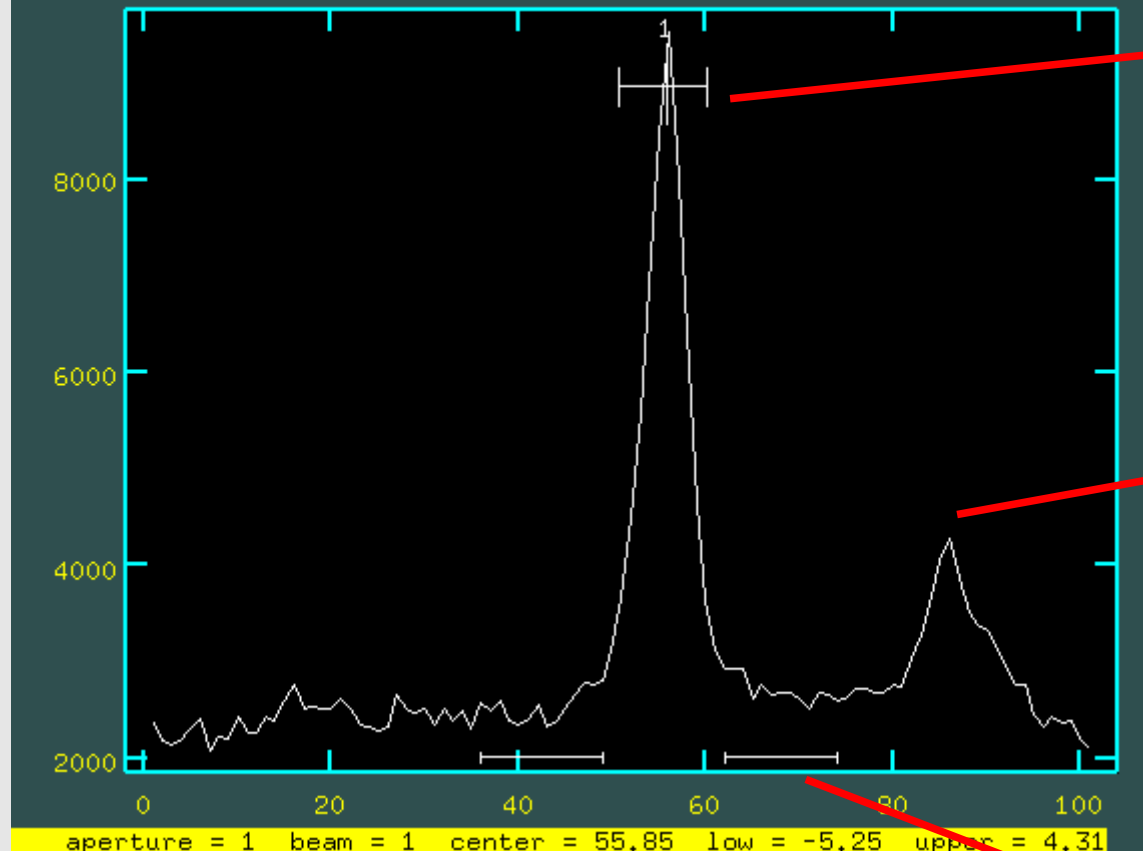
Le lampada di calibrazione più comuni sono tubi o ampole a scarica di gas nobili: Ar, Ne, Xe



Lampade Filly di Habitat – ancora Ar, Ne e Xe



NOAO/IRAF V2.14.1 paolo@valisa Tue 14:13:28 13-Mar-2018
Image=s2, Sum of columns 745-844
Define and Edit Apertures

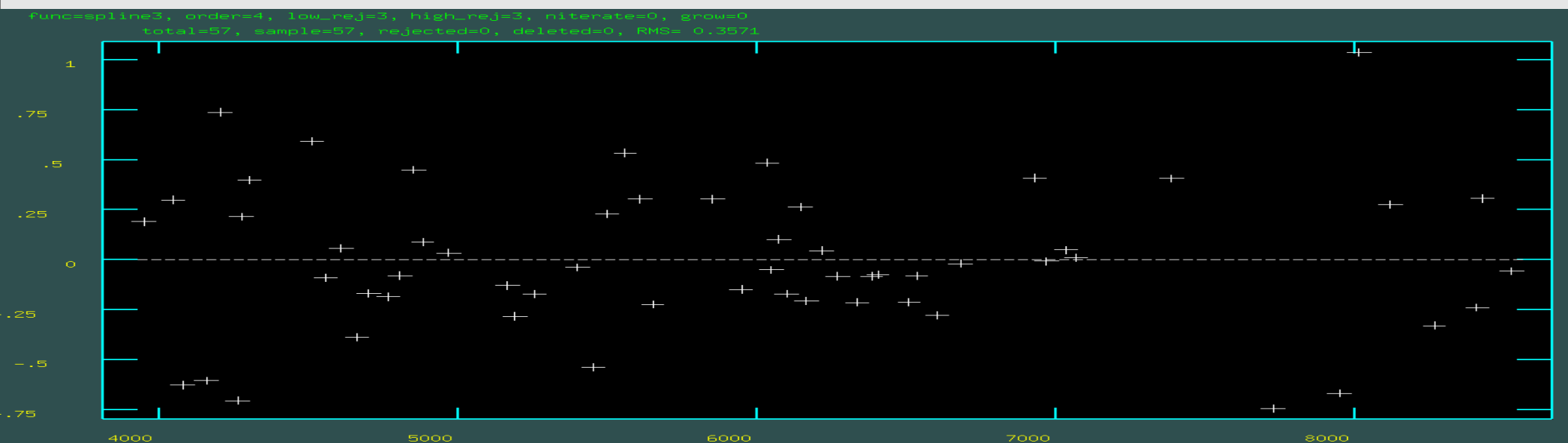
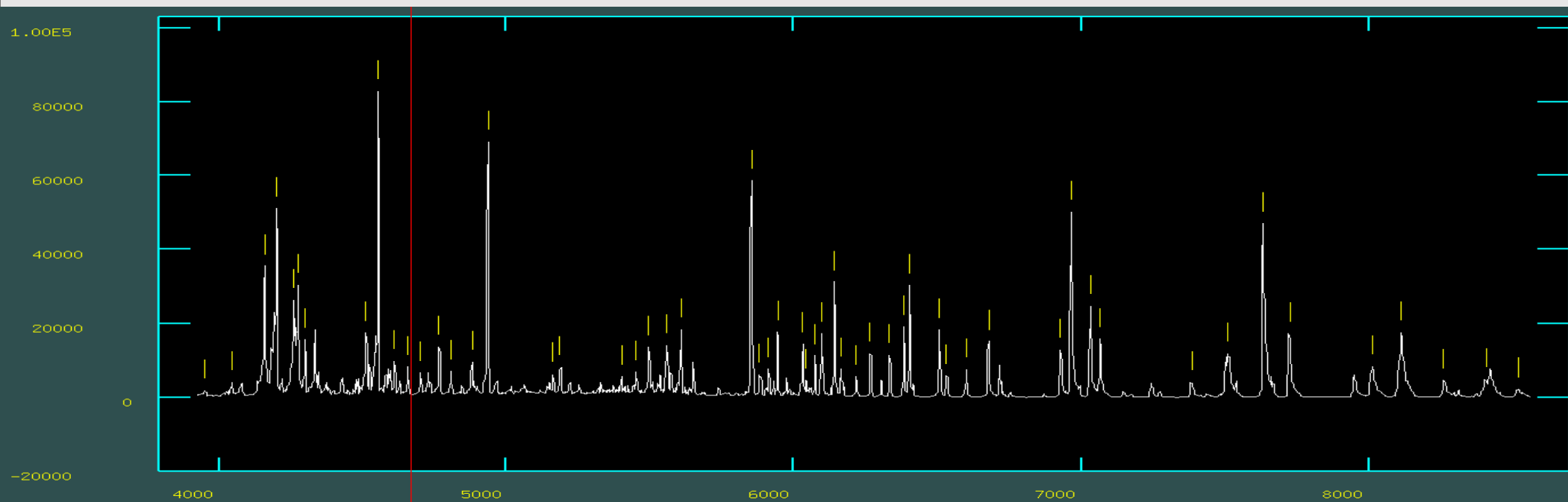


Posizione spettro

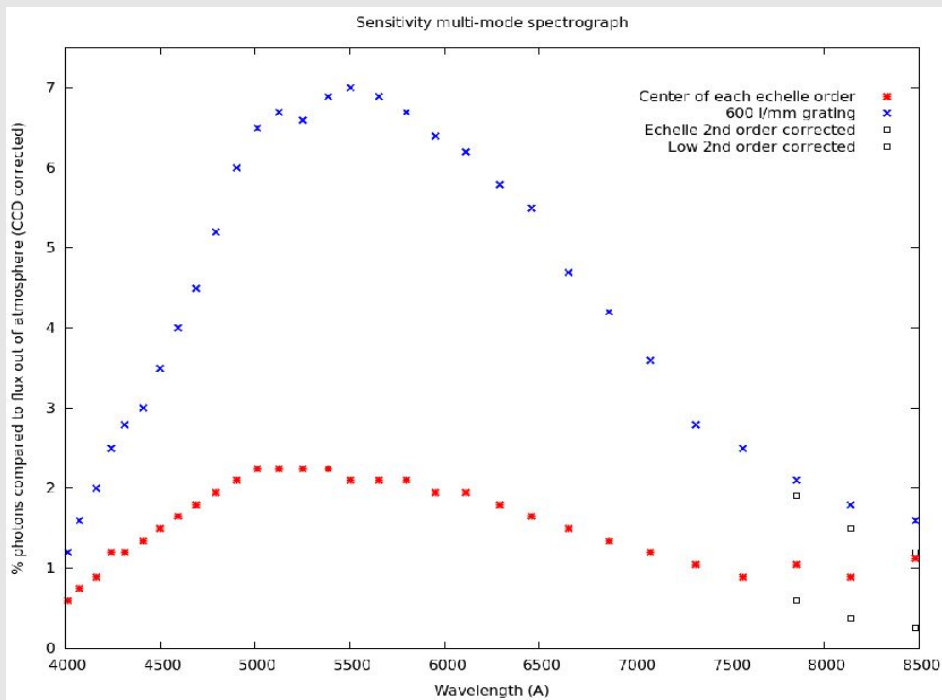
Seconda stella

Posizione background,
righe del fondo cielo e
persistenza lampada.

Calibrazione in lunghezza d'onda

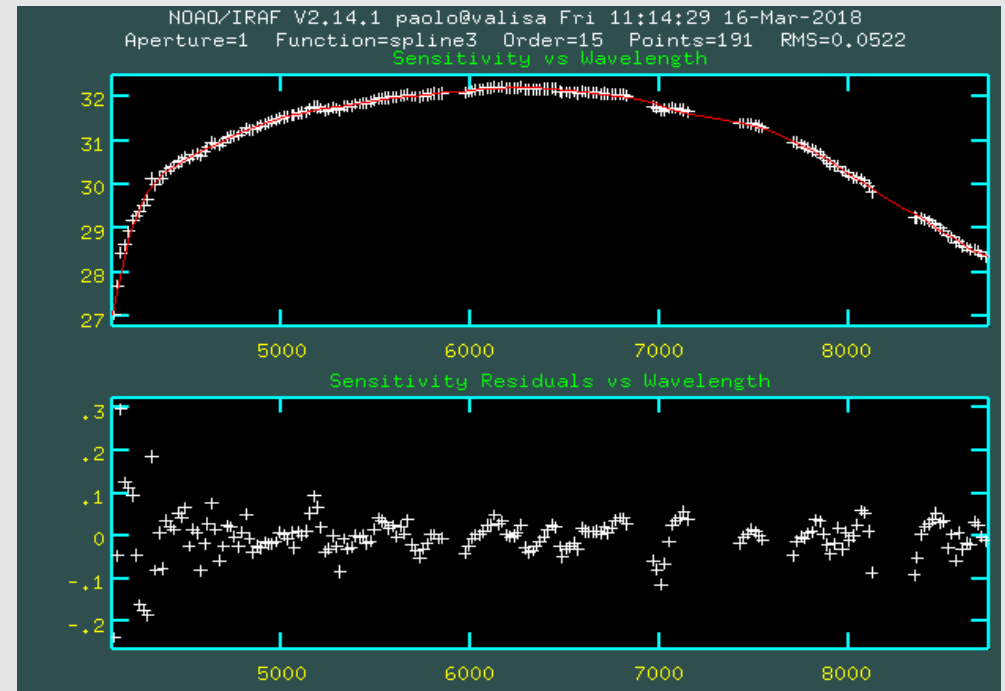
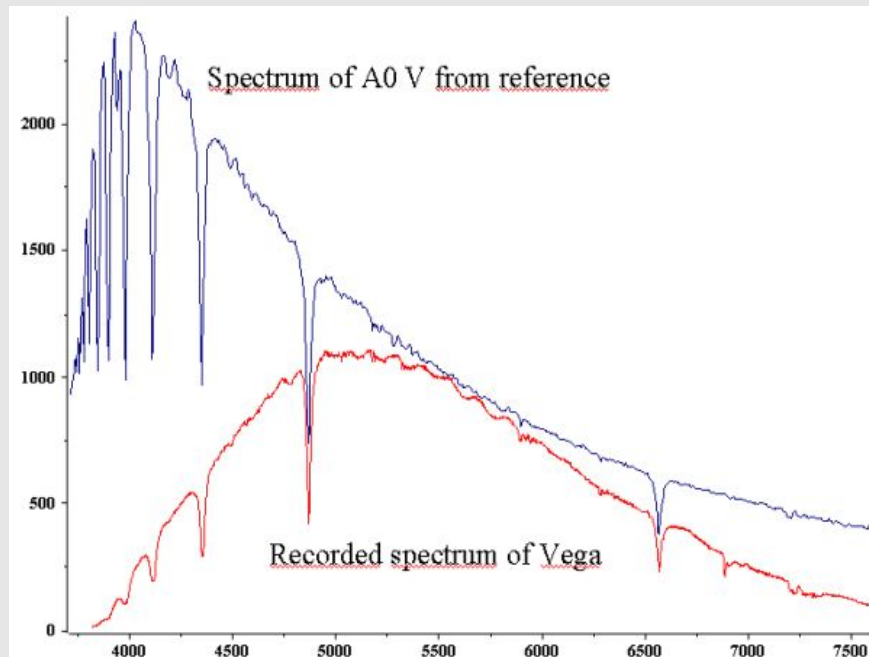


Residui tipici RMS 0.3 Å (R=1000) e 0,02 Å (R=15000)

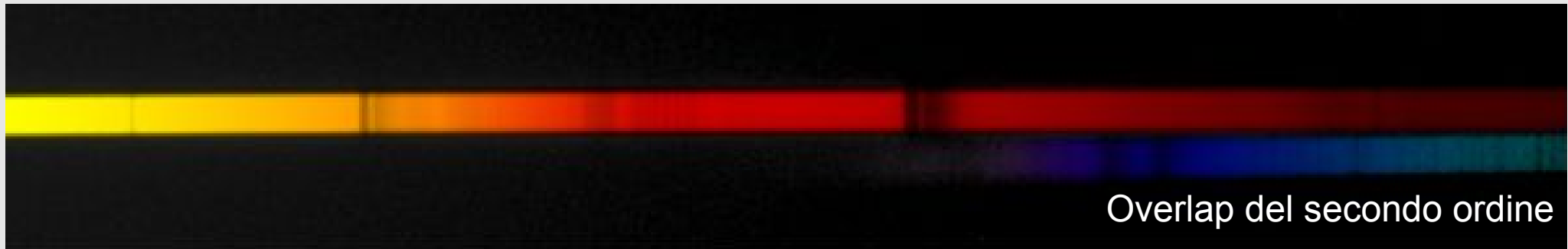


Calibrazione in flusso

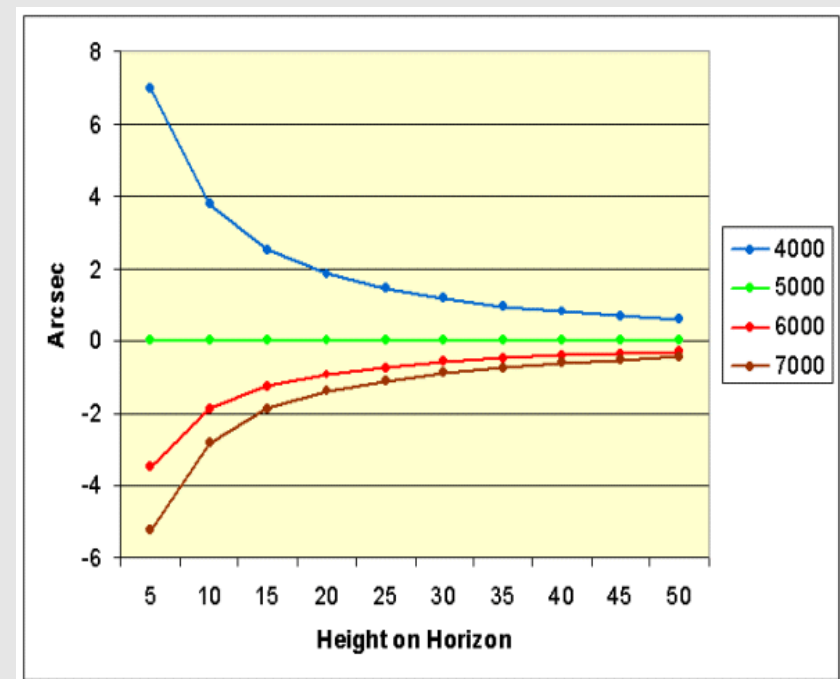
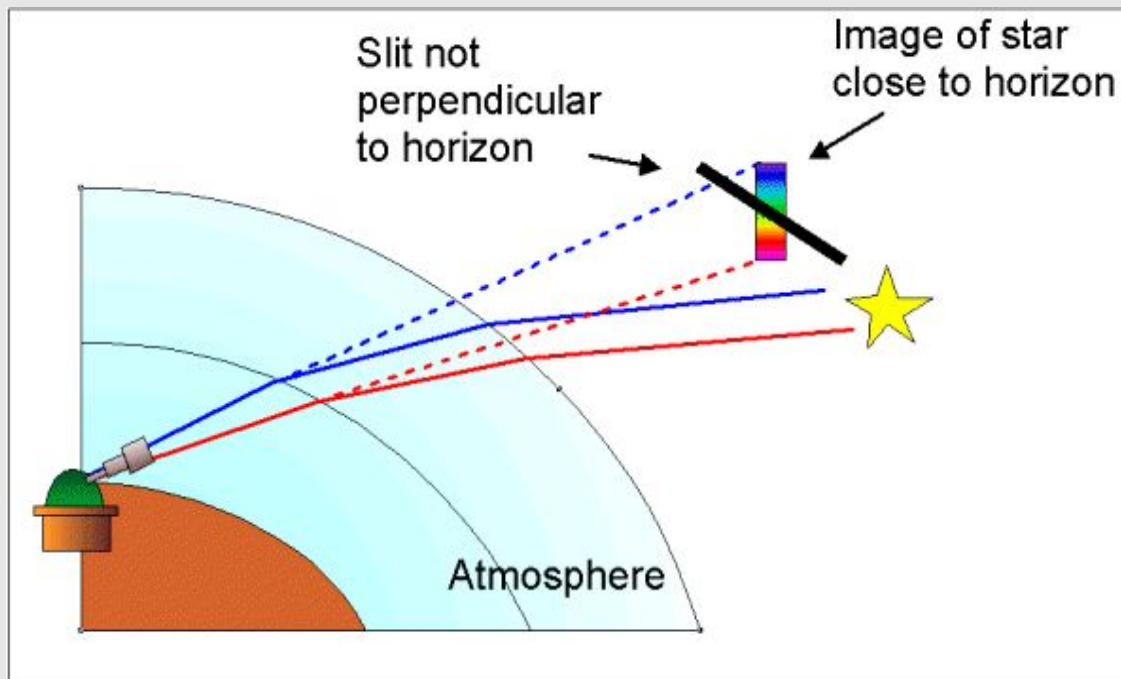
Assieme al target si acquisisce spettro di stella standard di flusso. Di quest'ultima per ogni lunghezza d'onda viene calcolato il rapporto tra intensità raccolta e intensità fuori dall'atmosfera. Il fattore correttivo viene poi applicato al target.

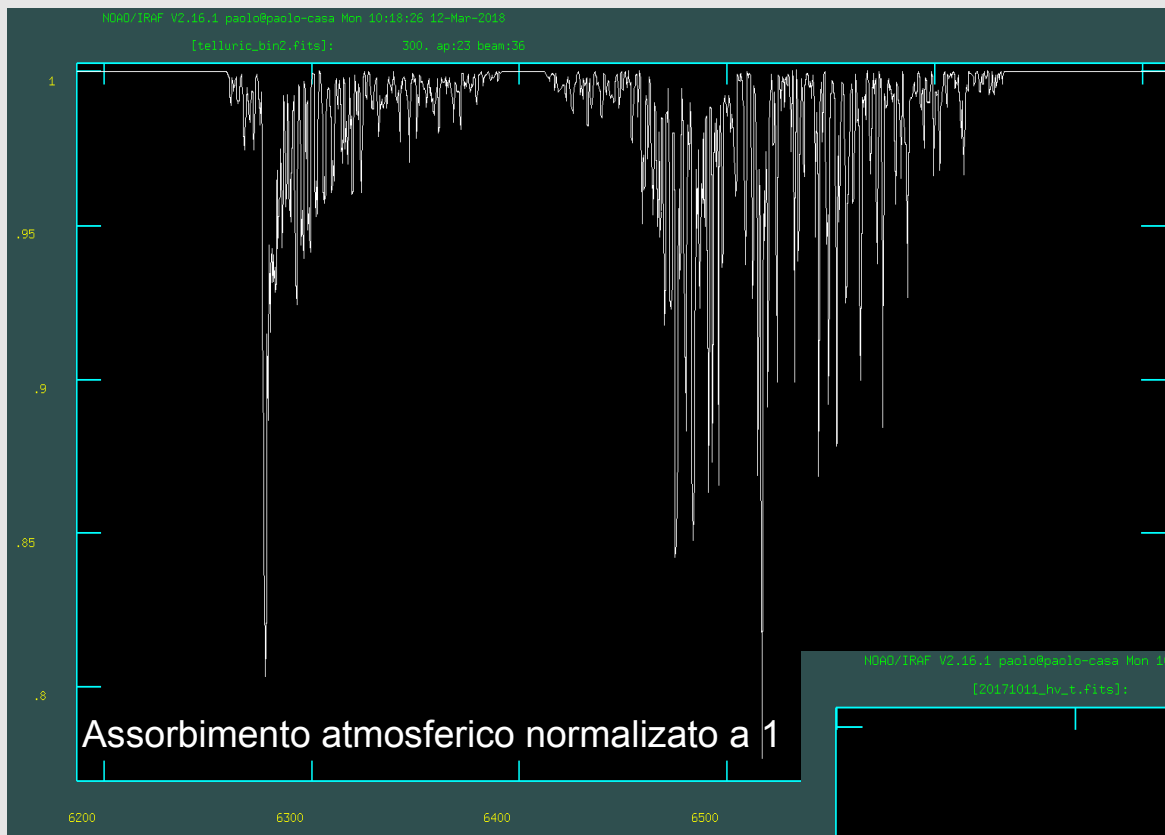


Maggiori problemi incontrati nel flussaggio:



Rifrazione atmosferica differenziale per rosso e blu. Necessità di fenditura perpendicolare all'orizzonte (parallattica)

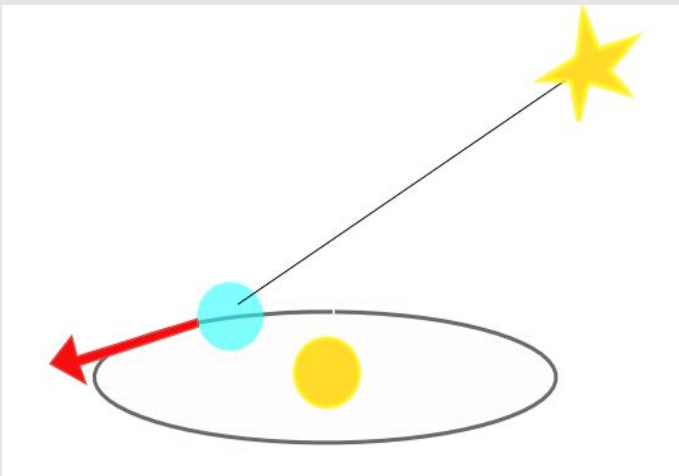
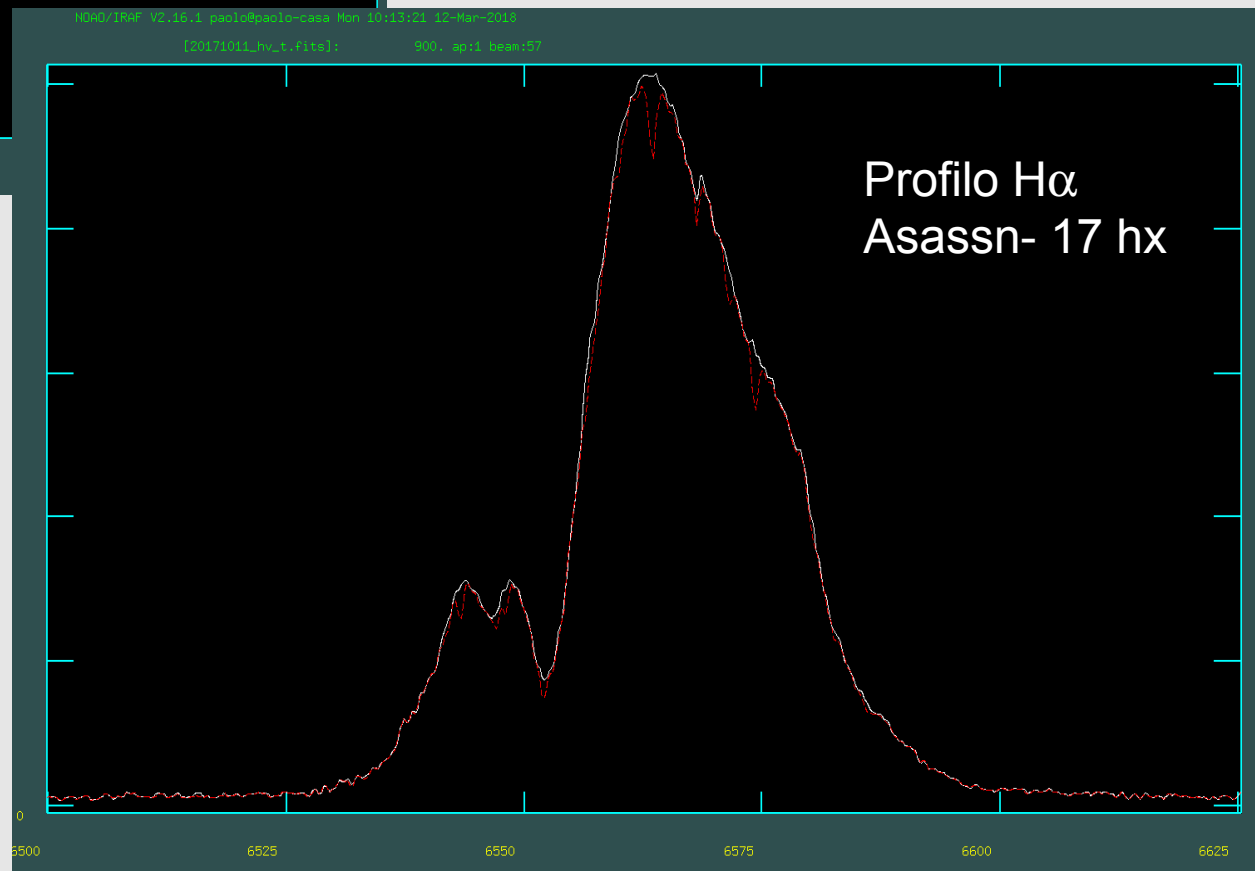




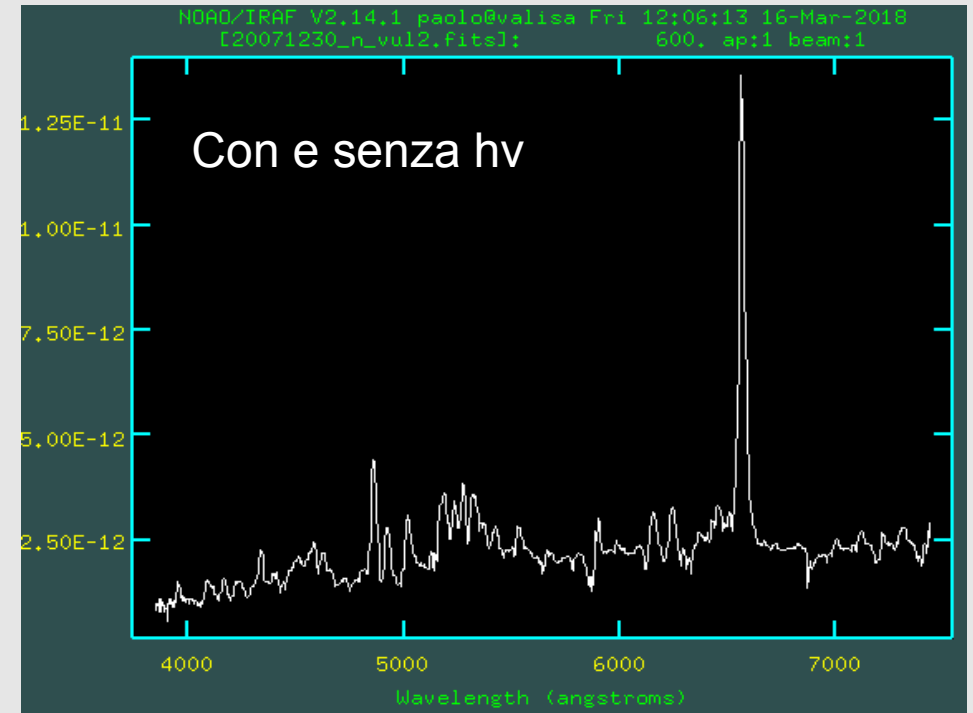
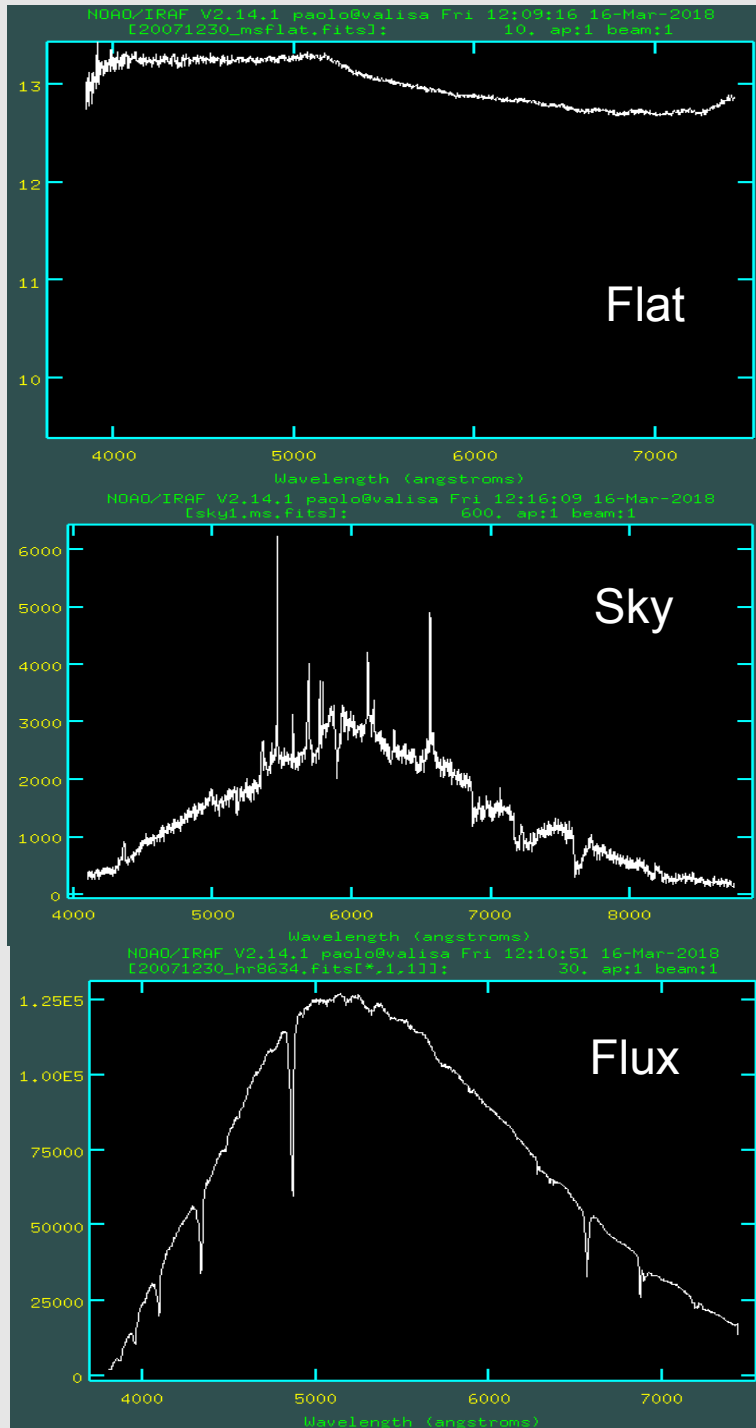
Per spettri in alta risoluzione:

Correzione Doppler per riportarsi
in un sistema di riferimento
eliocentrico.

Correzione righe telluriche



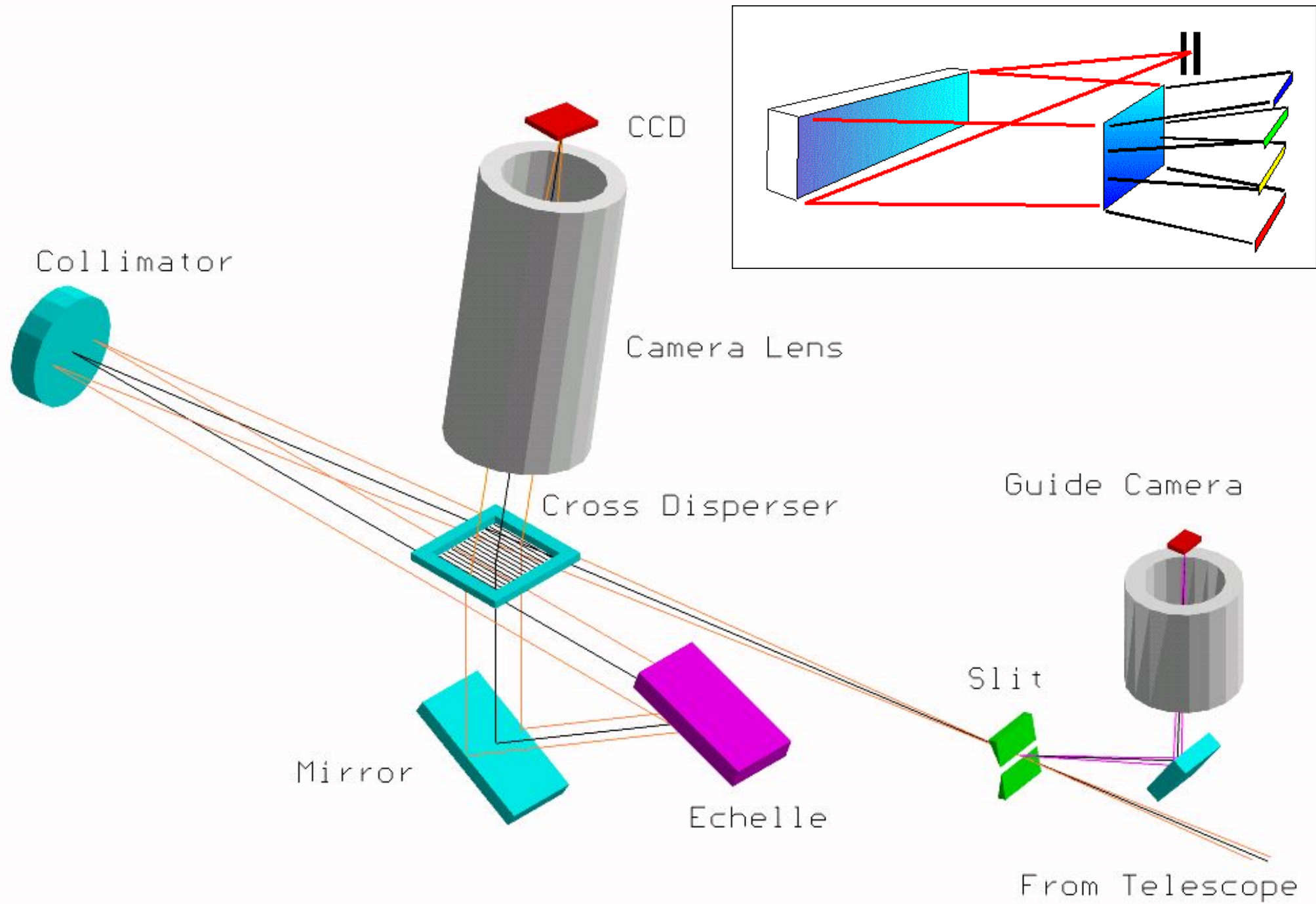
Ancillary files

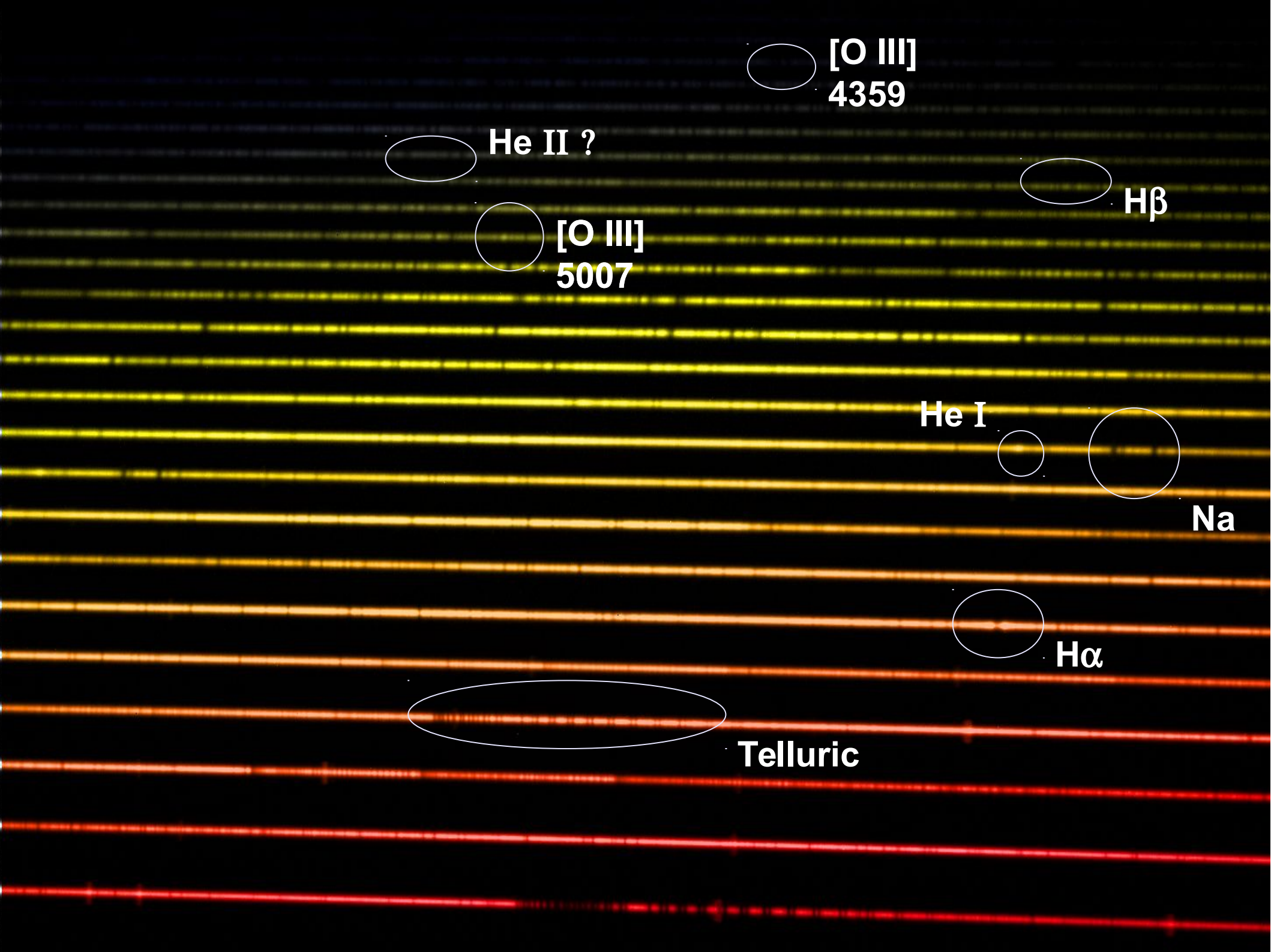


NOVA SCT 2017 – ASASSN-17hx GIORNO 05-07-2017							
	hh.mm	UT	AR	DEC	Posa	AirMass	note
600 l/mm	20,12	20,200	18,527	-14,270	300	3,09	PV, solo 5min liberi da nubi
HR6698	19,56	19,933	17,980	-9,773	5	2,38	Mark II red dump flux standard

NOVA SCT 2017 – ASASSN-17hx GIORNO 13-07-2017							
	hh.mm	UT	AR	DEC	Posa	AirMass	note
600 l/mm	20,18	20,300	18,527	-14,270	600	2,56	PV, seeing 3 arcsec
600 l/mm	20,31	20,517	18,527	-14,270	600	2,44	Mark II
600 l/mm	20,43	20,717	18,527	-14,270	600	2,34	
600 l/mm	20,55	20,917	18,527	-14,270	600	2,26	Posa #4 e standard nelle nubi
HR6698	21,02	21,033	17,980	-9,773	30	1,83	red dump flux standard

NOVA SCT 2017 – ASASSN-17hx GIORNO 14-07-2017							
	hh.mm	UT	AR	DEC	Posa	AirMass	note
echelle	20,15	20,250	18,527	-14,270	900	2,55	AM, seeing variabile, vento da N
echelle	20,31	20,517	18,527	-14,270	900	2,40	Mark II
echelle	20,48	20,800	18,527	-14,270	900	2,28	
echelle	21,07	21,117	18,527	-14,270	900	2,18	
echelle	21,24	21,400	18,527	-14,270	900	2,11	
HR6698	19,58	19,967	17,980	-9,773	120	2,08	red dump flux standard





[O III]
4359

This is a spectral image showing several emission lines. The lines are arranged vertically and have a color gradient from yellow at the top to red at the bottom. White circles and ovals are drawn around specific lines, and text labels are placed next to them. The labels include '[O III] 4359', 'He II ?', '[O III] 5007', 'Hβ', 'He I', 'Na', 'Hα', and 'Telluric'.

He II ?

[O III]
5007

Hβ

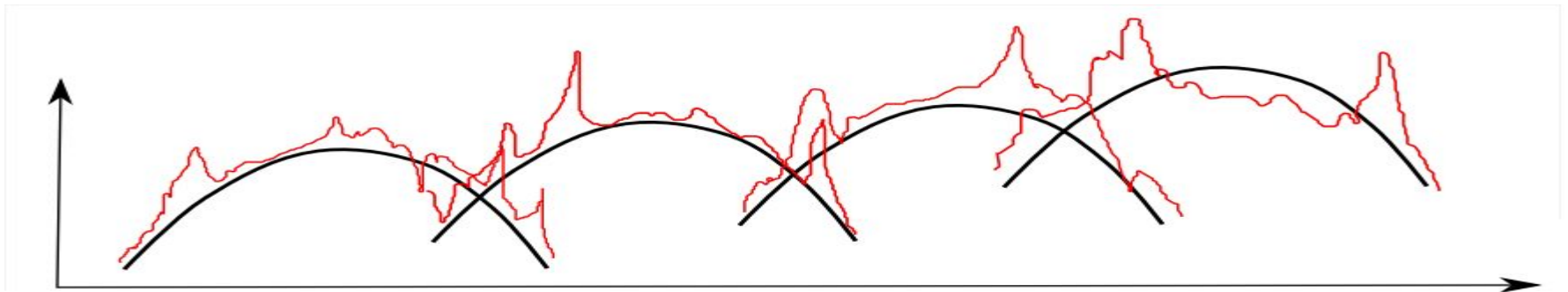
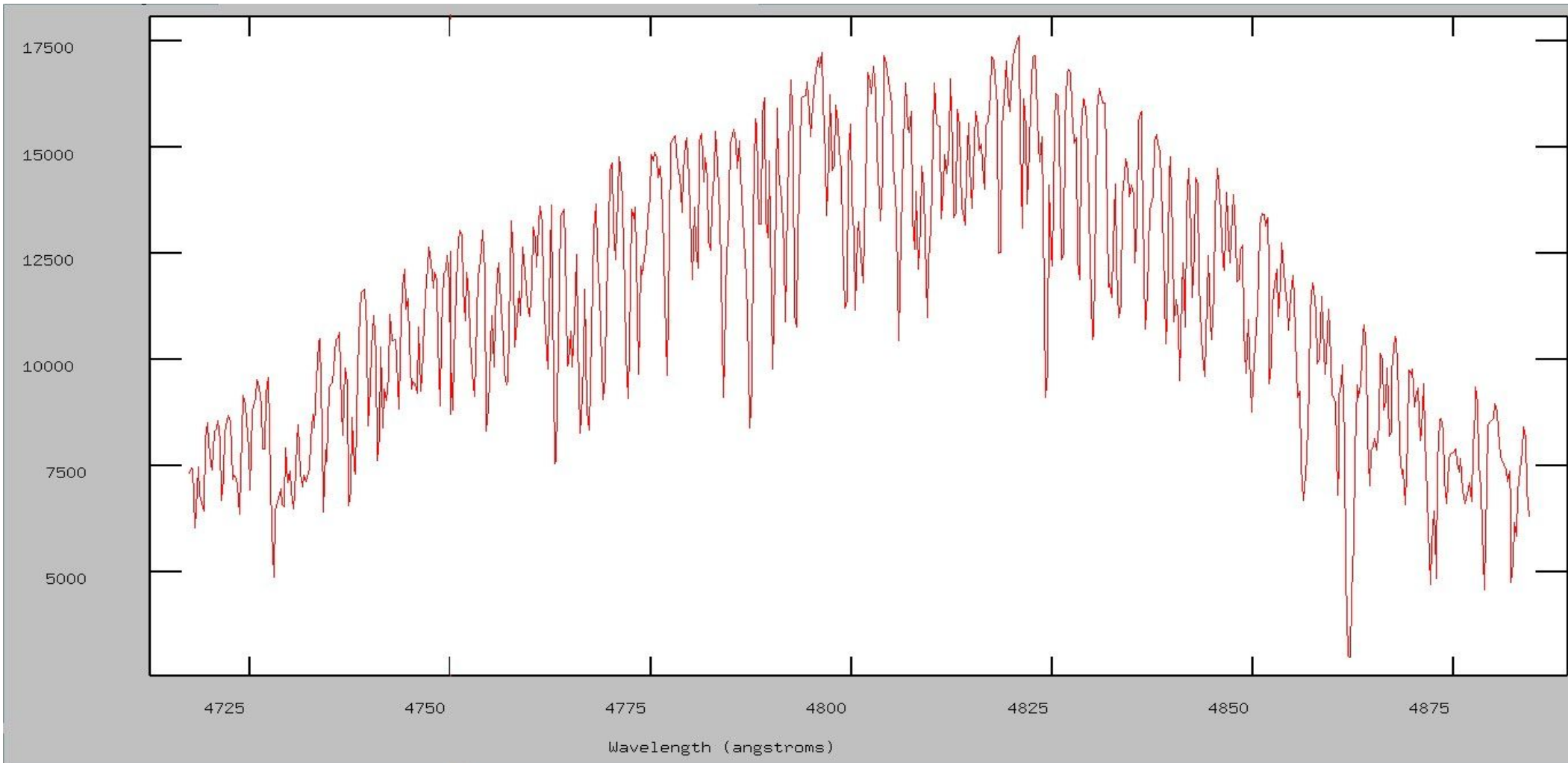
He I

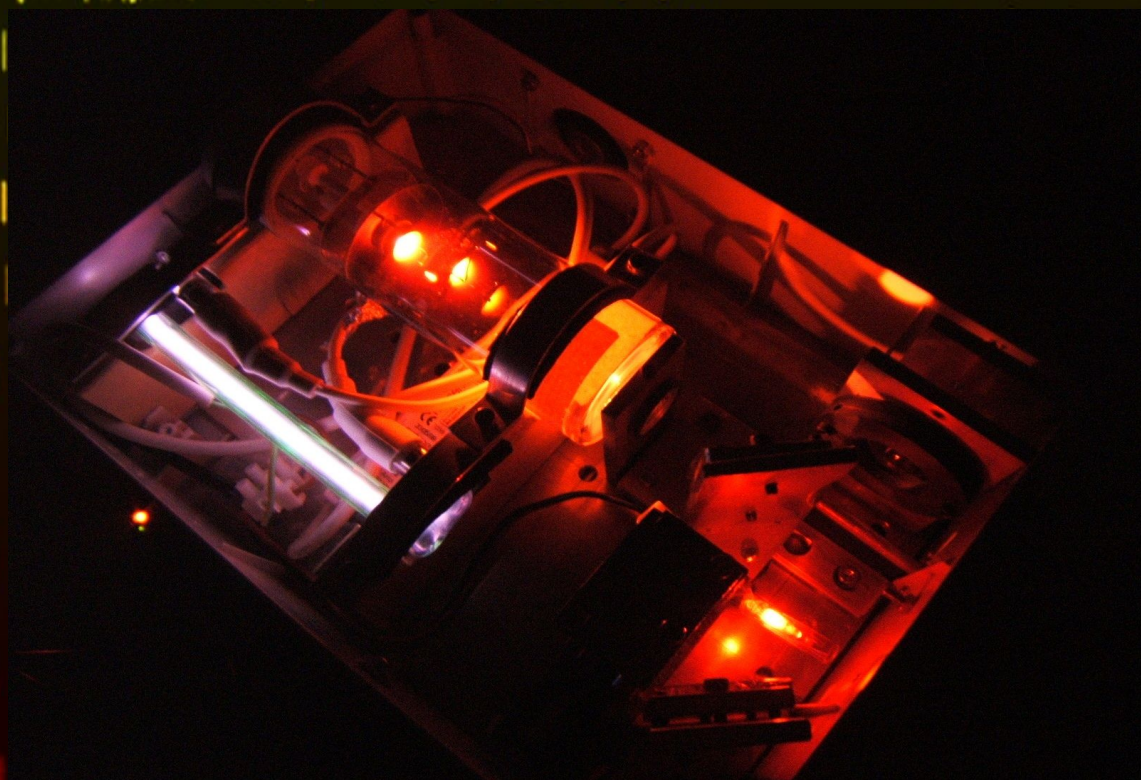
Na

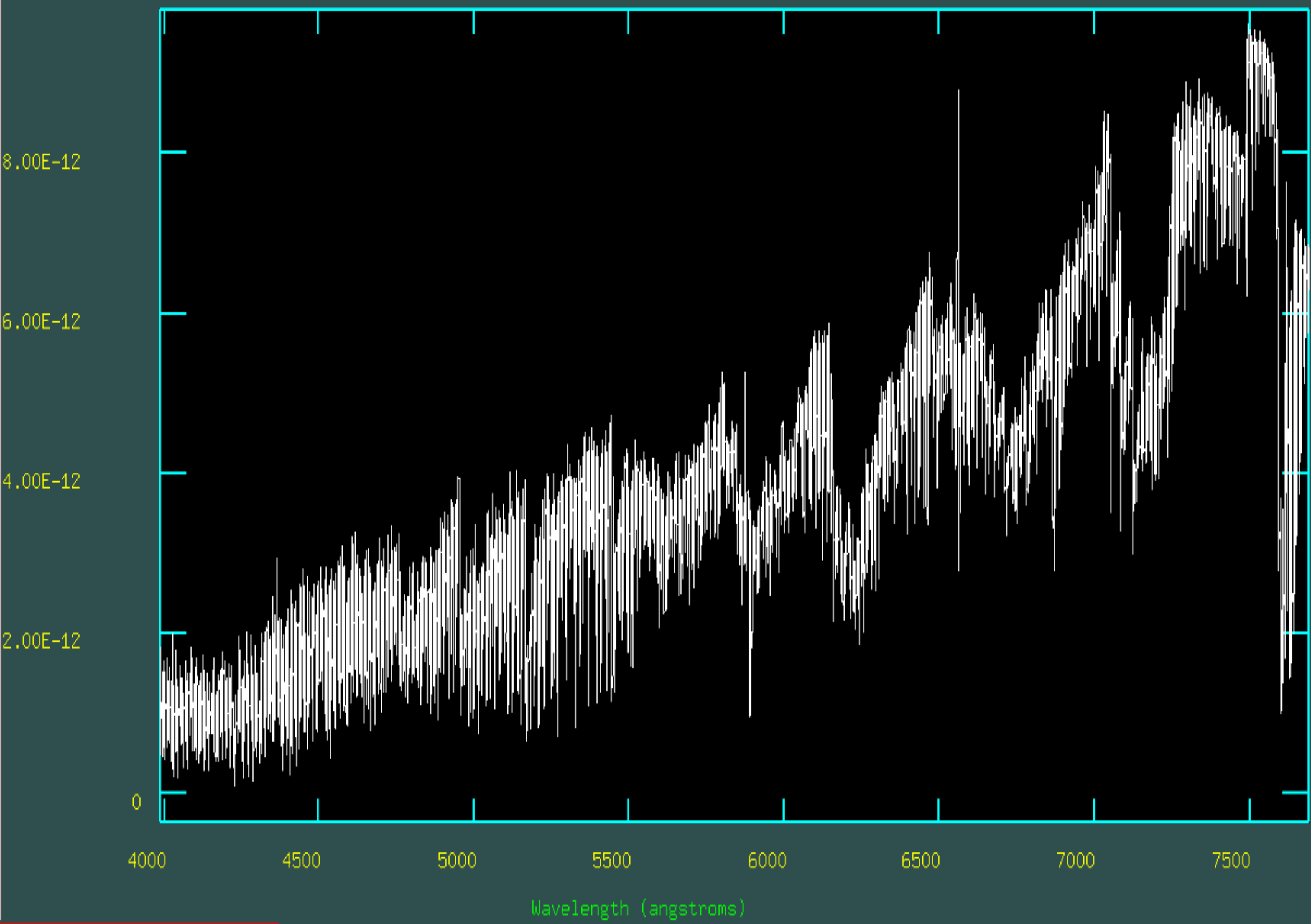
Hα

Telluric

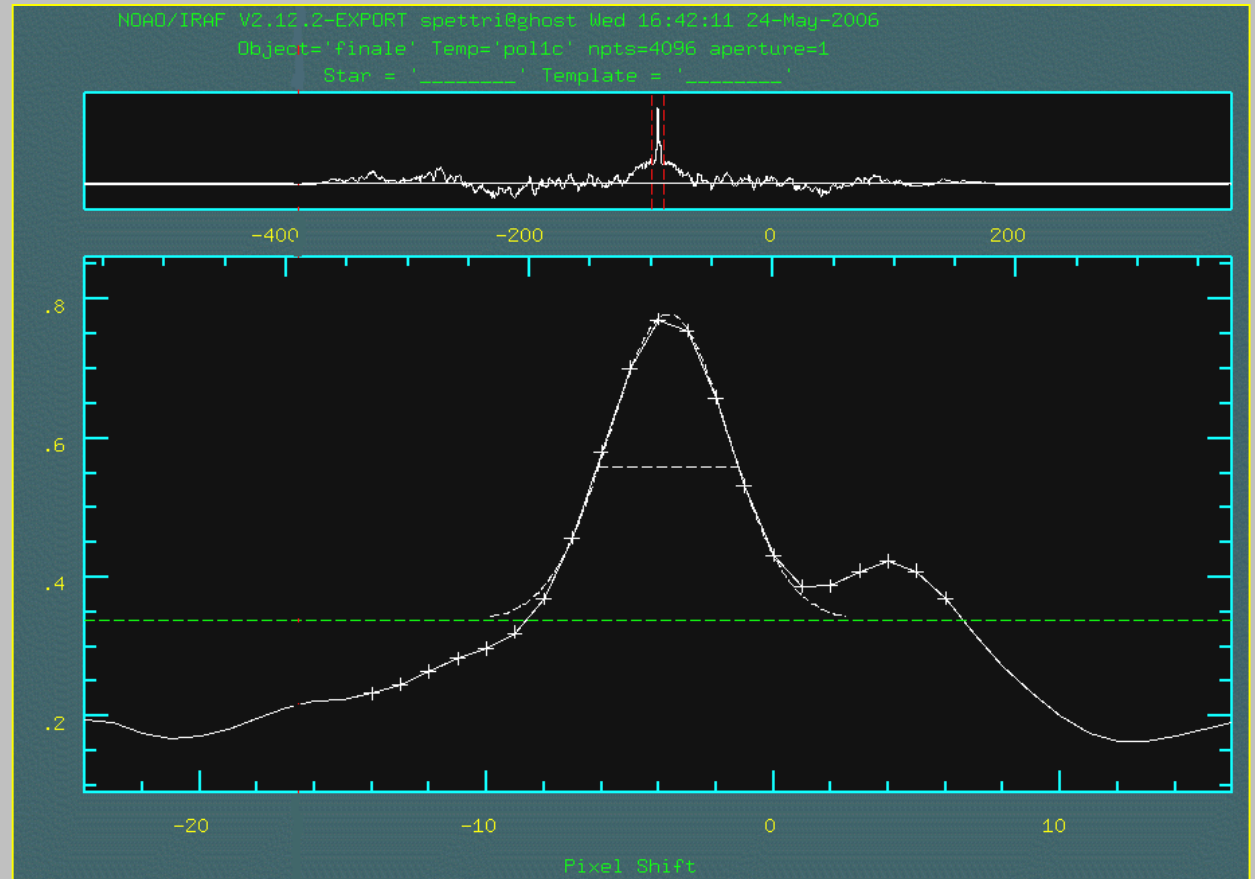
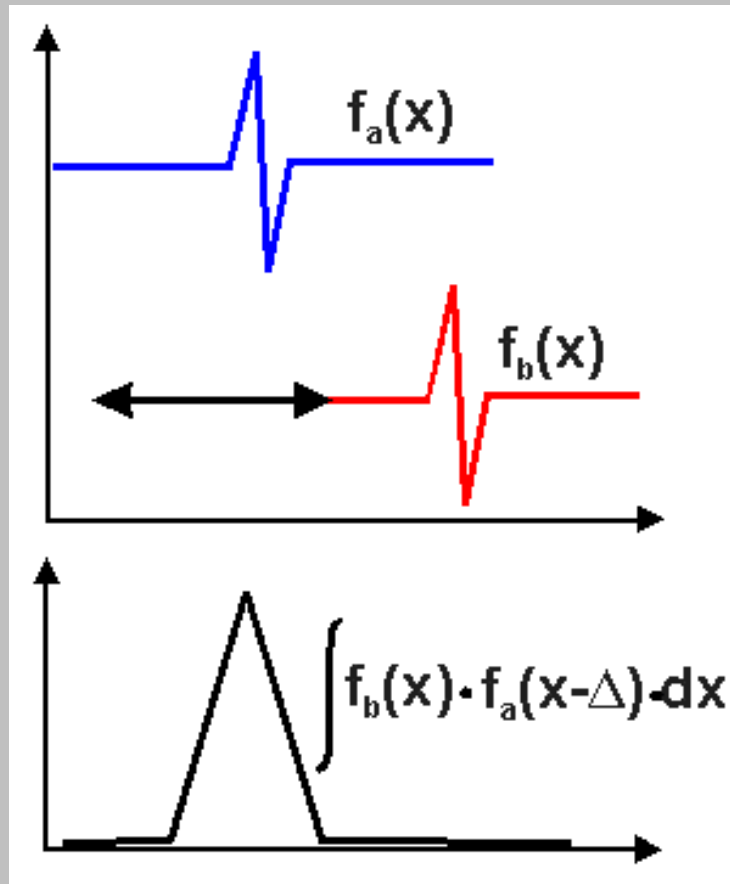
Blaze function degli spettrometri echelle





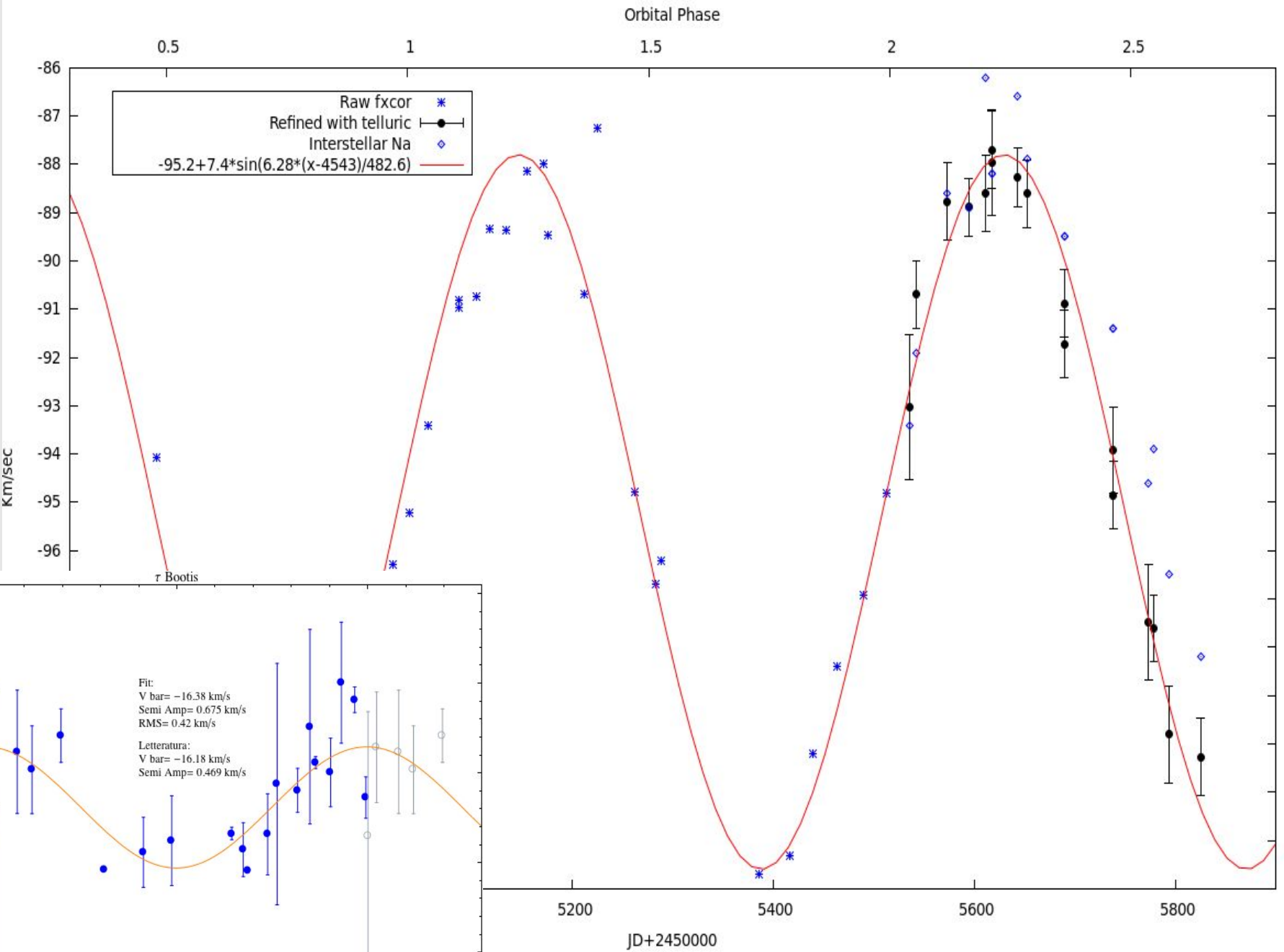


La funzione di cross-correlazione per la misura di Rv



$$Rv = 300'000 \text{ Km/sec} \times \Delta\lambda/\lambda$$

Velocità orbitale di EG And



Tau Boo

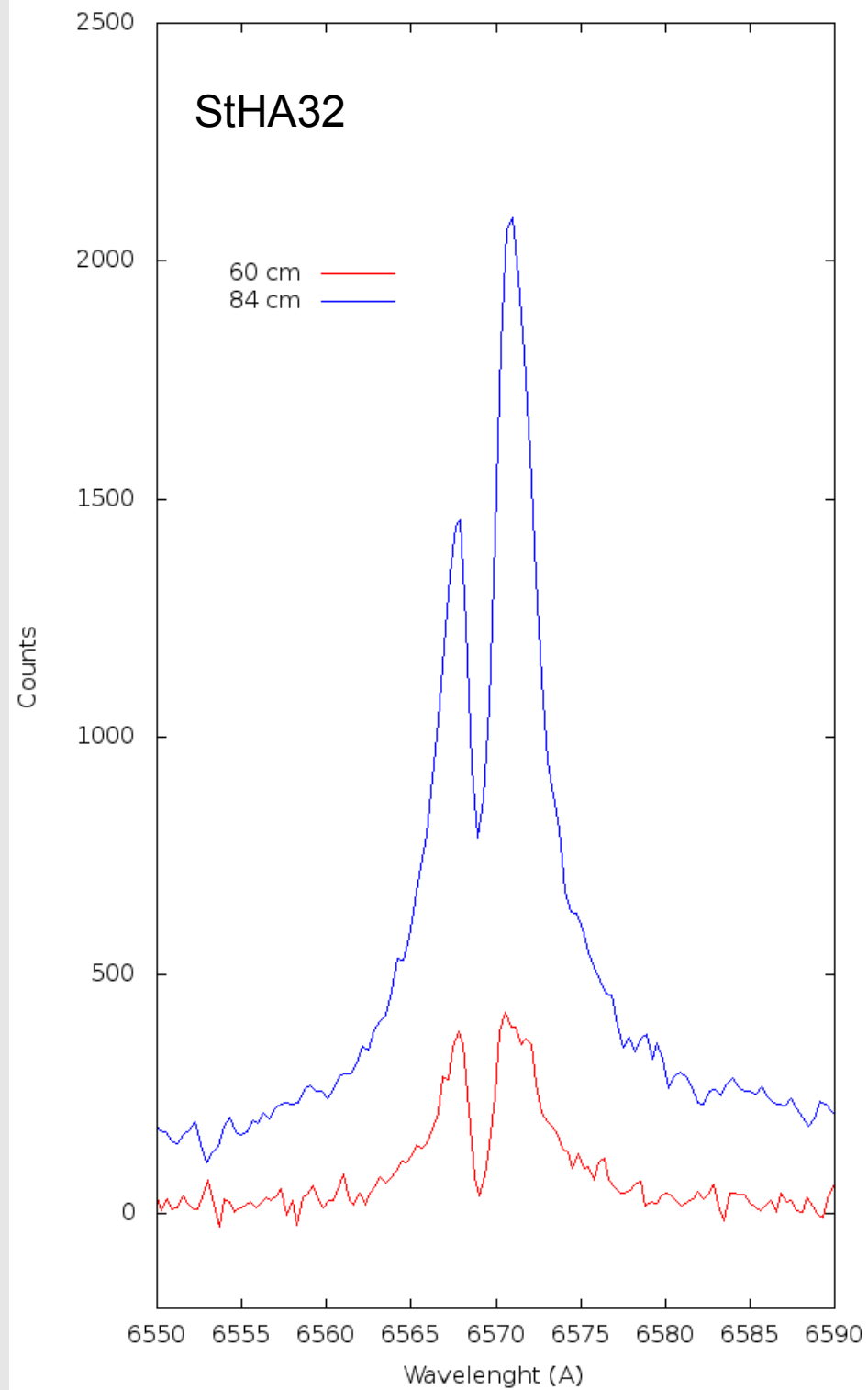
ASIAGO - EKAR



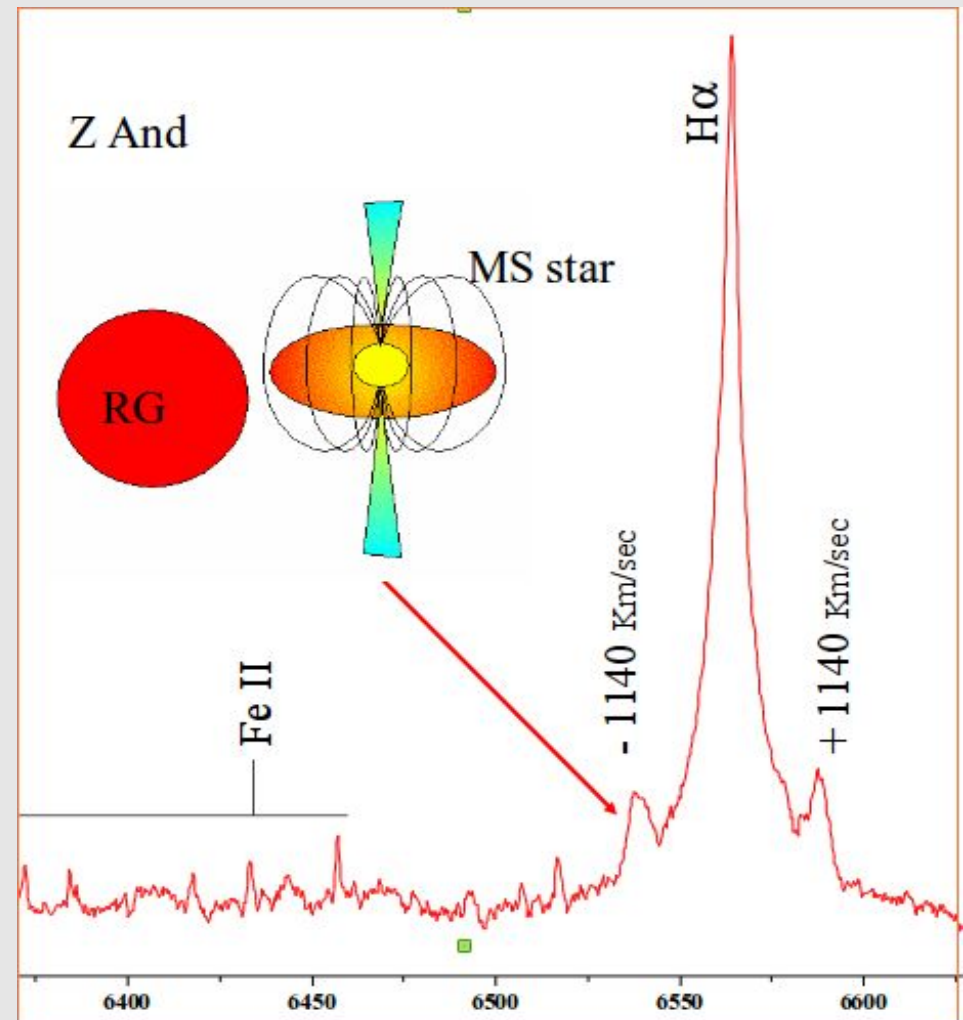
VARESE



Primo spettro 84cm



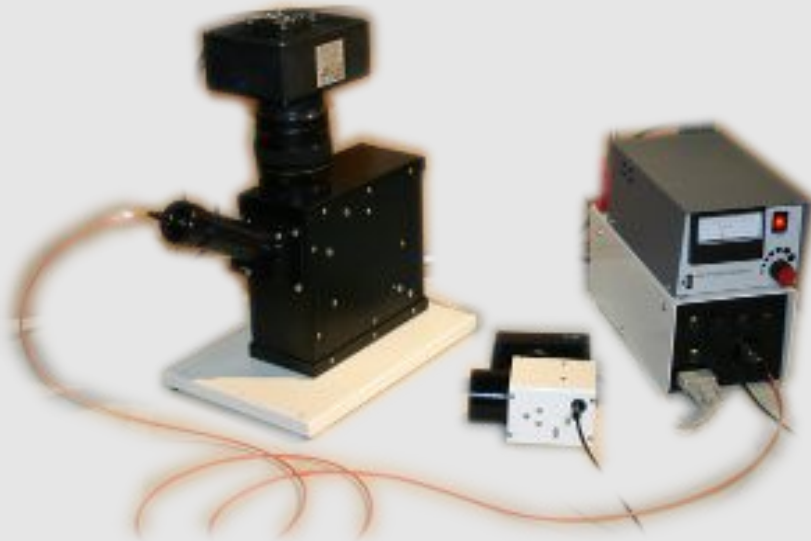
Primo spettro 84 cm – 14 marzo 2018



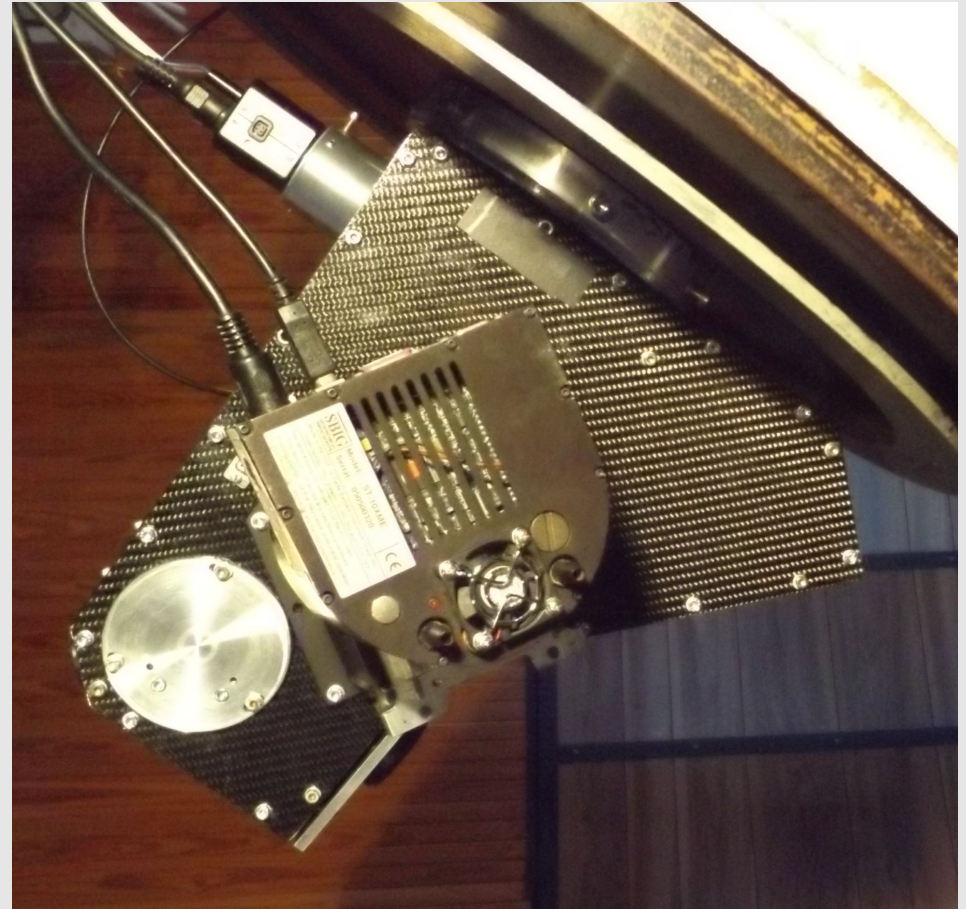
Spettrografi echelle commerciali:



BAADER
BACHES
ECHELLE-SPEKTROGRAF

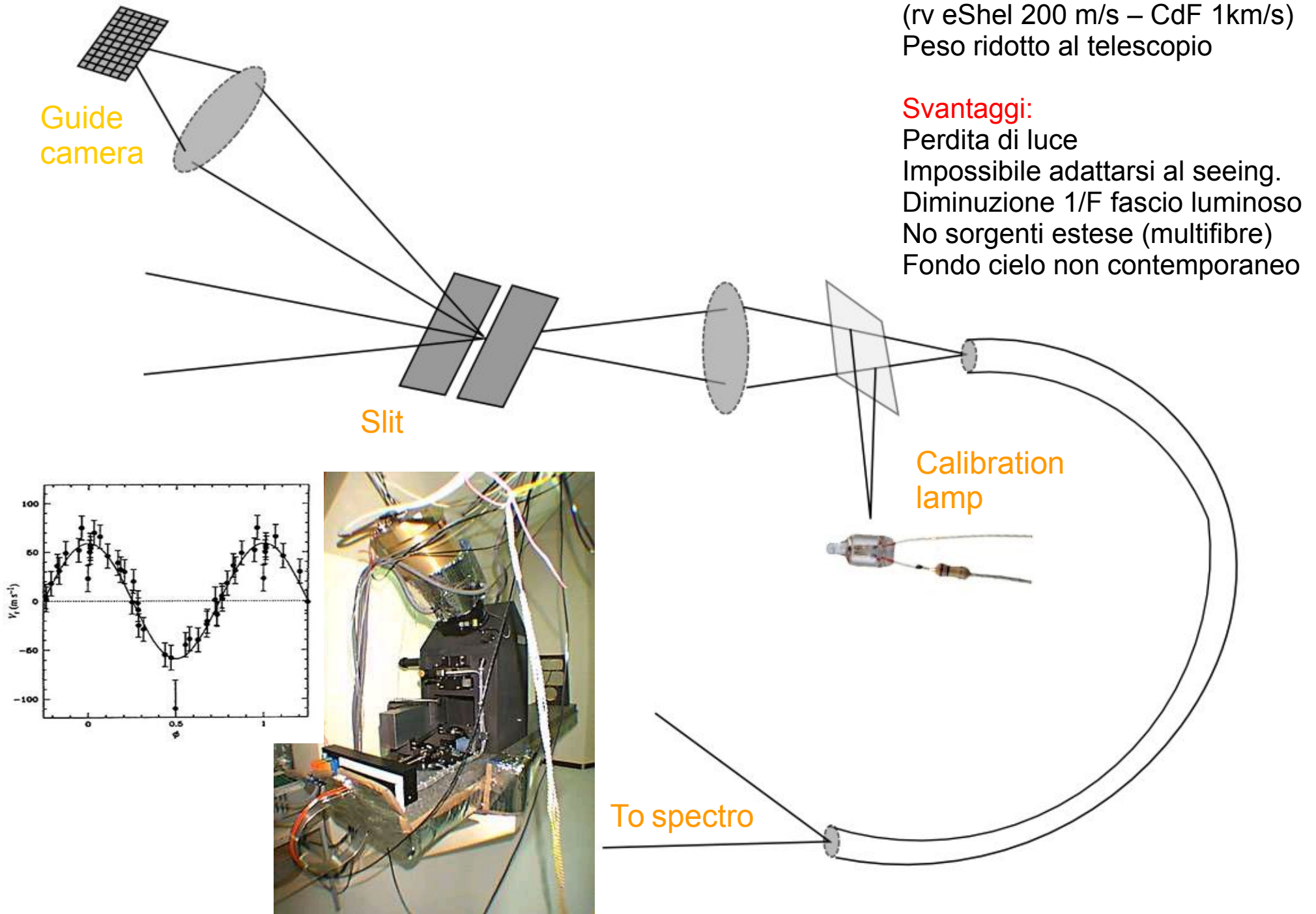


 **Shelyak**
INSTRUMENTS

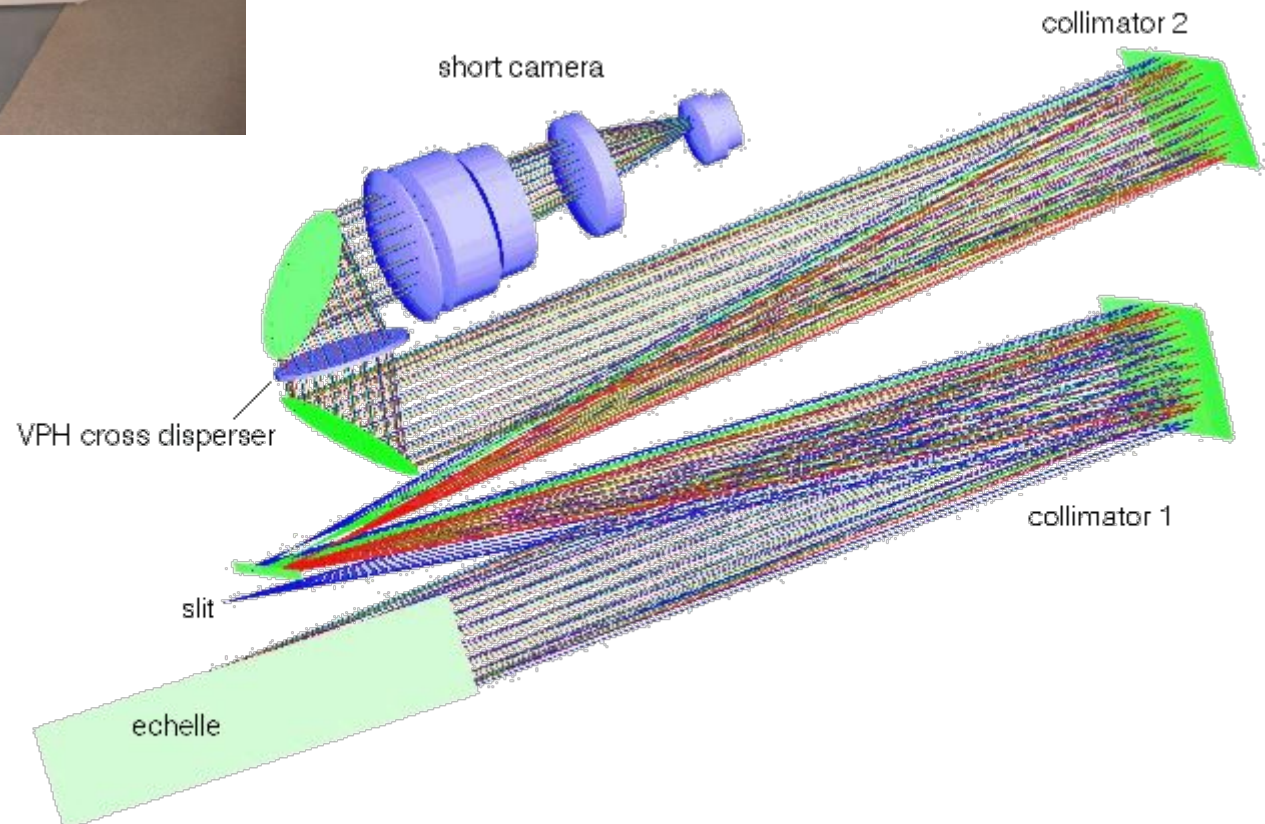
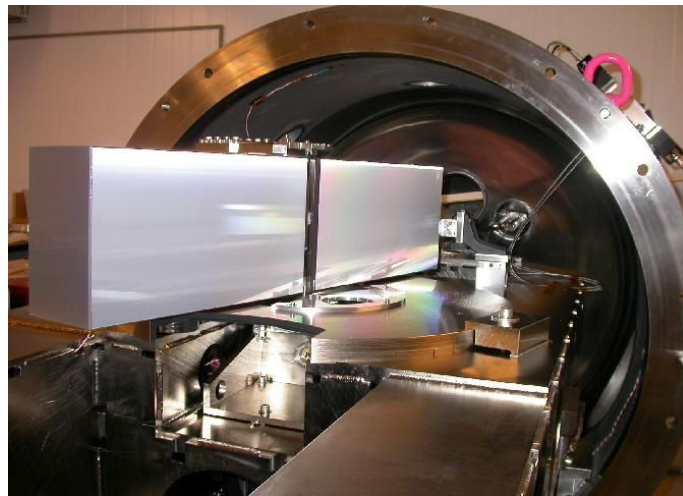
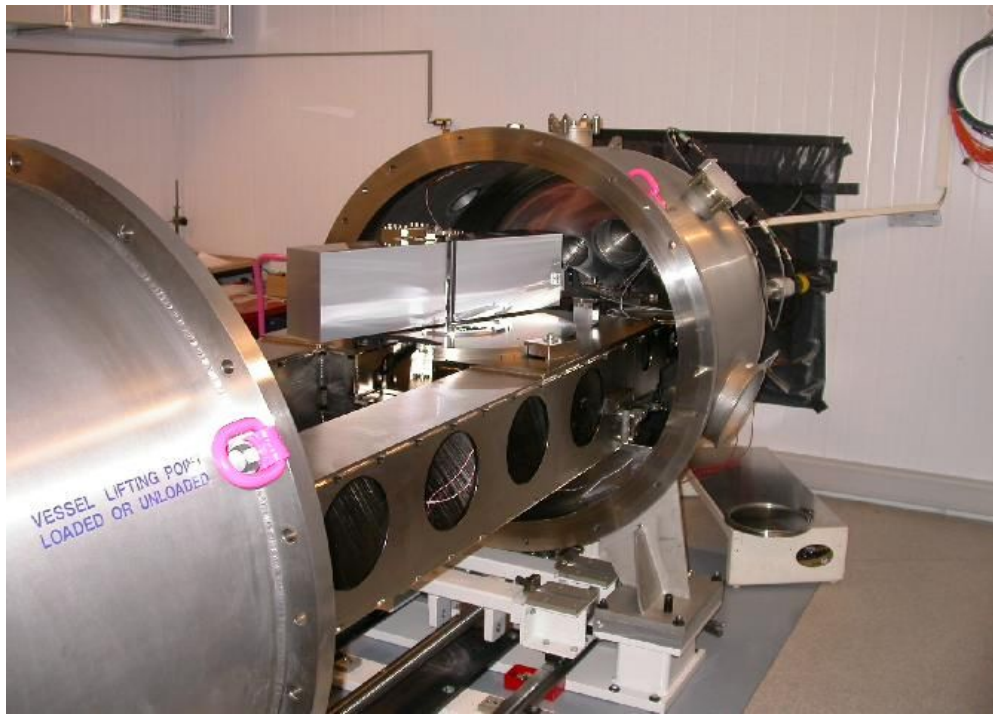


astrolight
instruments

Connessione tramite fibre ottiche



White Pupil spectrographs



"Sappiamo che è possibile determinare la forma delle stelle, le loro distanze, dimensioni e movimenti; al contrario non avremo mai nessun mezzo a disposizione per conoscere la loro composizione chimica o la struttura mineralogica e tantomeno nessun modo di conoscere la natura di creature organizzate che vivessero sulla loro superficie...in definitiva la nostra conoscenza delle stelle è necessariamente limitata puramente a fenomeni geometrici e meccanici, senza che sia possibile affrontare ricerche fisiche, chimiche o fisiologiche..."

"Cours de Philosophie Positive" - Auguste Comte (1835)