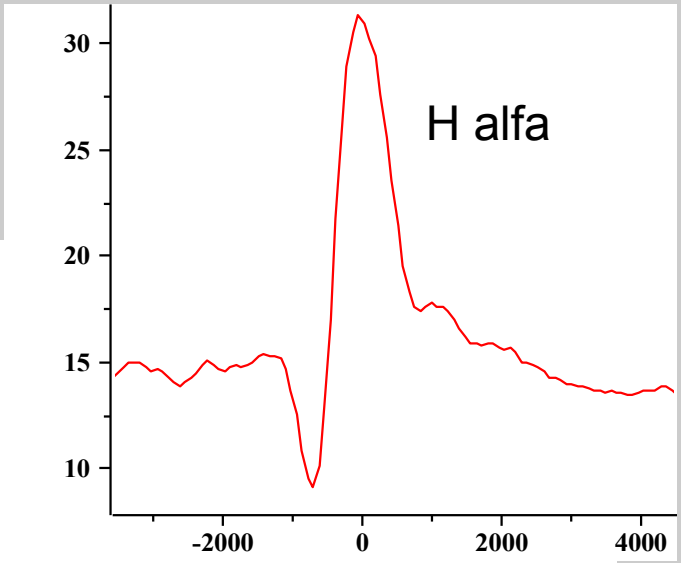
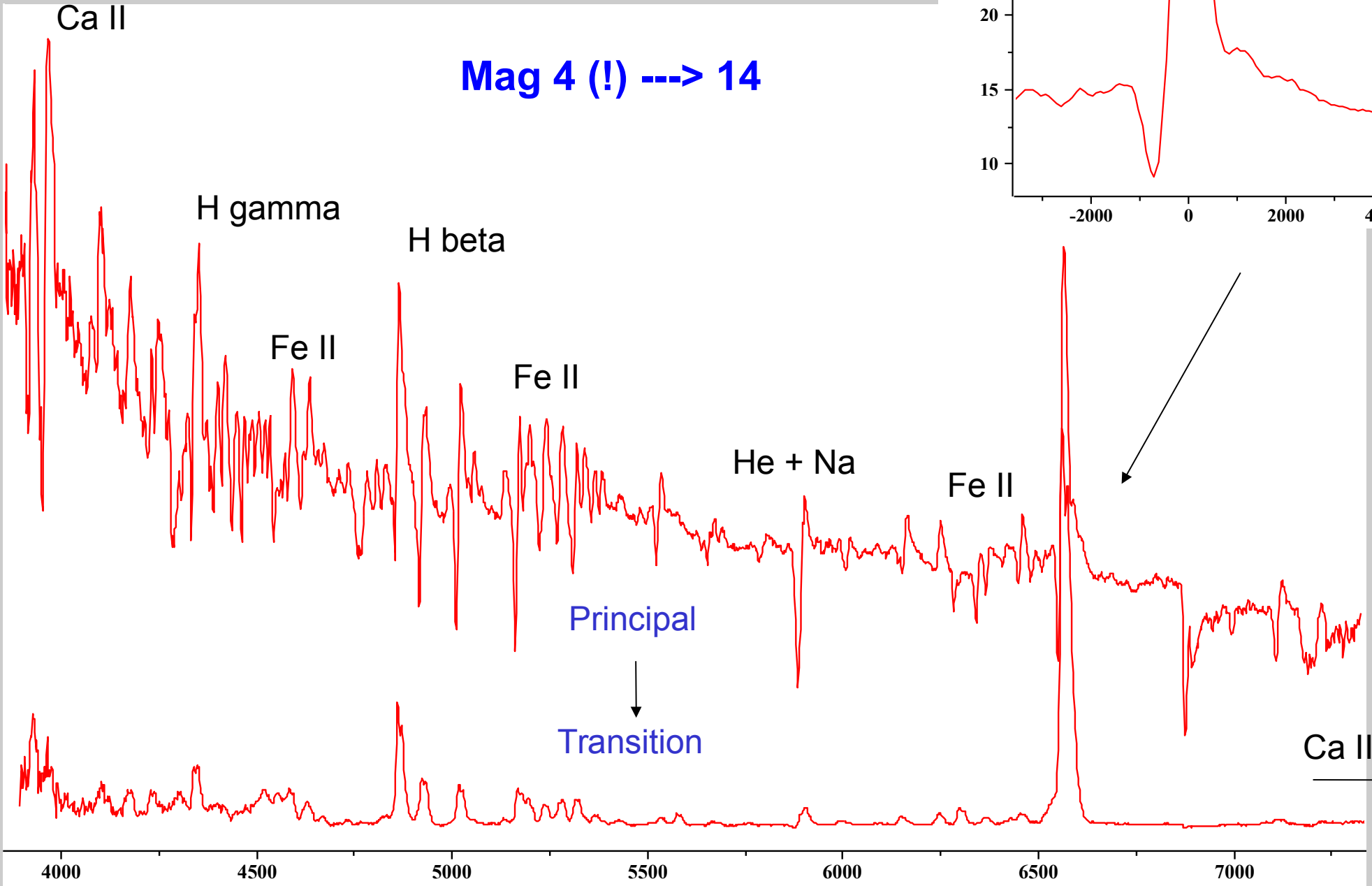
Spettroscopia: Calibrazioni, caratteristiche del proprio spettrometro, scelta delle condizioni operative.
Preparazione ad una notte osservativa.

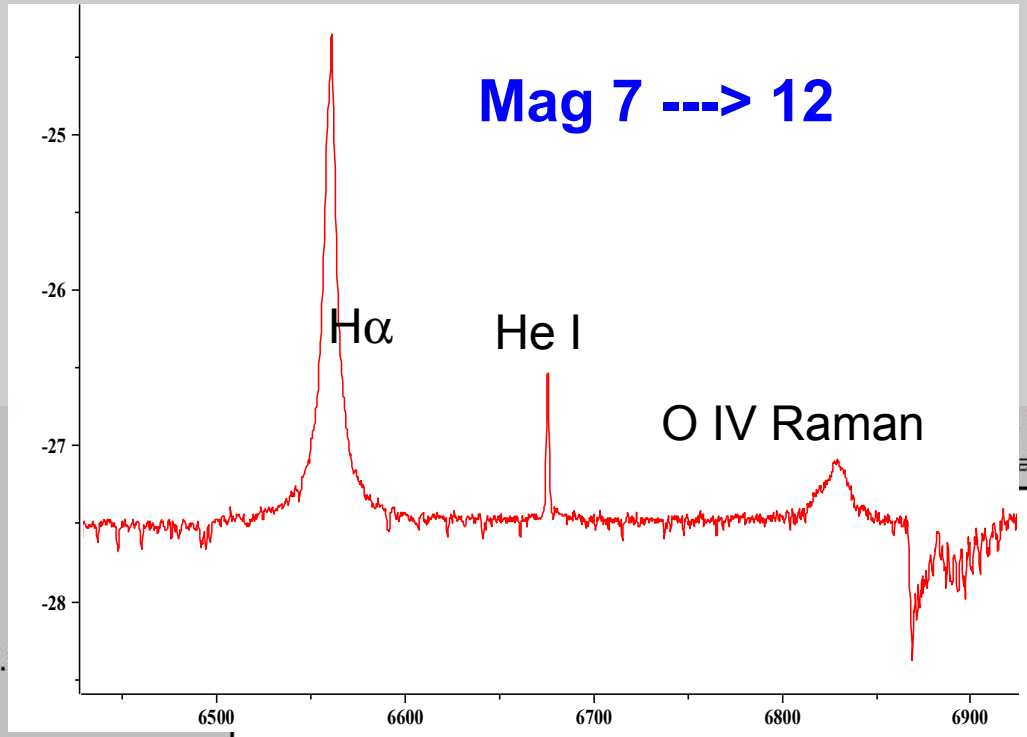
Paolo Valisa - Oss. Astro Schiaparelli - Varese

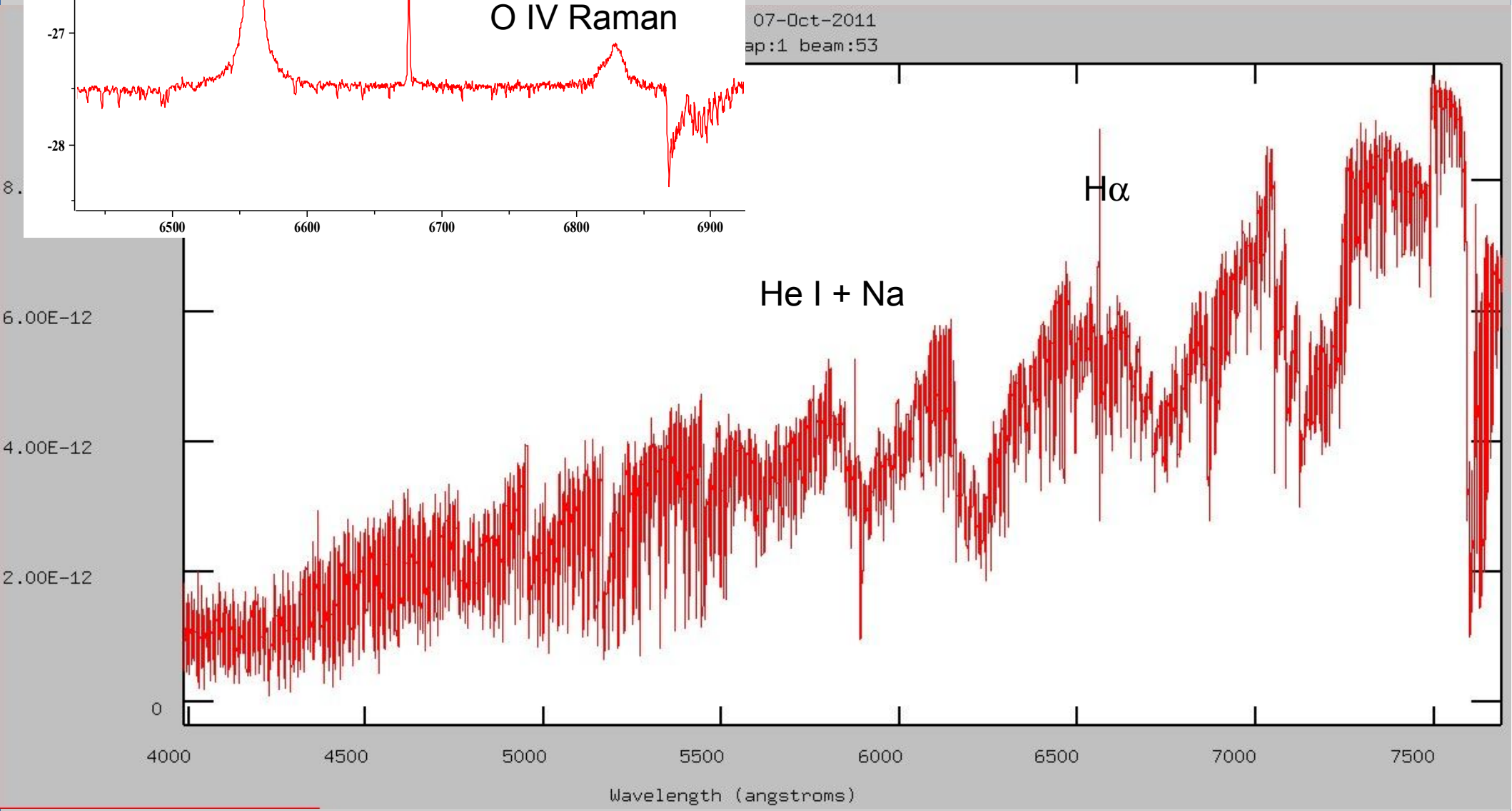
Caratteristiche spettroscopiche dei target di ANS – Le novae

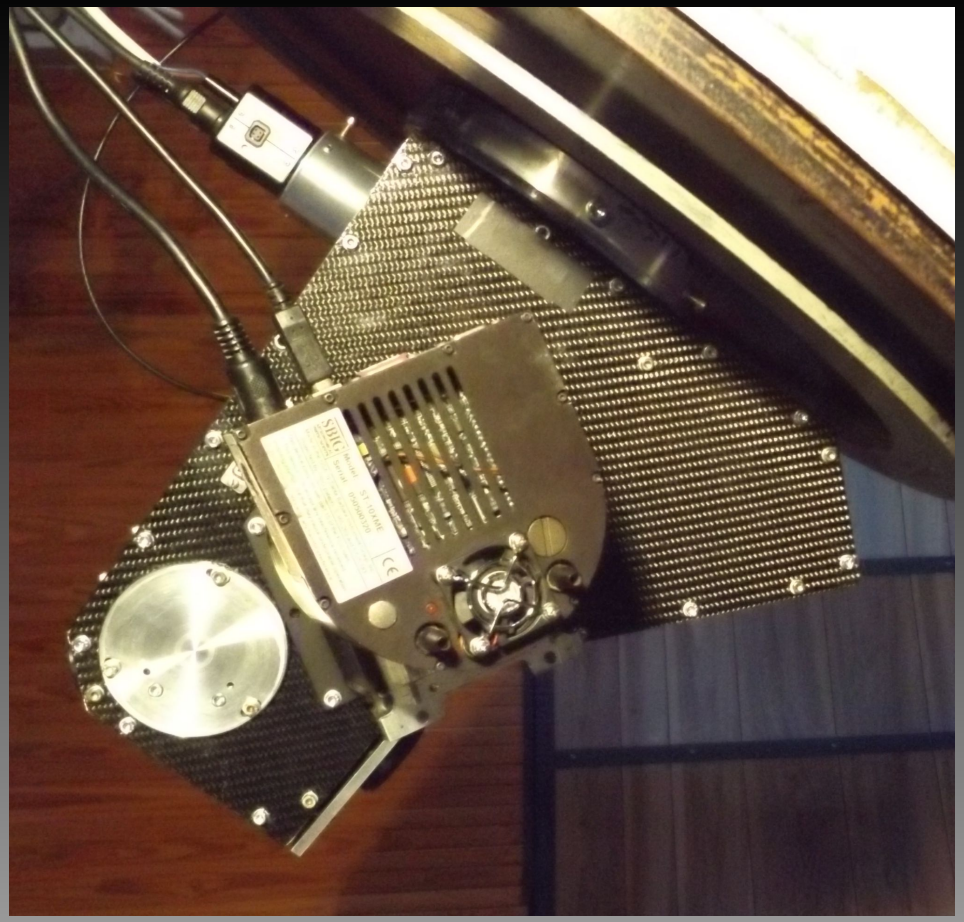




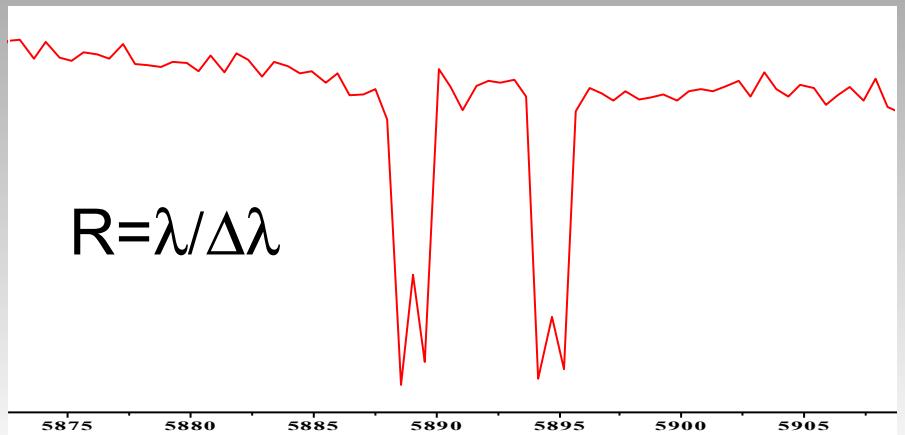
Caratteristiche spettroscopiche dei target di ANS – Le stelle simbiotiche







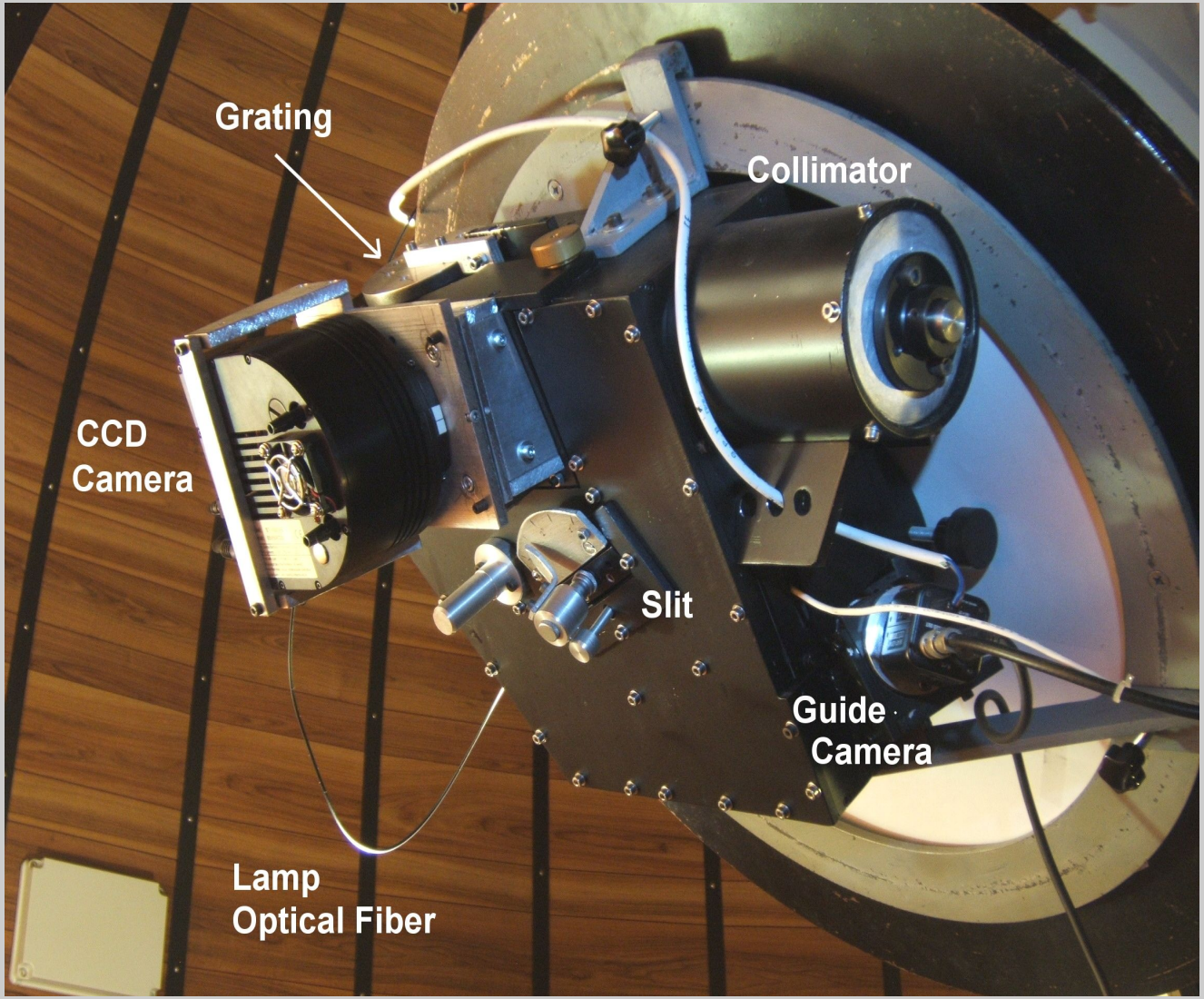
Risoluzione, intervallo spettrale coperto



Spettrografi commerciali:

Lhires, Alpy, Dados

Lo spettrografo del 60 cm. Lo useremo in bassa dispersione – Long Slit



Dispersione 2,8 A/pix

R=1200 (slit 2.5”)

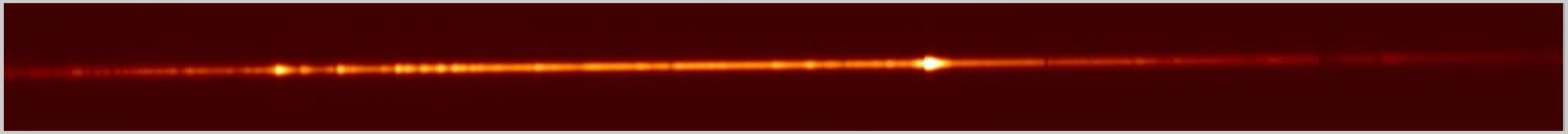
W1=4100 – W2=8700

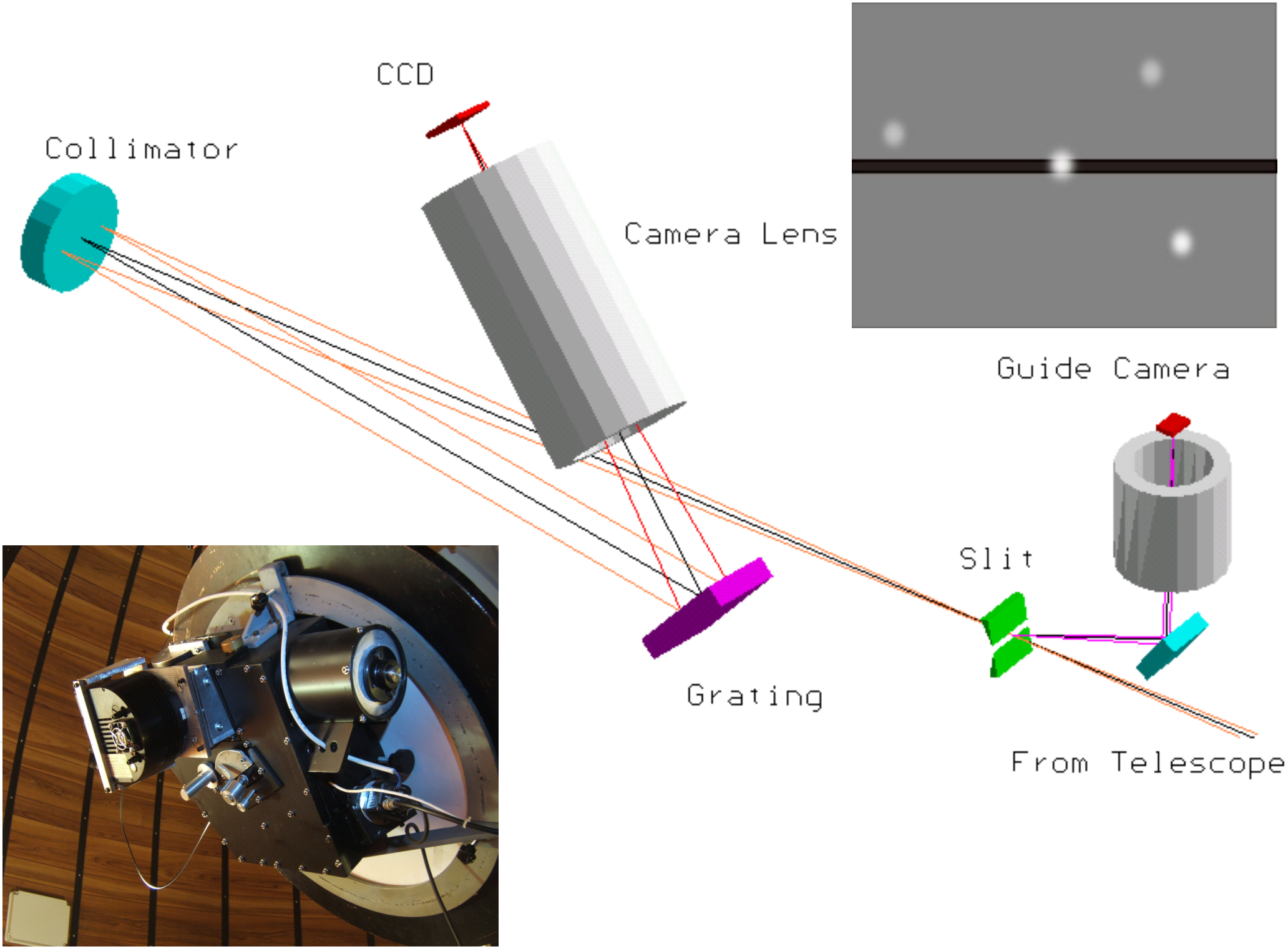
Possibilità di ruotare

Fenditura regolabile per il seeing

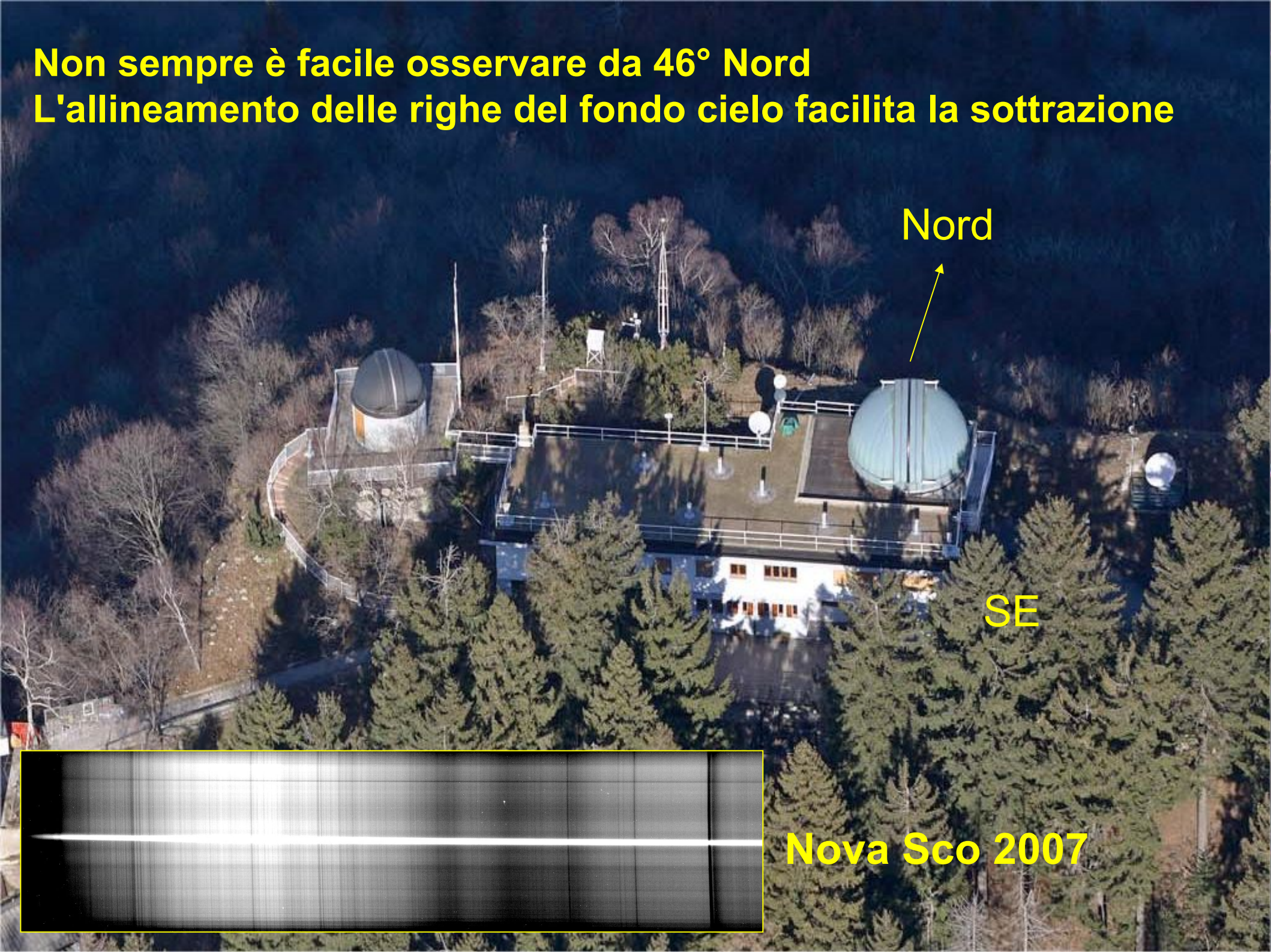
Lampada Ar – Ne

Fuoco sul CCD regolabile.

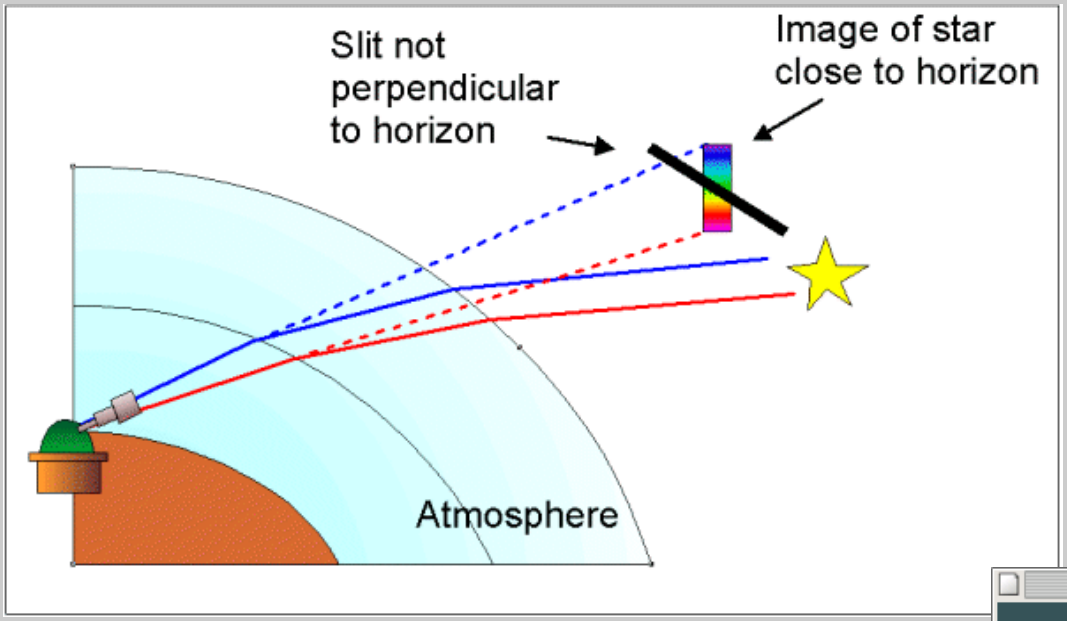


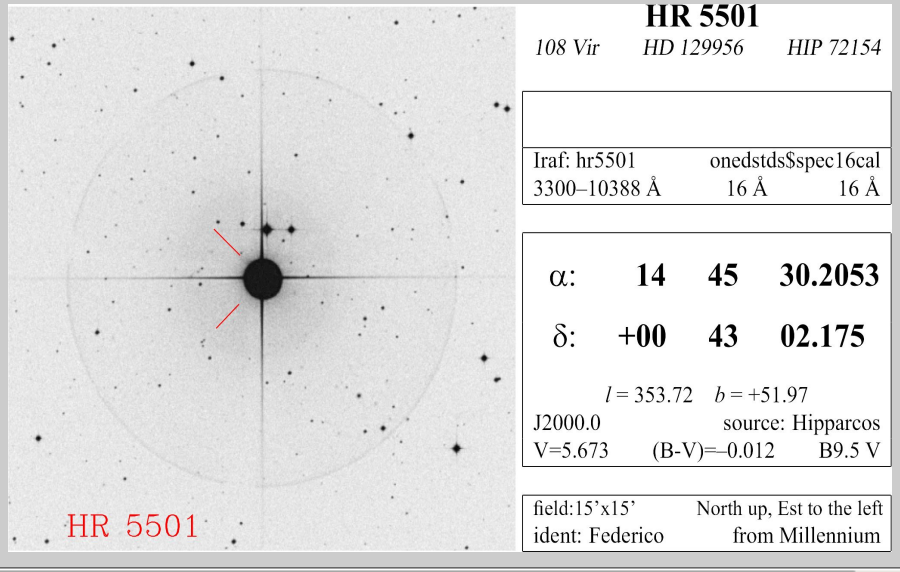

CCD
Collimator
Camera Lens
Guide Camera
Slit
Grating
From Telescope

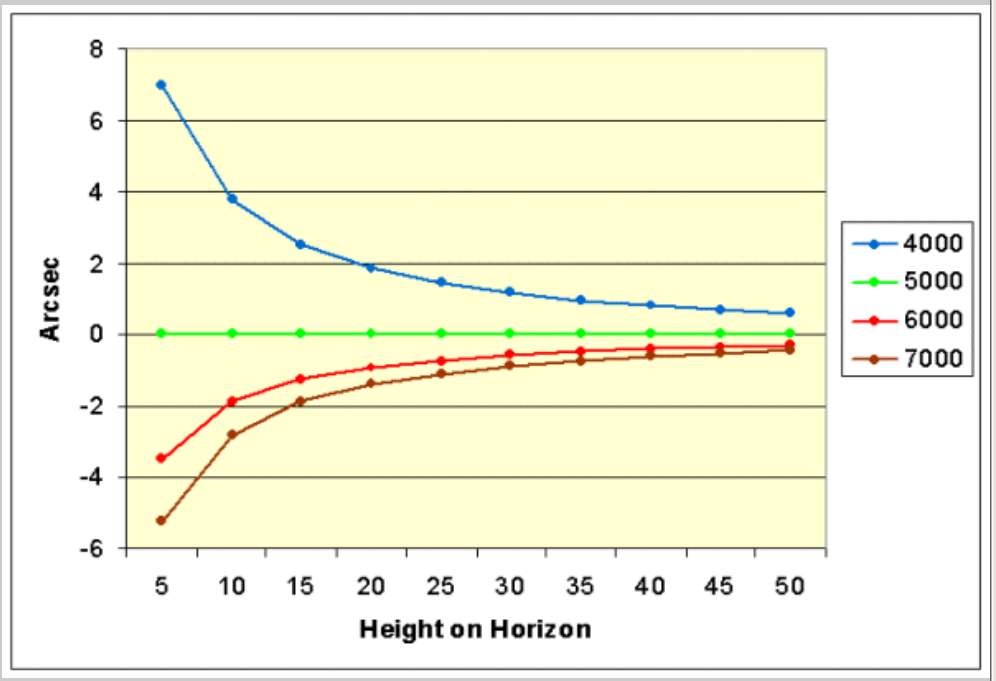
Non sempre è facile osservare da 46° Nord
L'allineamento delle righe del fondo cielo facilita la sottrazione

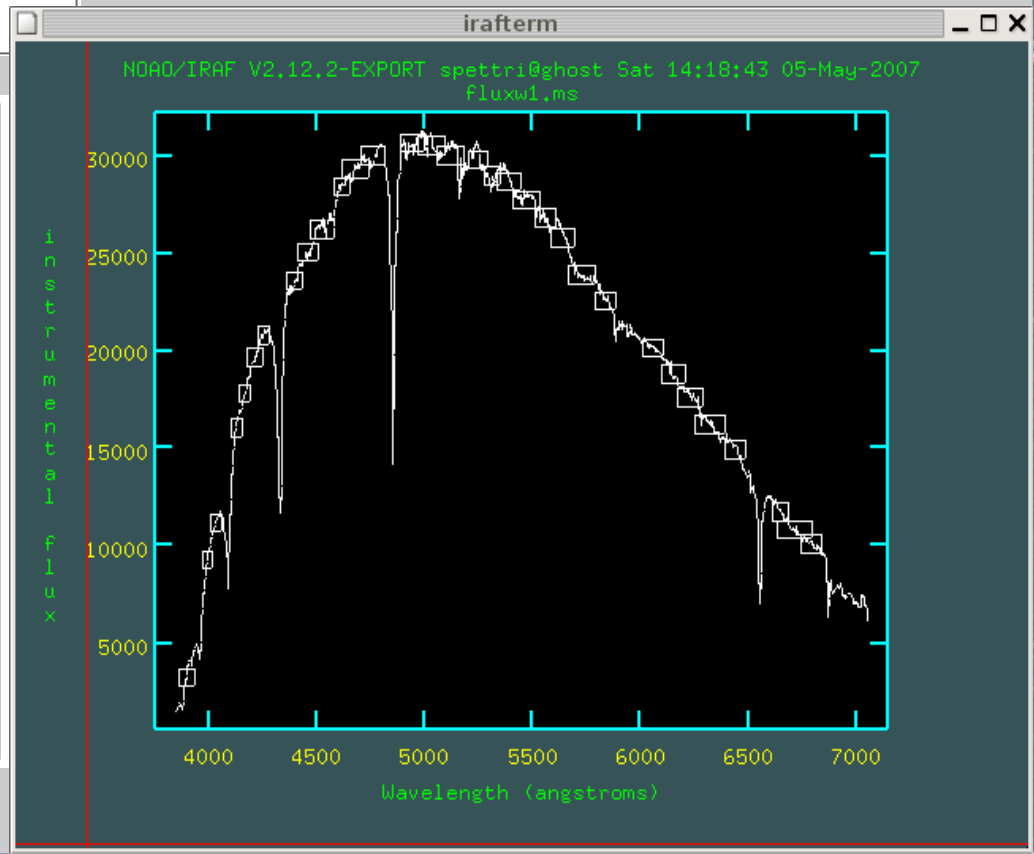


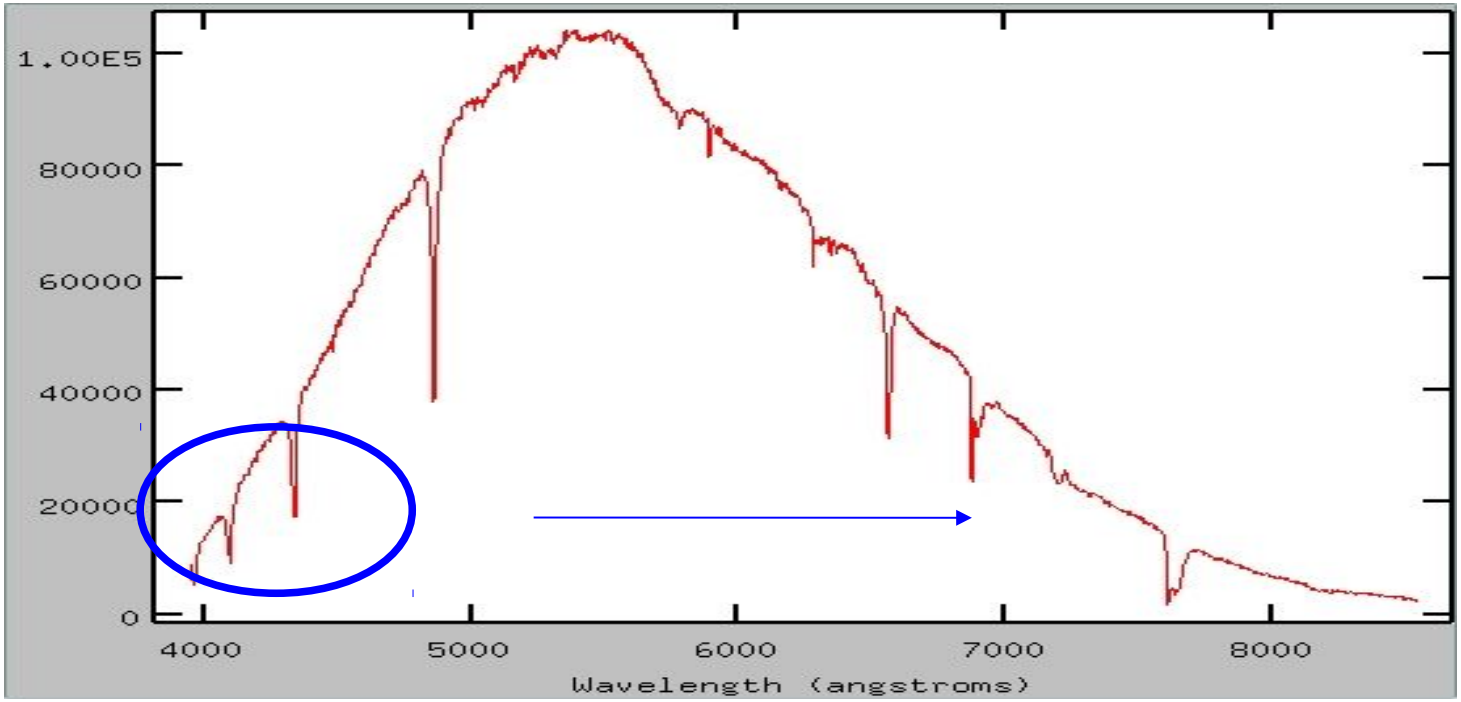
Se il target è basso, rotazione parallattica e attenzione alla standard di flusso!



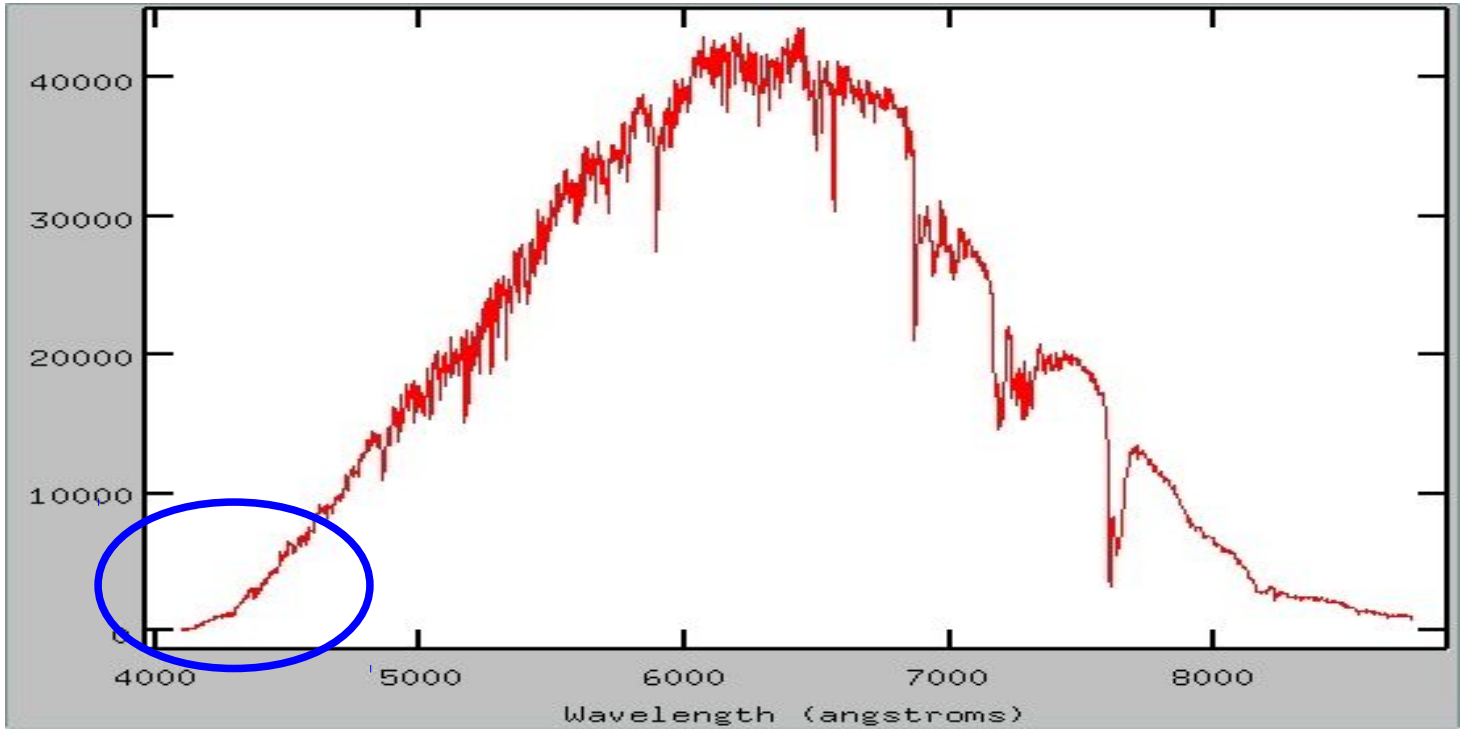








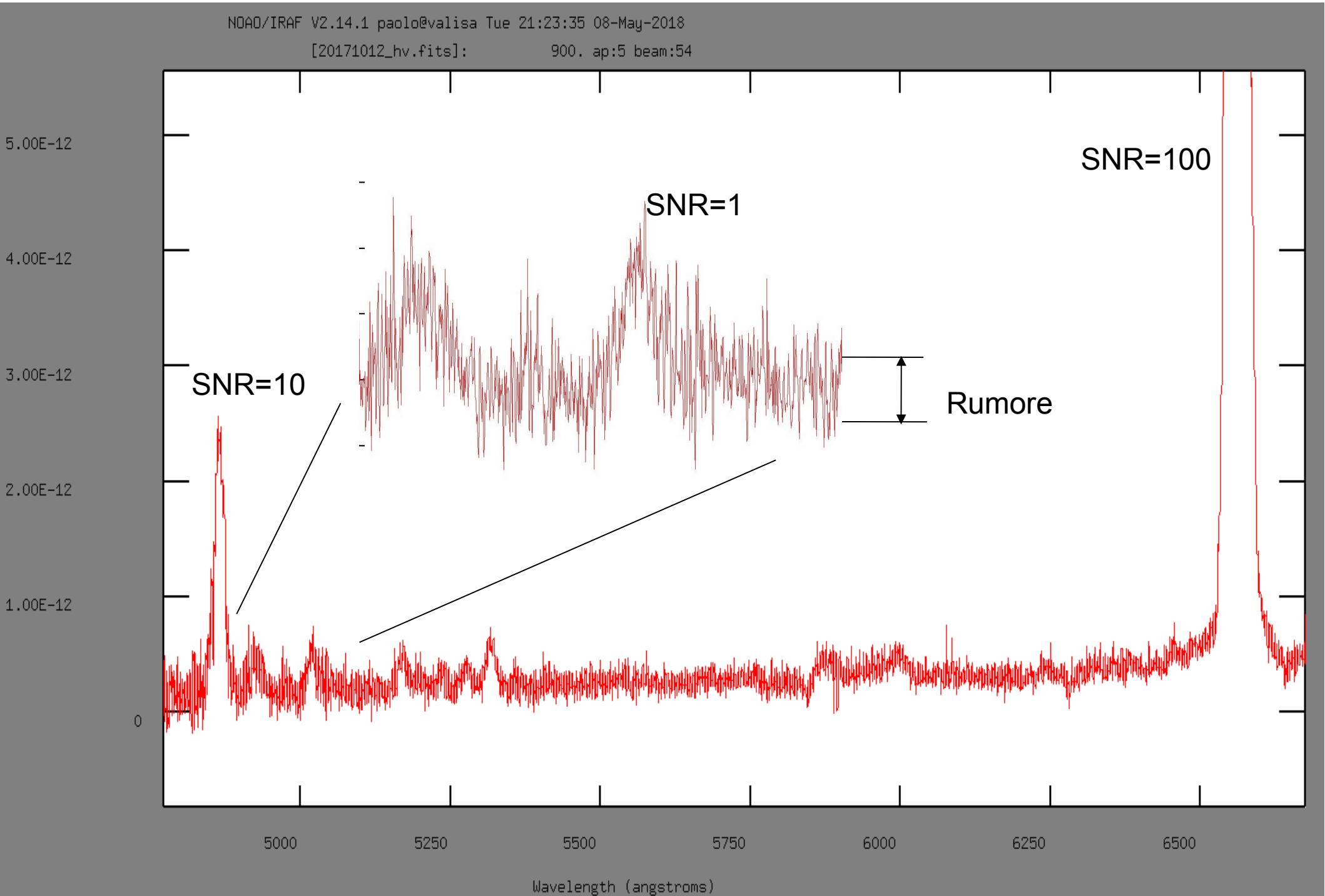
Le standard di flusso di IRAF sono stelle A0, con poche righe ma intense nel blu, con conseguente intensità nel secondo ordine 4000x2=8000

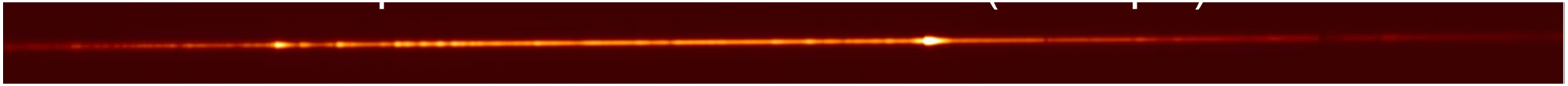


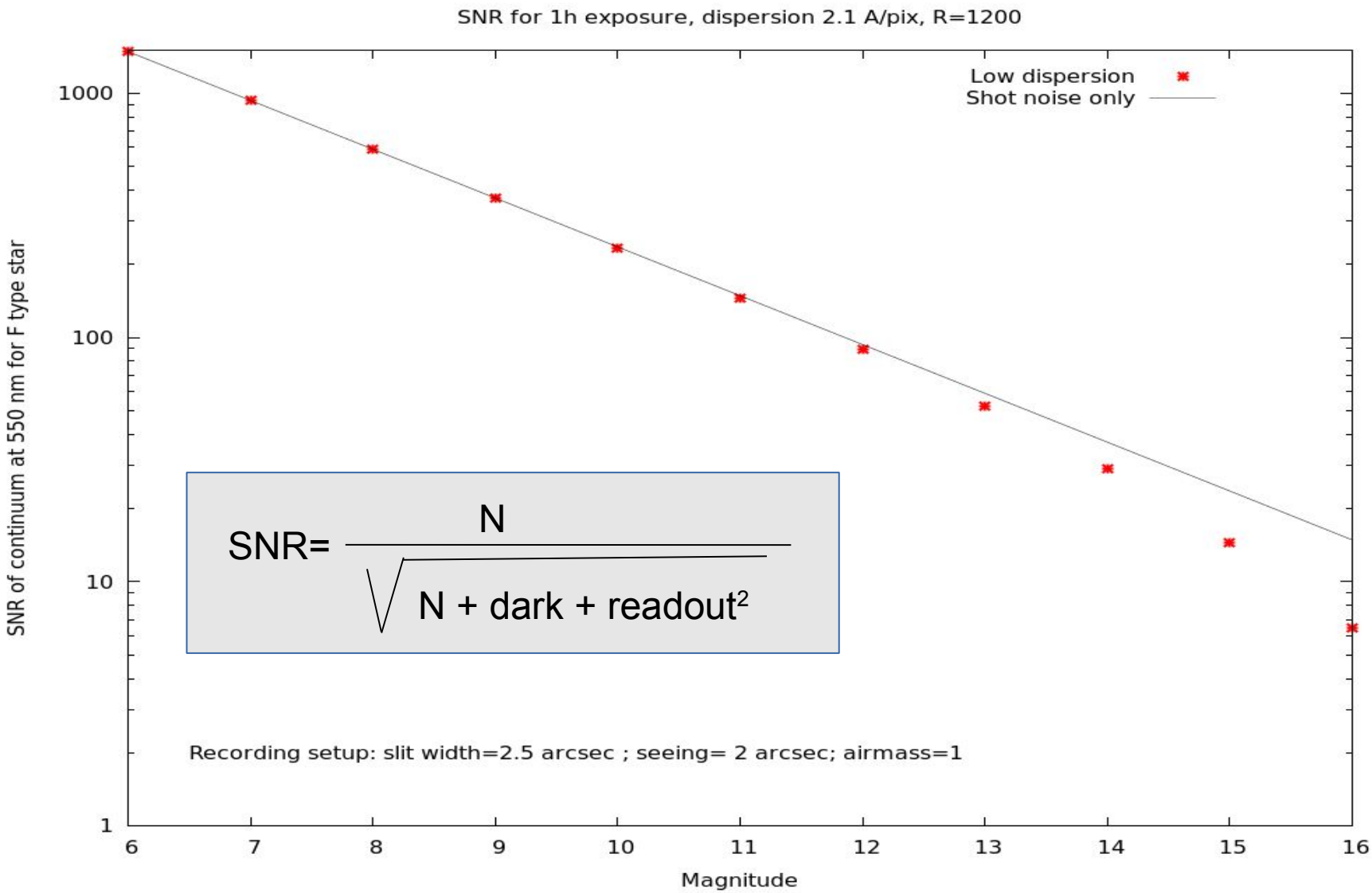
Ulisse ha preparato un set di standard di flusso di classe spettrale KIII, numerose e ben distribuite .

L'intensità nel blu è scarsa e la contaminazione del secondo ordine trascurabile.

La scelta del tempo di esposizione. Il rapporto Segnale rumore in spettrometria





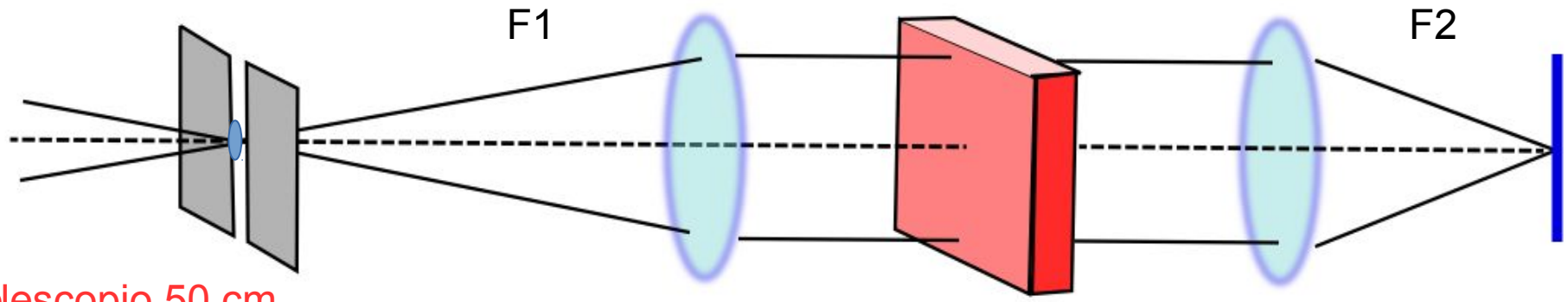


$$SNR = \frac{N}{\sqrt{N + dark + readout^2}}$$

Per target particolarmente deboli, è da considerare un binning 2x2. Deve essere scelto subito, perché il binning a posteriori aumenta il rumore di lettura.

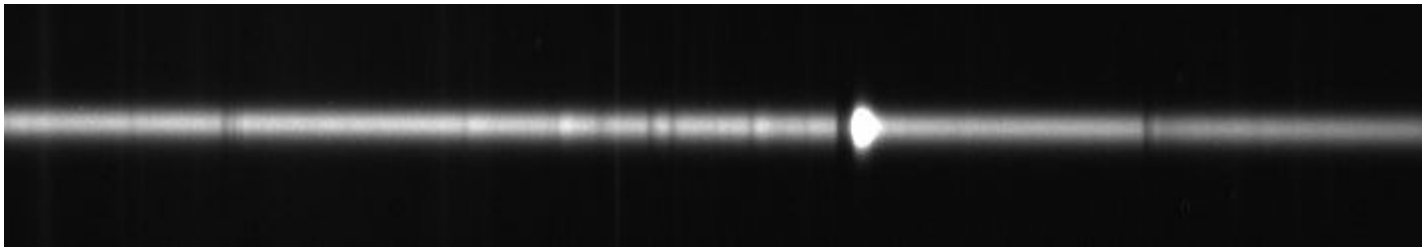
La sensibilità al seeing

F1/F2=3
2”=50/3=16 μm = 2 pix sul rivelatore

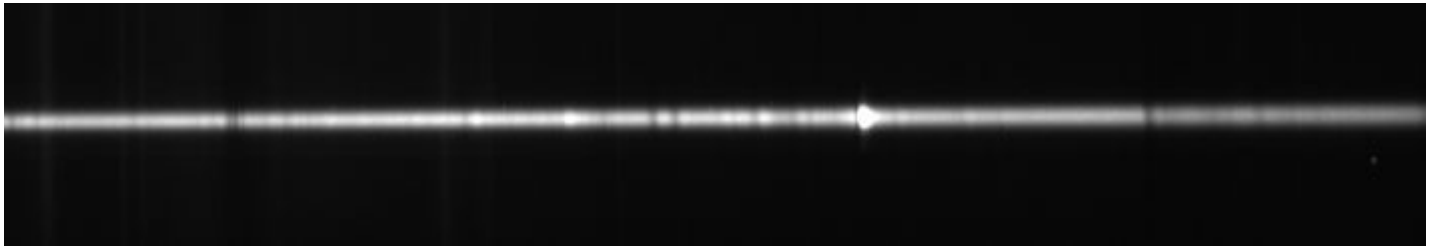


Telescopio 50 cm
Fenditura 2”=50 μm @f10

Per telescopi con diametri > 40 cm il seeing spesso limita la luce che può entrare in fenditura, e si deve scegliere se perdere risoluzione (allargando la fenditura) o segnale.
La scelta deve essere fatta all'inizio. Non si può cambiare setup durante le pose.



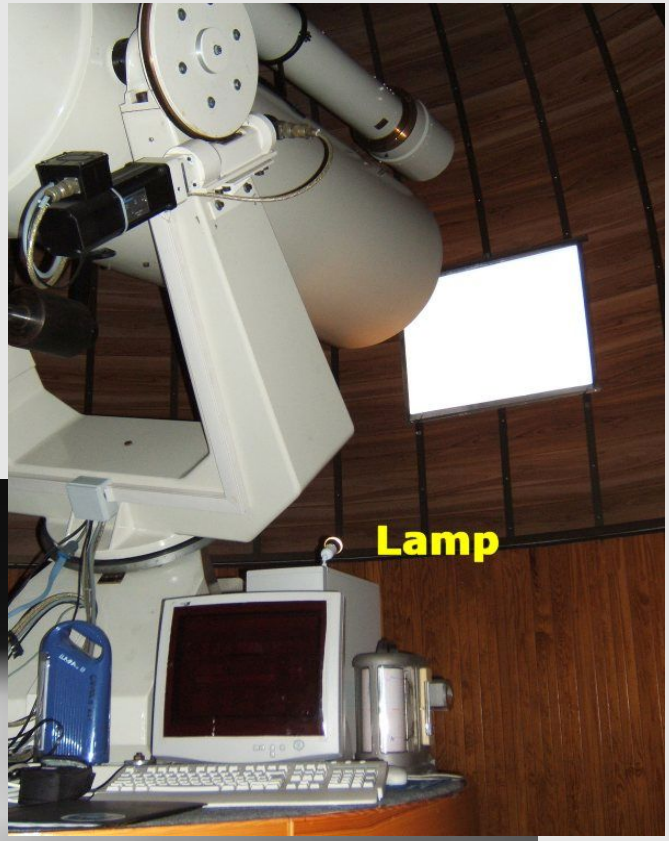
Seeing 8”
(+righe=+rumore)

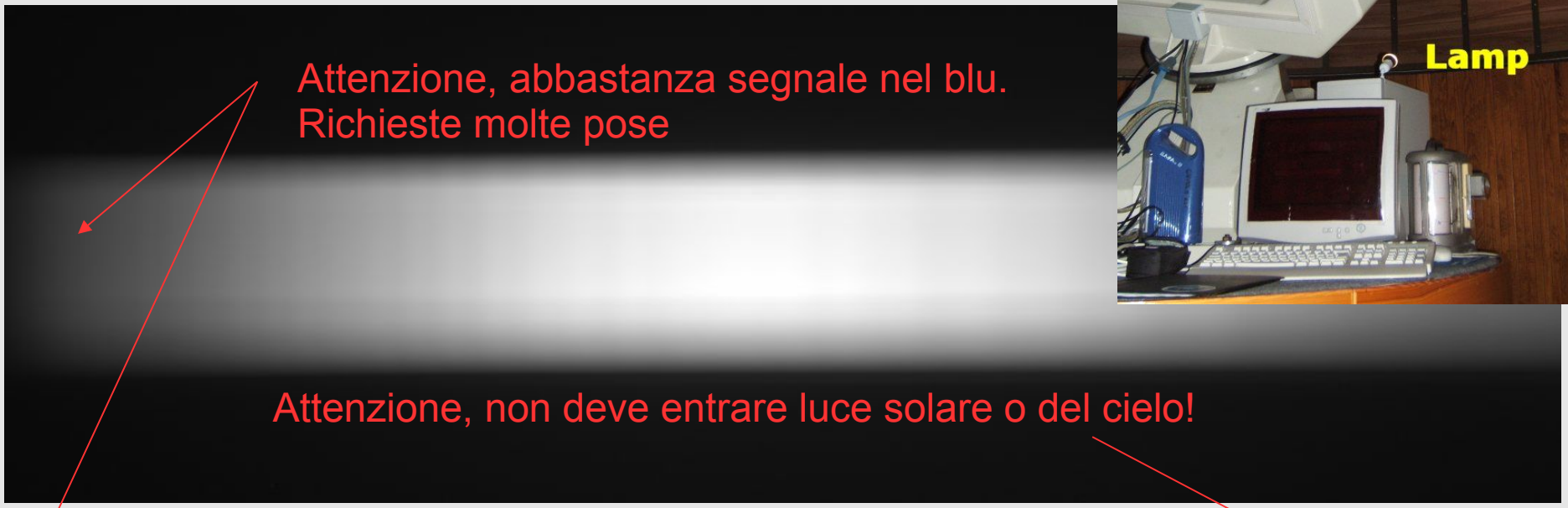


Seeing 2”

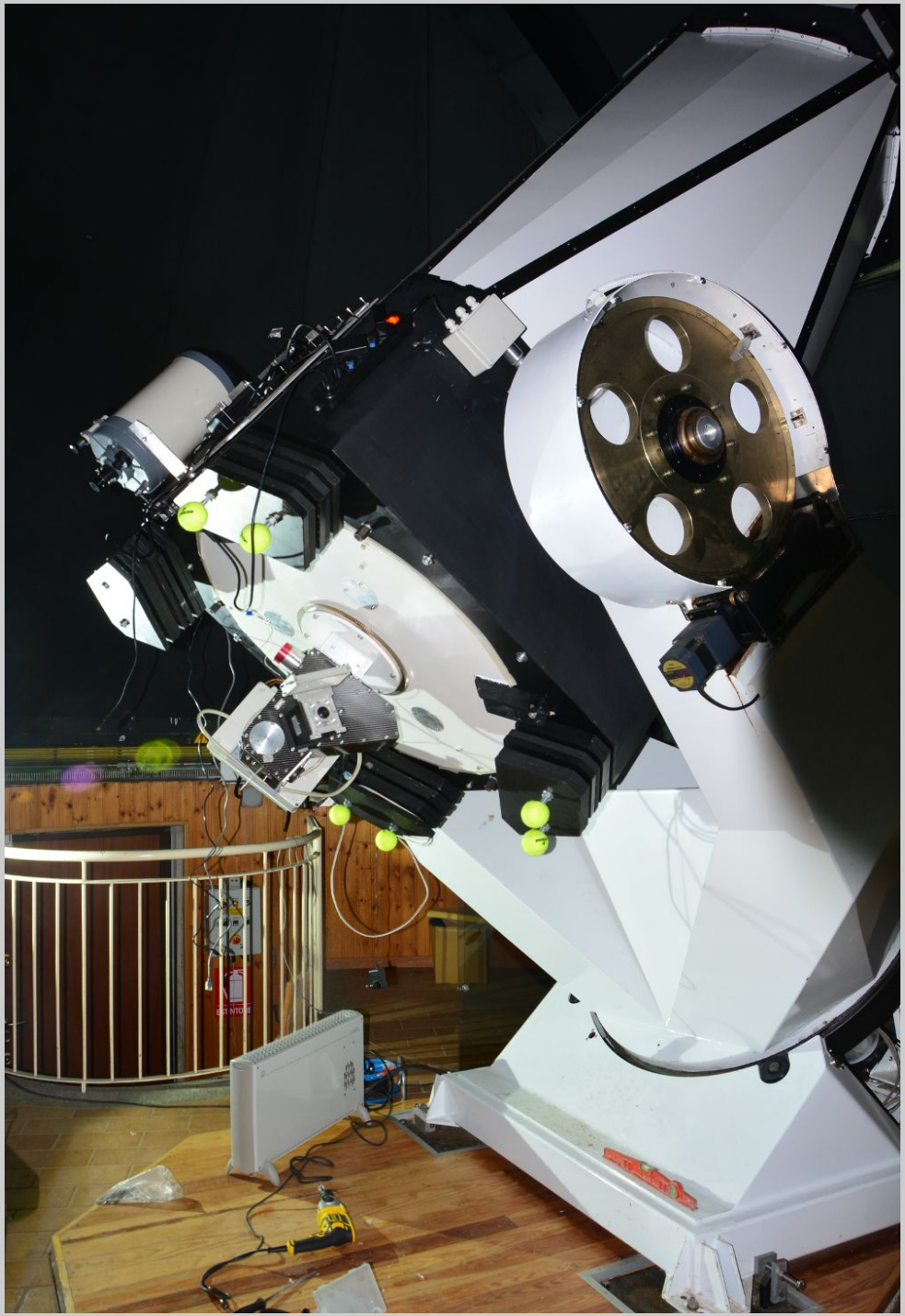
Acquisizione del flat.

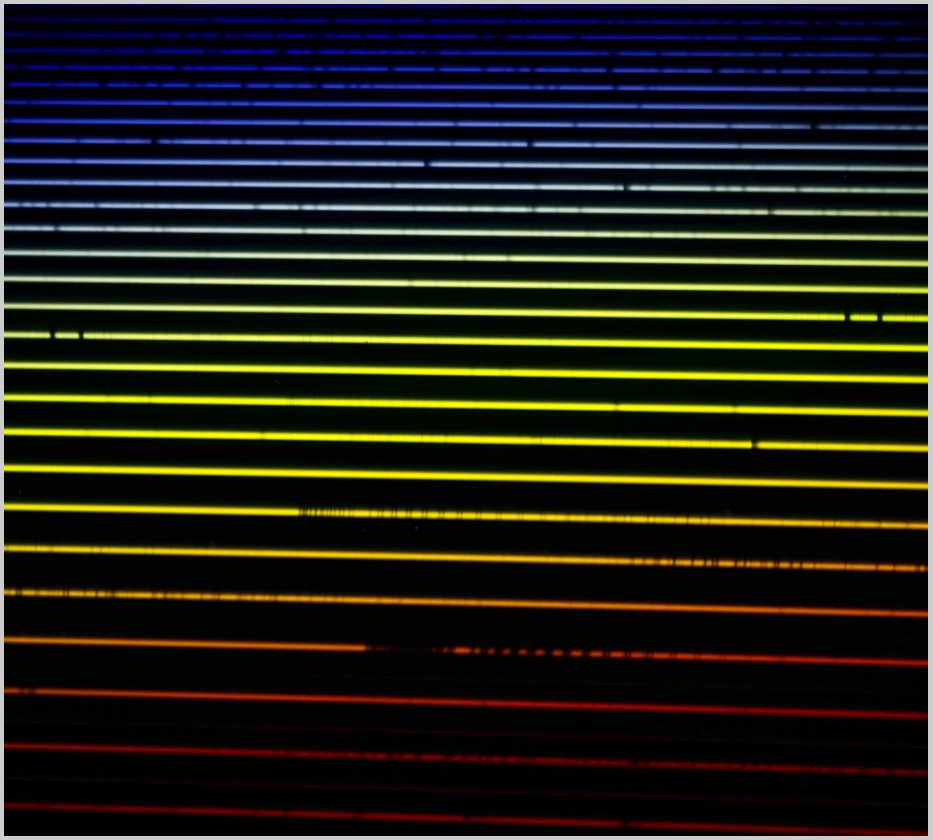
Il fringing è molto elevato nell'IR per i CCD back illuminati, poiché il silicio diviene semitrasparente. Con fasci molto aperti (nel nostro caso F2.5), diviene trascurabile.





Lo spettrografo sul telescopio da 84 cm





Risoluzione 8'000 – 15'000

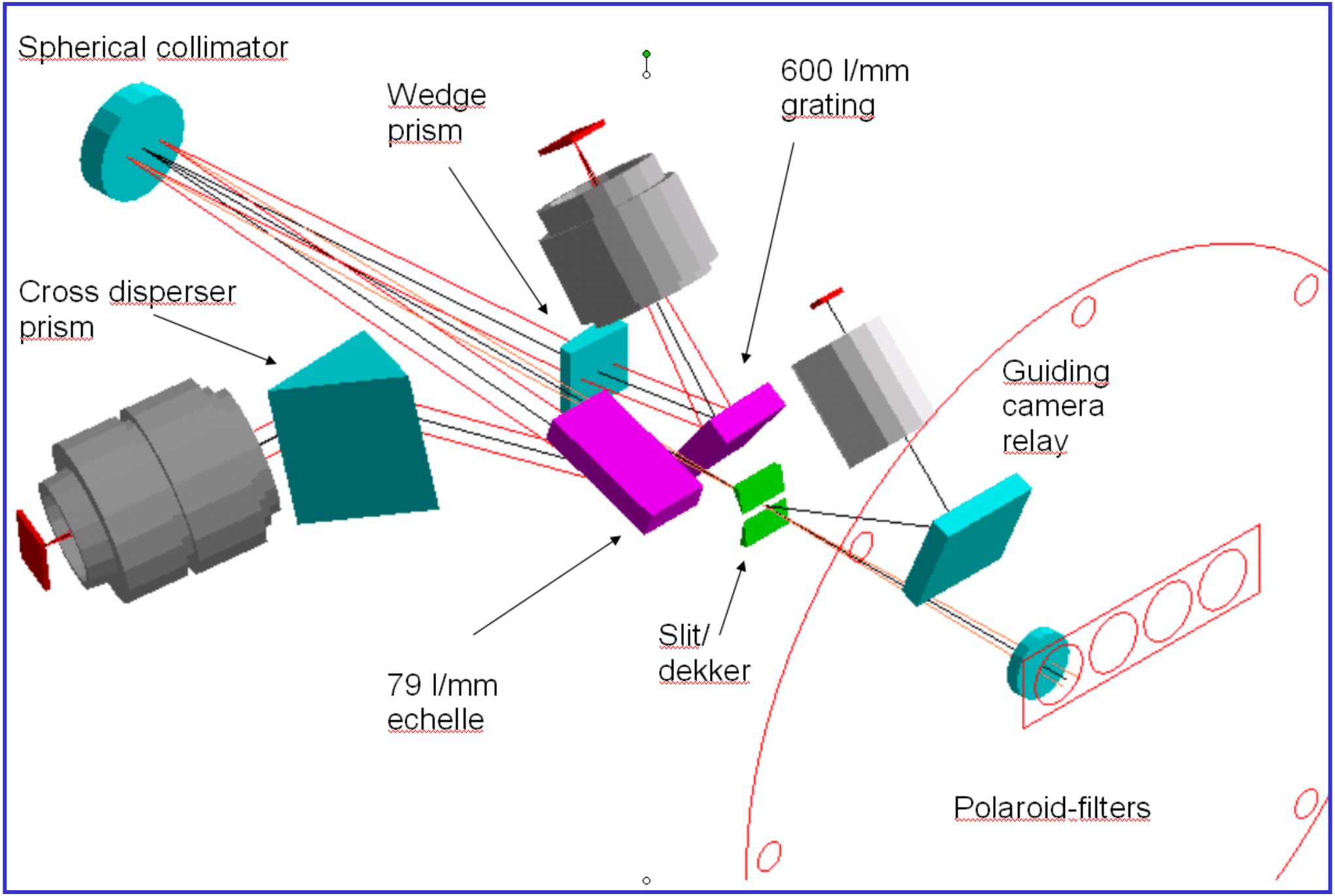
Dispersione 0.15 A/pix o 0.3 A/pix

W1=4100 – W2=8700 A

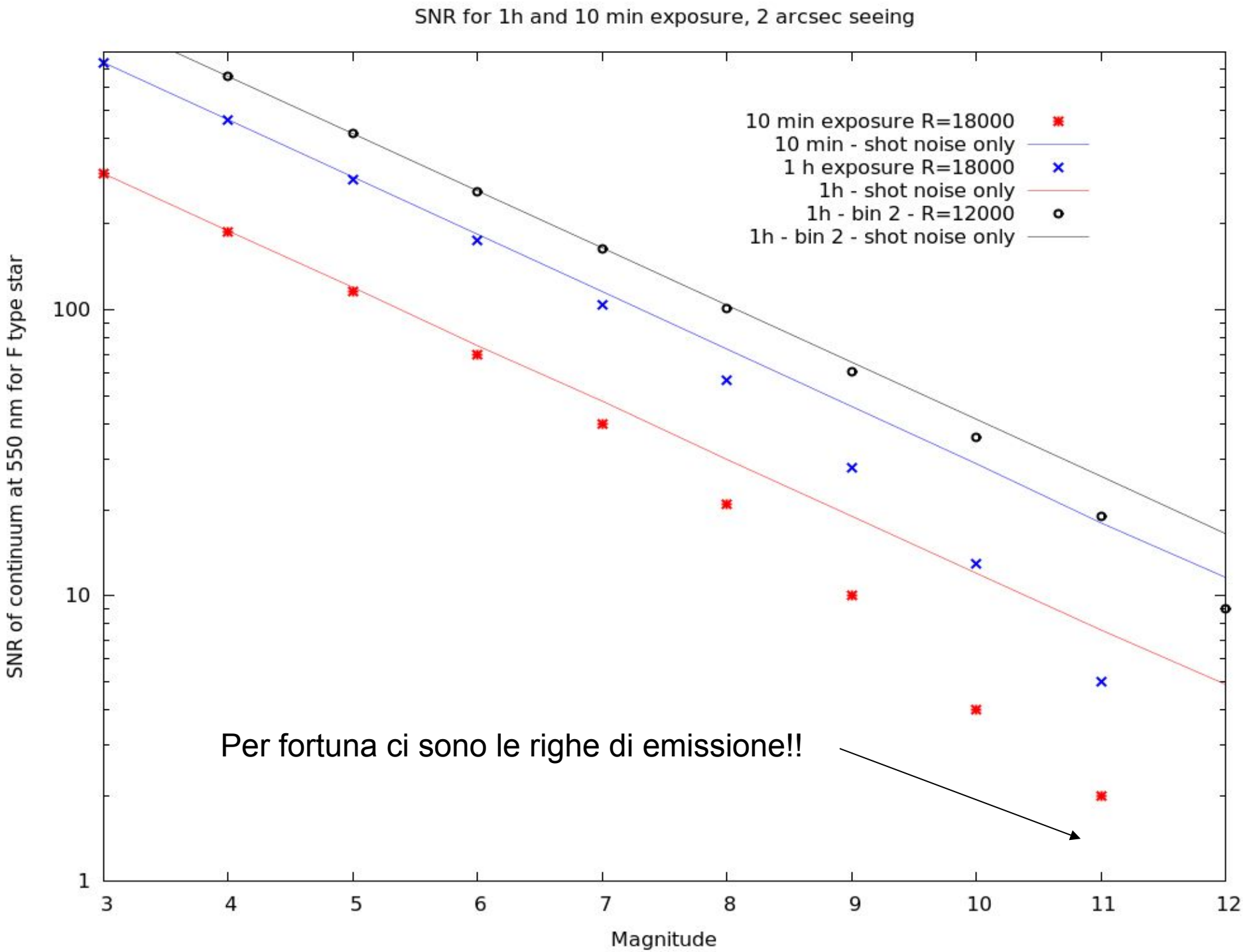
Rotazione per angolo parallattico

Fenditura regolabile per il seeing

Schema ottico spettrografo multimodo echelle – long slit

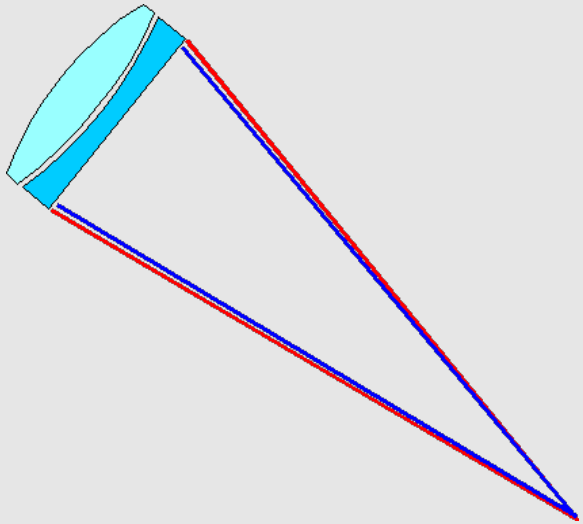


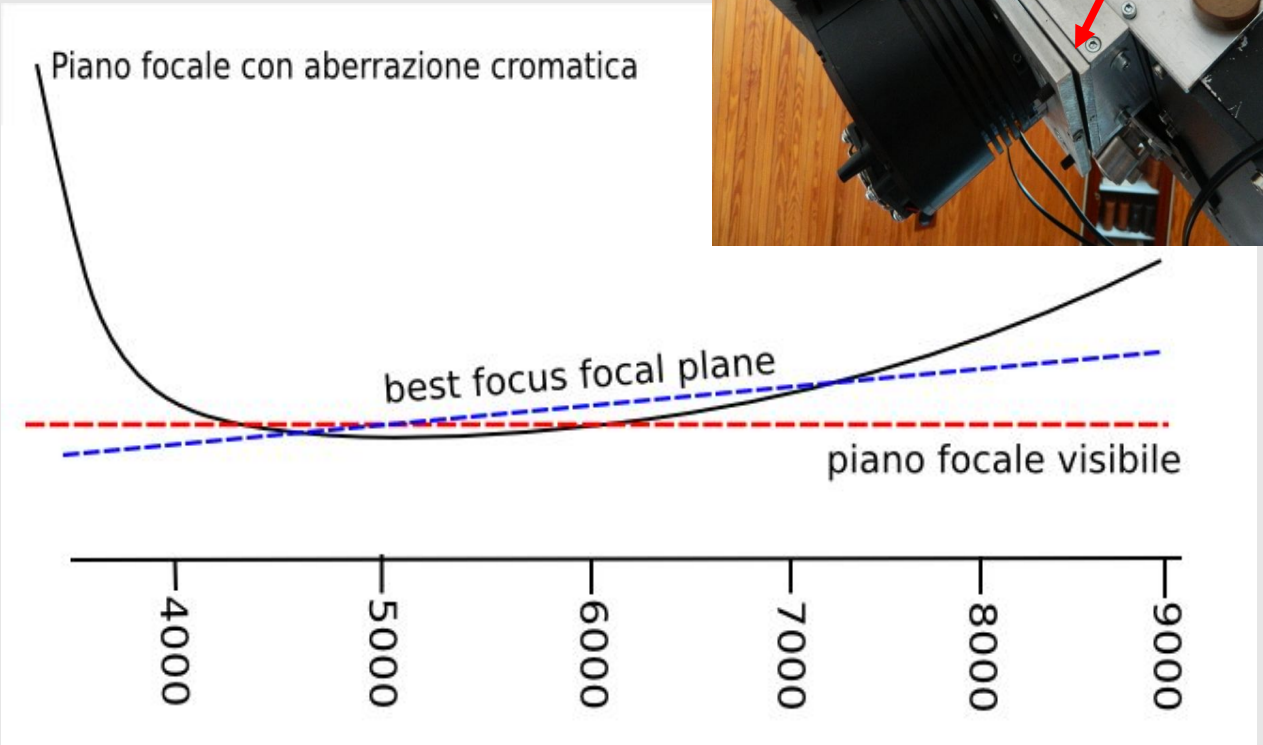
Echelle res. pow. 18,000 3940-8640 Å 30 orders

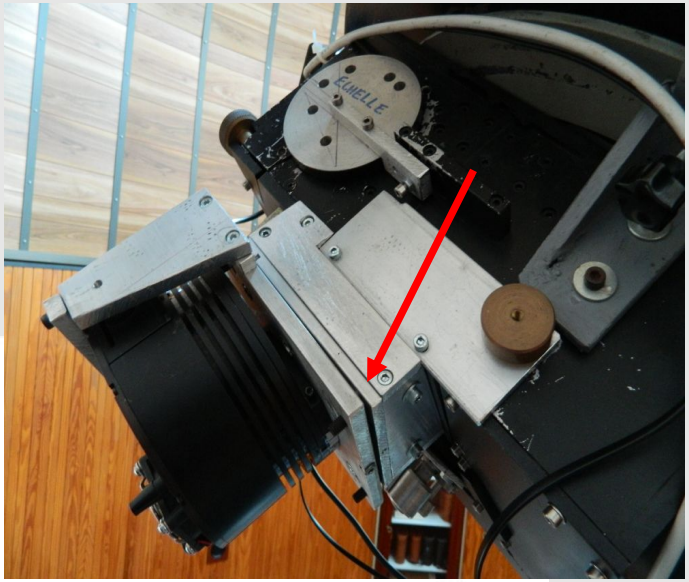


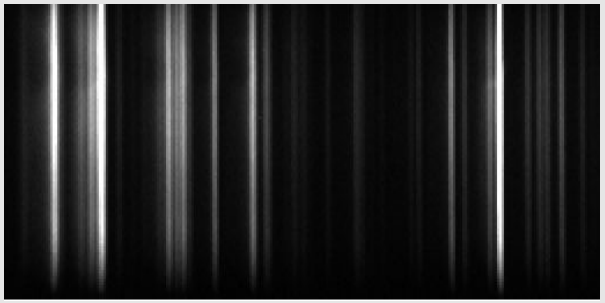
Per fortuna ci sono le righe di emissione!!

Messa a fuoco degli obiettivi fotografici commerciali.
Tilt del piano focale



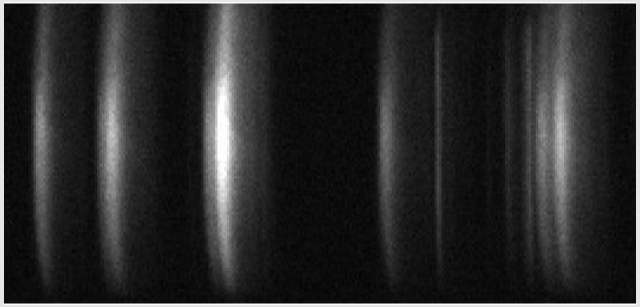






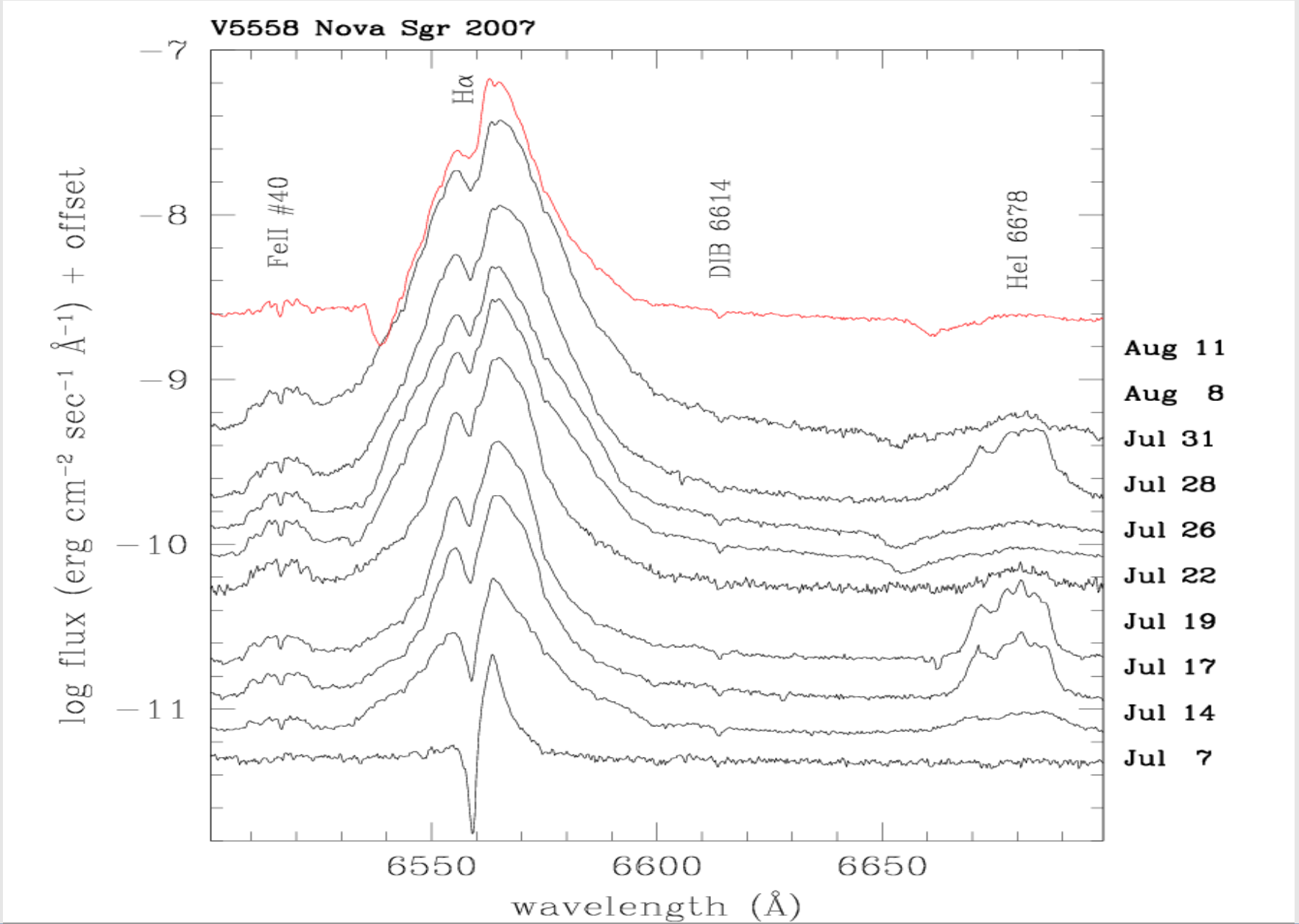
4500

6000

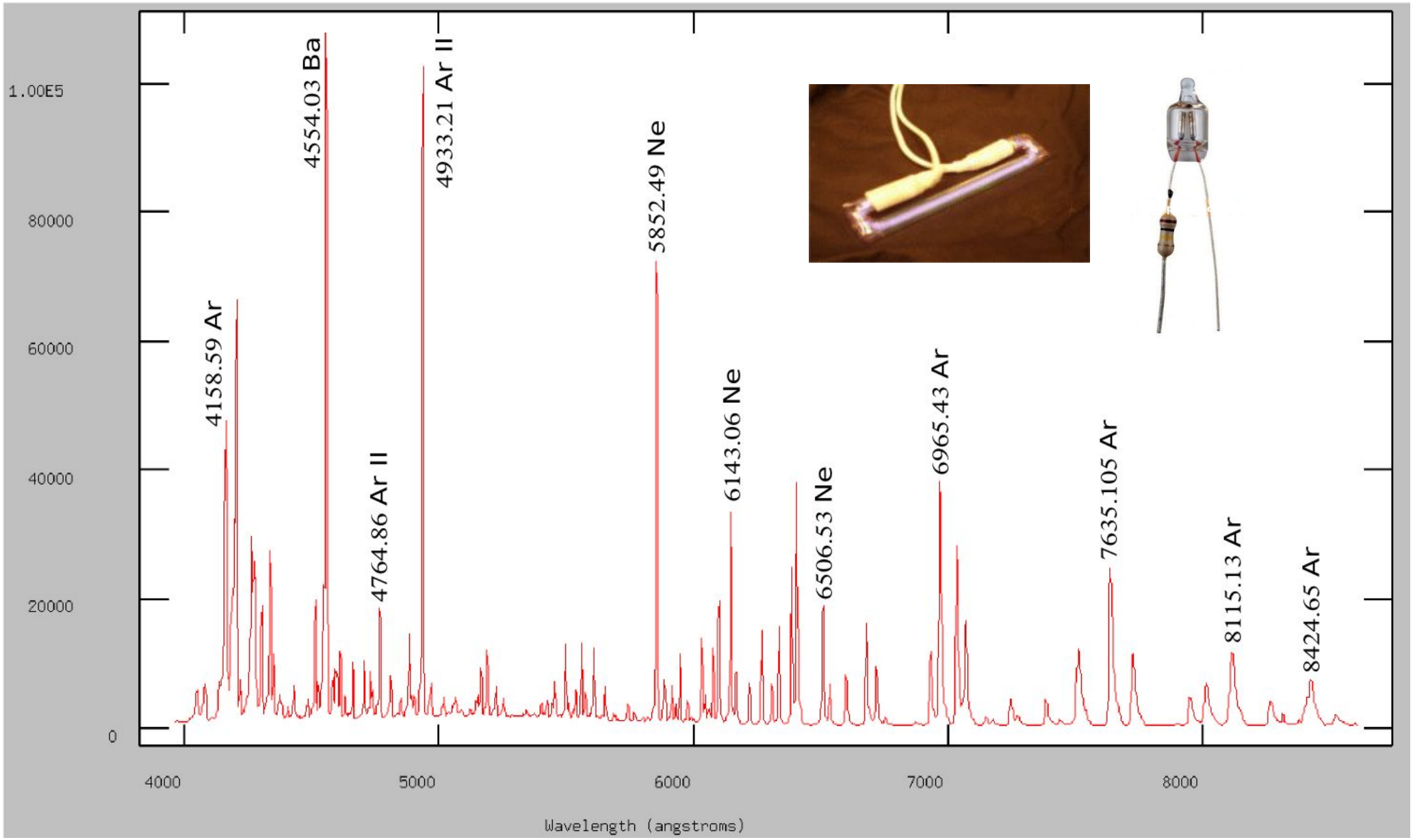


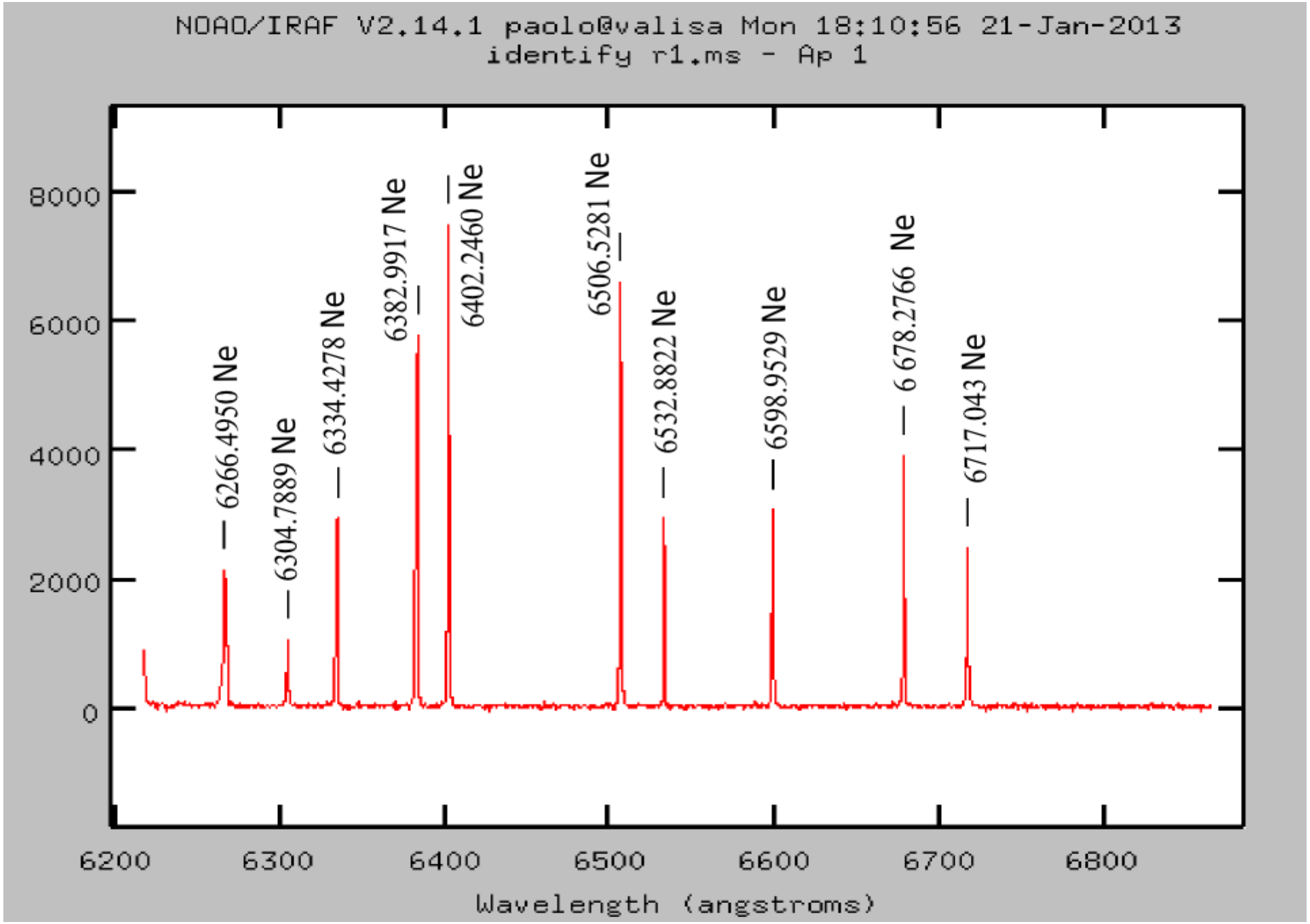
8000

Il problema della messa a fuoco richiede solo una traslazione del piano focale se il campo spettrale è piccolo (ad esempio con reticoli 1800 l/mm o 2400 l/mm tipo LHIRES).
E' però altrettanto utile dedicarsi allo studio dell'evoluzione di una particolare riga spettrale, nel visibile come Halfa o nel IR come K I interstellare.



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





Se si lavora su un intervallo ristretto di lunghezze d'onda le righe non sono numerose

La sequenza di acquisizione degli spettri:

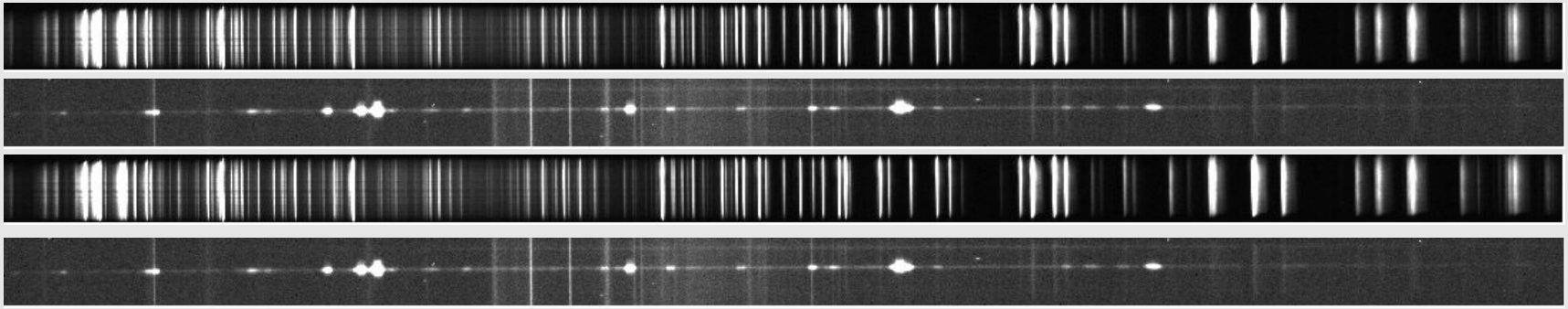
1) Flat, flux standard + lamp.

2) Lamp

3) Science

4) Lamp

5) Science

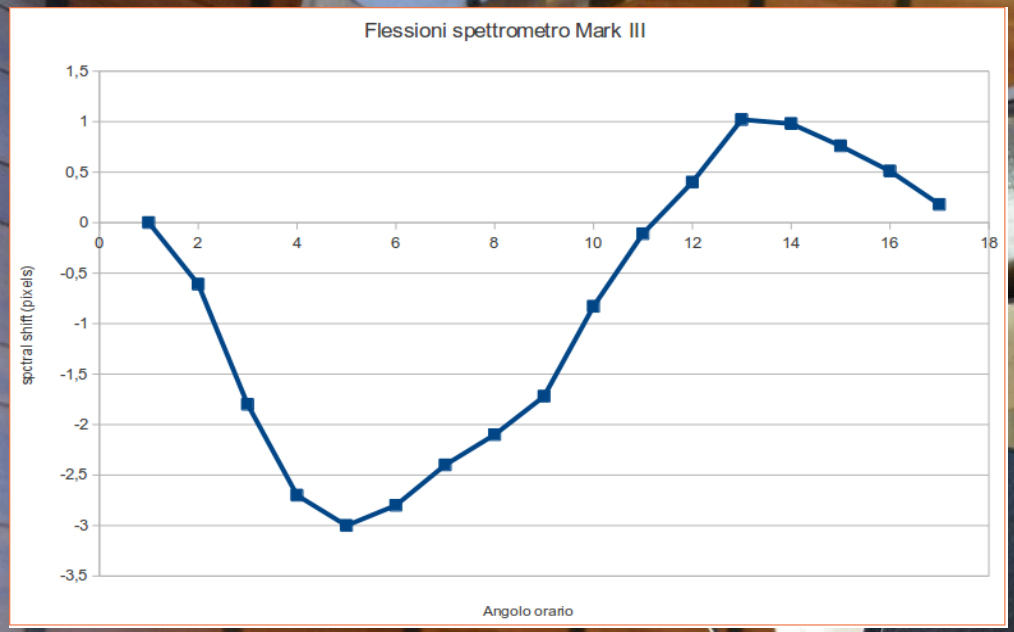


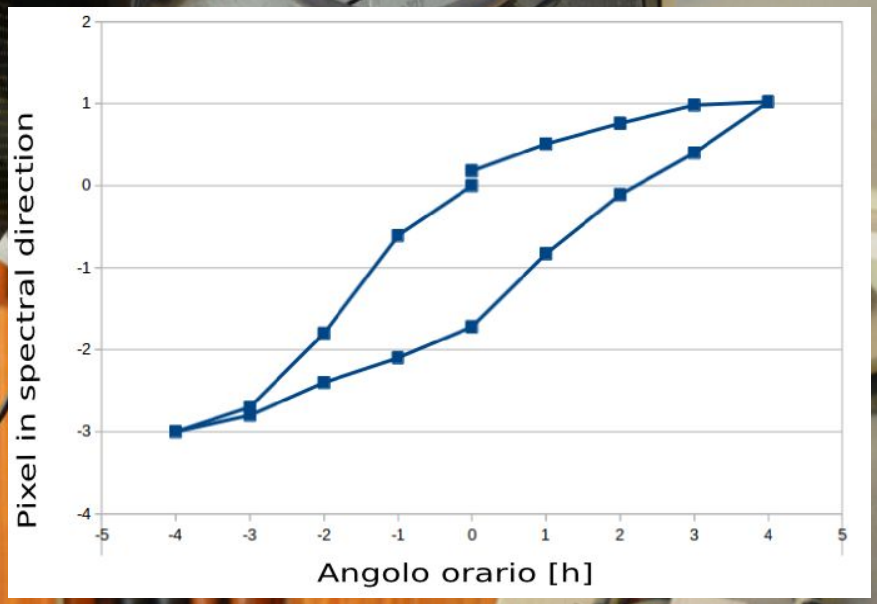
L'acquisizione di almeno 3 spettri science è fortemente raccomandata poiché è possibile farne la mediana ed eliminare eventuali cosmici

Considerazione sul massimo tempo di posa:

non deve eccedere il tempo di saturazione dei pixel caldi del CCD, altrimenti il masterdark nonè scalabile correttamente (900 sec per SBIG St10).

Nel caso di misure di precisione delle lunghezze d'onda non deve eccedere il regime lineare delle flessioni meccaniche. Altrimenti non vale più fare la media tra la lampada prima e quella seguente la posa (600 sec per il nostro spettrometro).





1 pixel=0,15 A = 7.5 km/sec

Scelta standard di velocità radiale

A&A 552, A64 (2013)
DOI: 10.1051/0004-6361/201220927
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Astronomy & Astrophysics

The catalogue of radial velocity standard stars for *Gaia*

I. Pre-launch release★,★★

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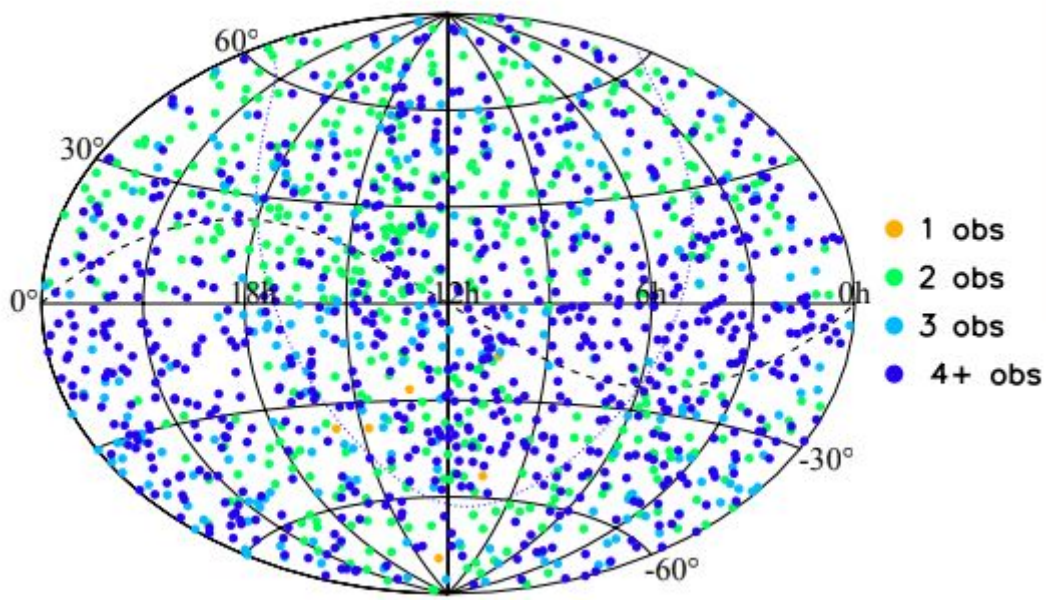
ABSTRACT

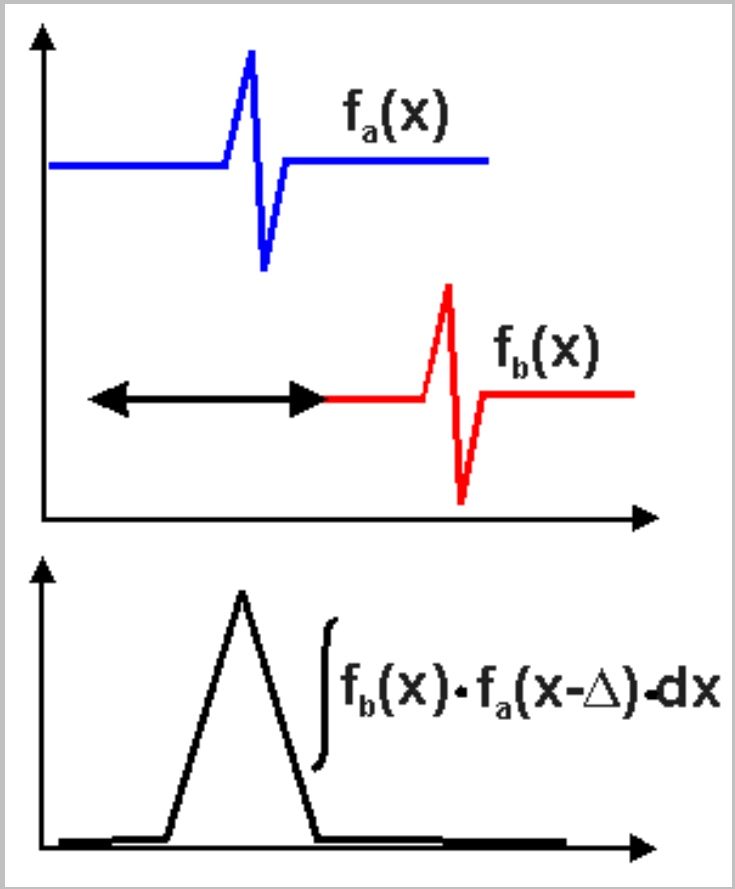
The Radial Velocity Spectrograph (RVS) on board *Gaia* needs to be calibrated using stable reference stars known in advance. The catalogue presented here was built for that purpose. It includes 1420 radial v
to fulfil the *Gaia*-RVS requirements. A large programme of ground-based obs
stars and verify their stability, which has to be better than 300 m s^{-1} over s
spectrographs ELODIE and SOPHIE on the 1.93-m telescope at Observatoir
Bernard Lyot at Observatoire du Pic du Midi and CORALIE on the *Euler*-Swi
Observatory archives have also been retrieved as have HARPS spectra from
the SOPHIE scale for each star, derived from the combination of velocities
estimated their differences in zero points. In total, 10214 radial velocity me
a mean time baseline of 6.35 years, 92.9% of the candidates fulfil a target st
stars are found to be constant at the level of 100 m s^{-1} over 10 years. Compa
for FGK stars, with zero-point differences lower than 100 m s^{-1} and a remar
that the precision of the catalogue presented here is better than this value.
spectroscopic surveys, such as APOGEE, *Gaia*-ESO, HERMES, and LAMO

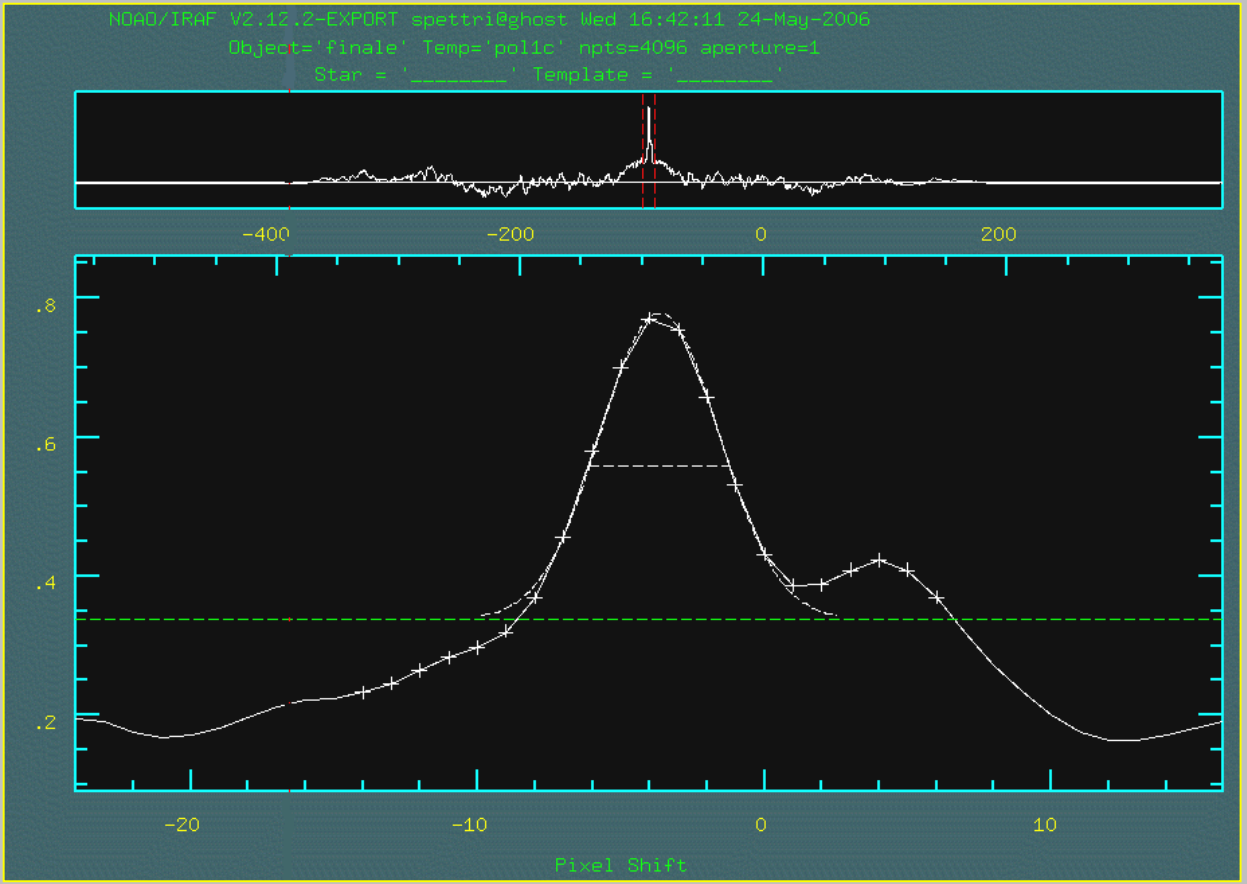
Key words. catalogs – stars: kinematics and dynamics

C. Soubiran et al.: The catalogue of radial velocity standard stars for *Gaia*. I.

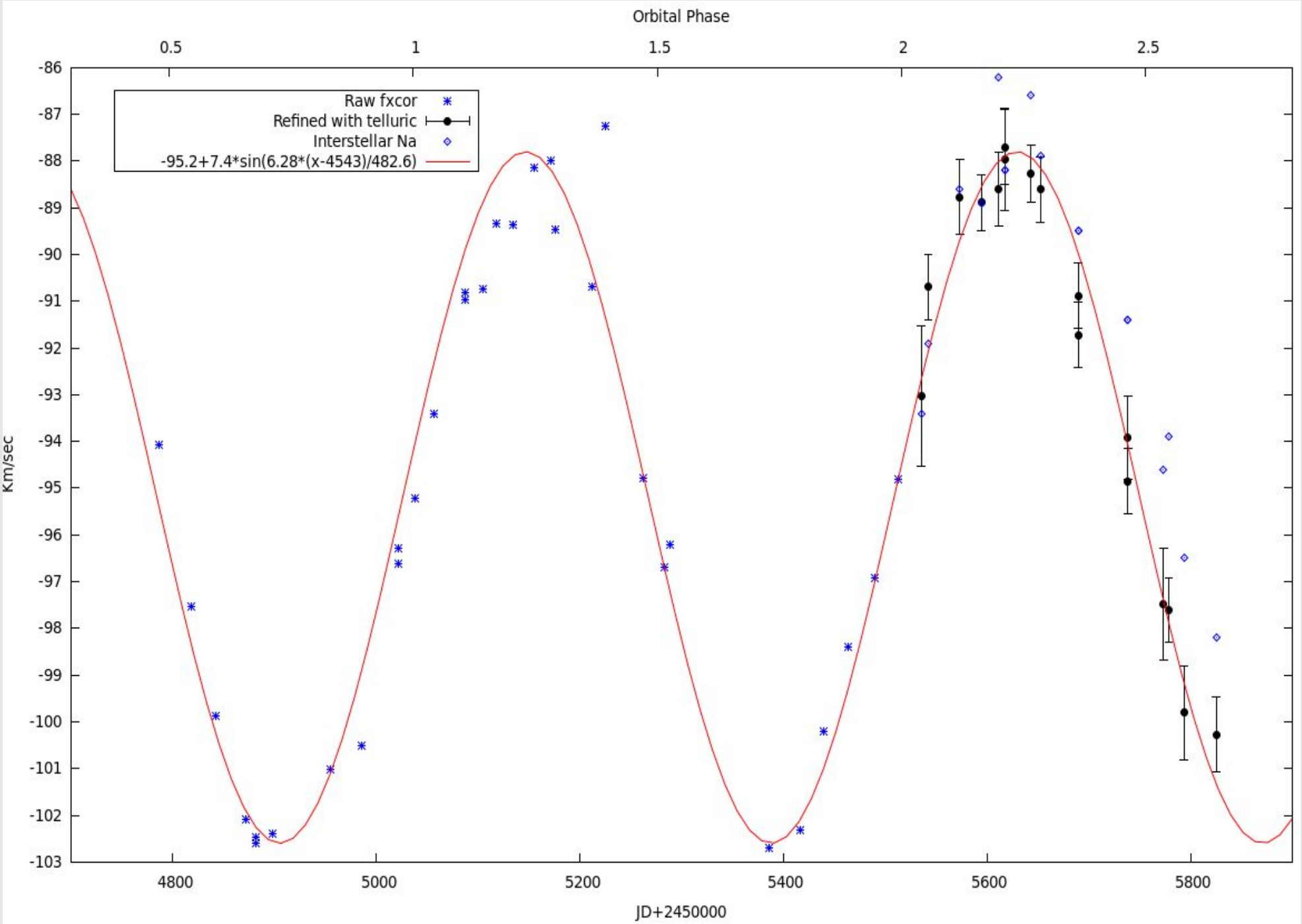


La funzione di cross-correlazione per la misura di Rv





Rv = 300'000 Km/sec x $\Delta\lambda/\lambda$



Velocità orbitale di EG And

Buona Osservazione!