AGA0414

Redução de espectros obtidos com o espectrógrafo Cassegrain

+ telescópio de 1.6m (OPD) +

Rede de 600 linhas/mm

(exemplo para noite de 4 março de 2014)

Abrir uma janela xgterm no seu diretorio iraf e inicializa-lo com *cl*

Ir ao diretorio dos dados e dar *ls*

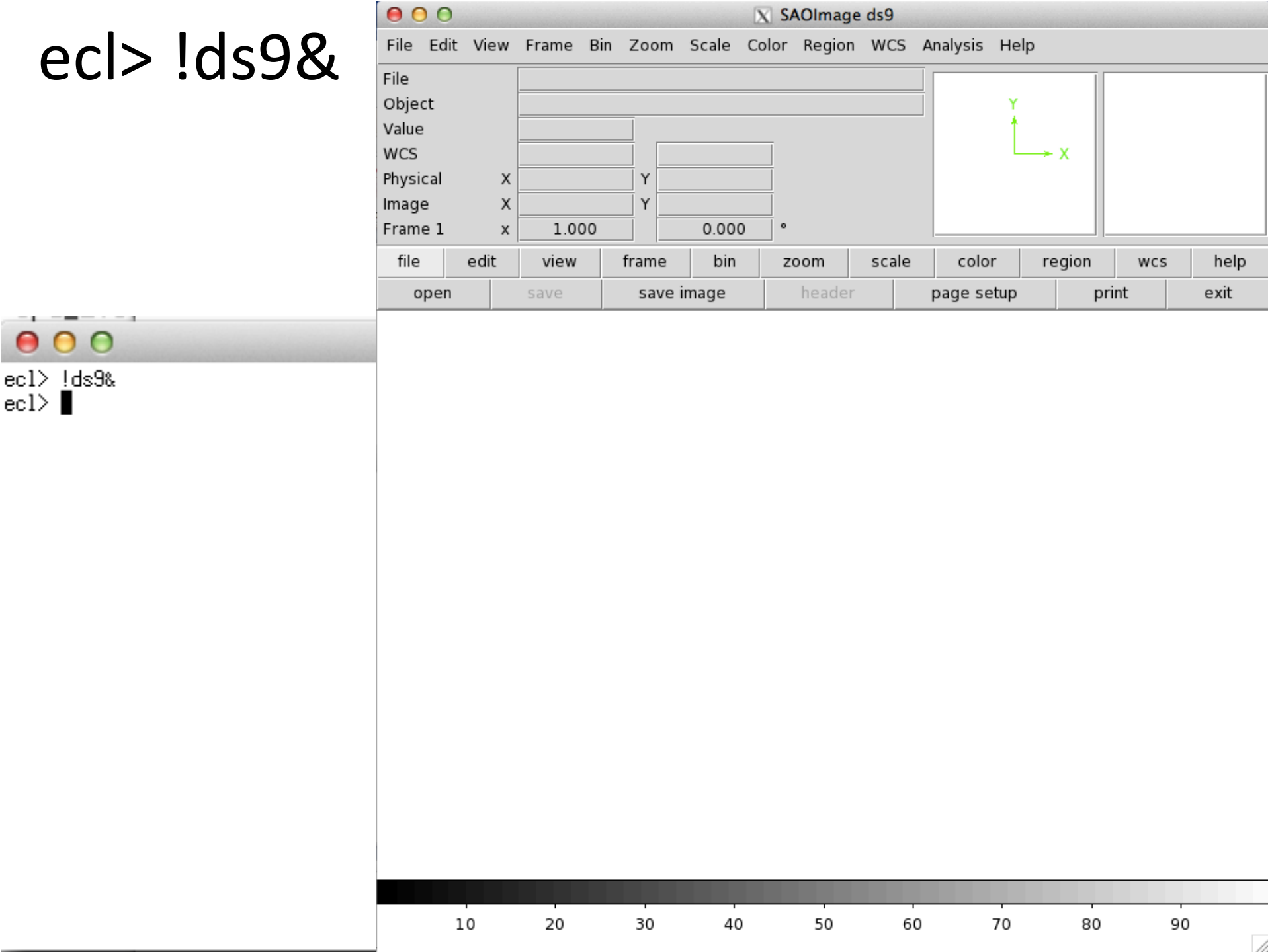
```
ecl> pwd
/Users/jorge/iraf
ecl> cd /Users/jorge/Dropbox/aga0414/trabalho/14mar04/
ecl> pwd
/Users/jorge/Dropbox/aga0414/trabalho/14mar04
ecl> ls
HD036079.fits   bias_002.fits   bias_007.fits   flat_002.fits   flat_007.fits
HD036673.fits   bias_003.fits   bias_008.fits   flat_003.fits   flat_008.fits
HD045289.fits   bias_004.fits   bias_009.fits   flat_004.fits   flat_009.fits
MP0190.fits     bias_005.fits   bias_010.fits   flat_005.fits   flat_010.fits
bias_001.fits   bias_006.fits   flat_001.fits   flat_006.fits   he-ar_001.fits
ecl>
```

HD.fits e MP0190.fits :* **estrelas**

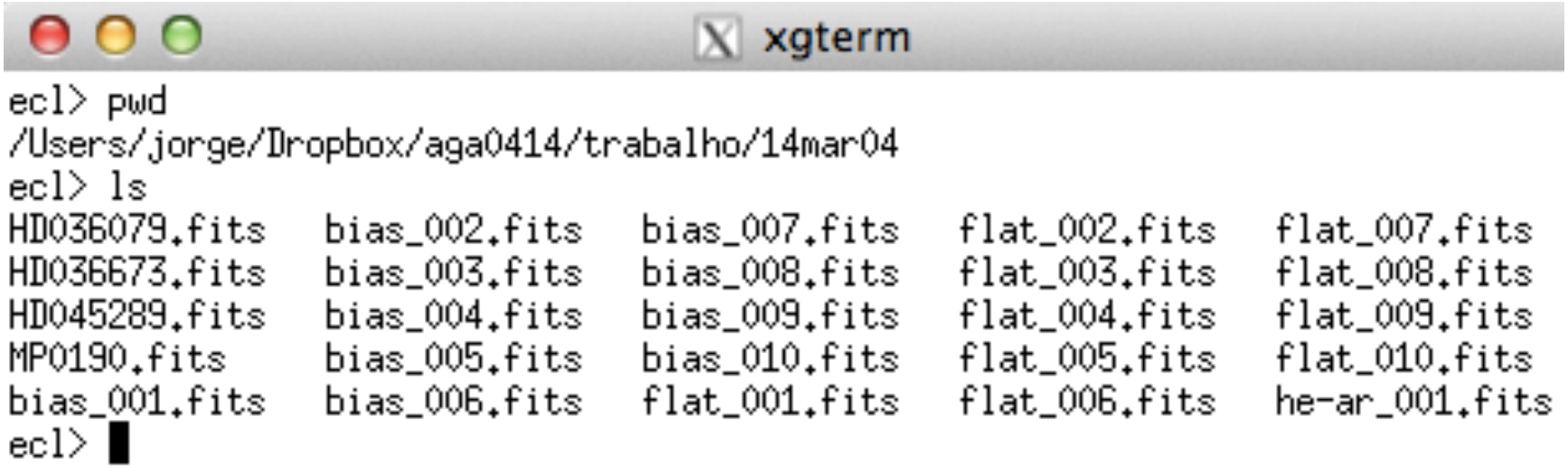
bias_*.fits : **bias** *flat_*.fits :* **flats**

he-ar_001.fits : **He-Ar** (para calibrar em lambda)

ecl> !ds9&


SAOImage ds9
File Edit View Frame Bin Zoom Scale Color Region WCS Analysis Help
File
Object
Value
WCS
Physical X Y
Image X Y
Frame 1 x 1.000 0.000 °
Y
X
file edit view frame bin zoom scale color region wcs help
open save save image header page setup print exit
ecl> !ds9&
ecl>
10 20 30 40 50 60 70 80 90

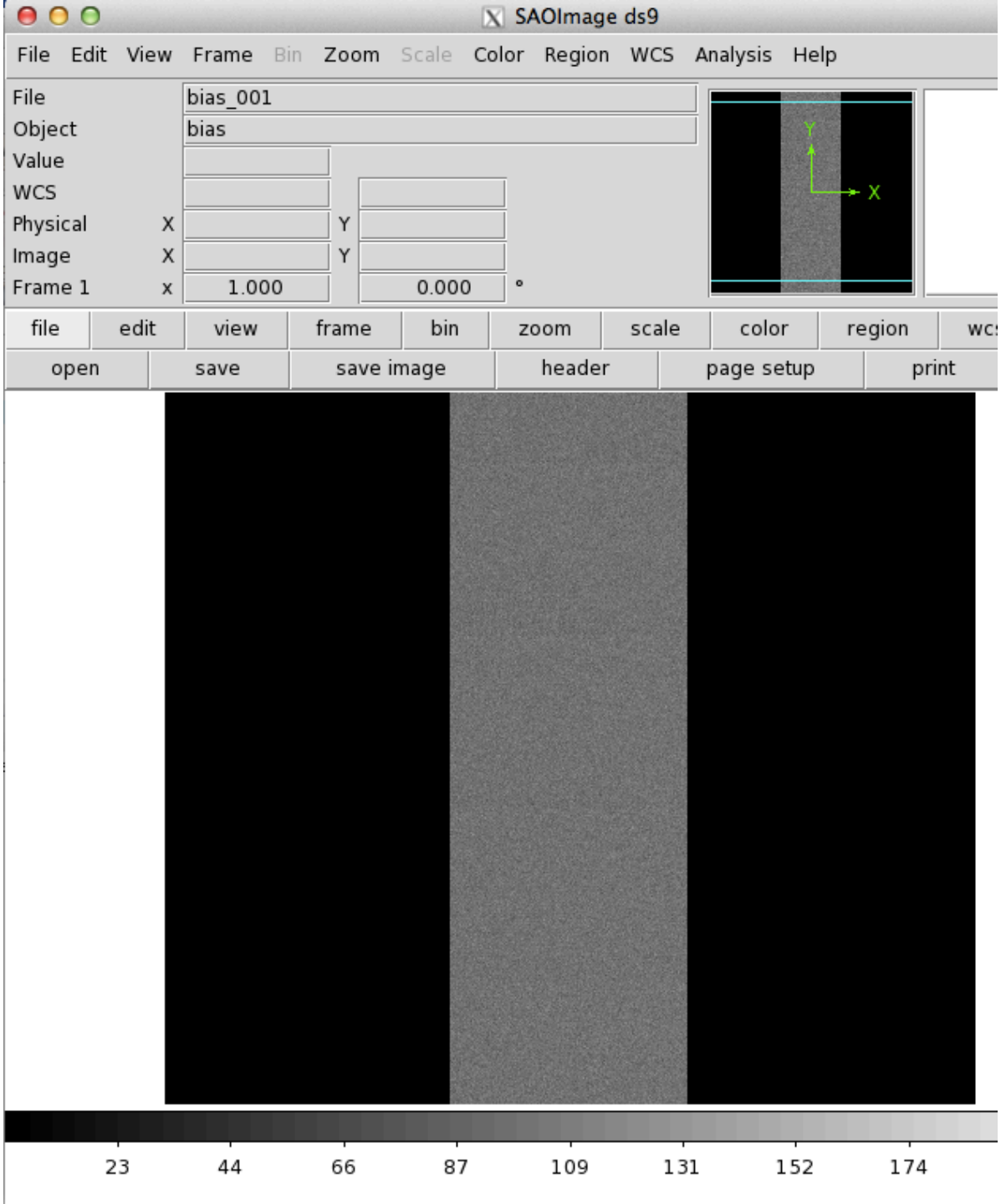
ecl>ls



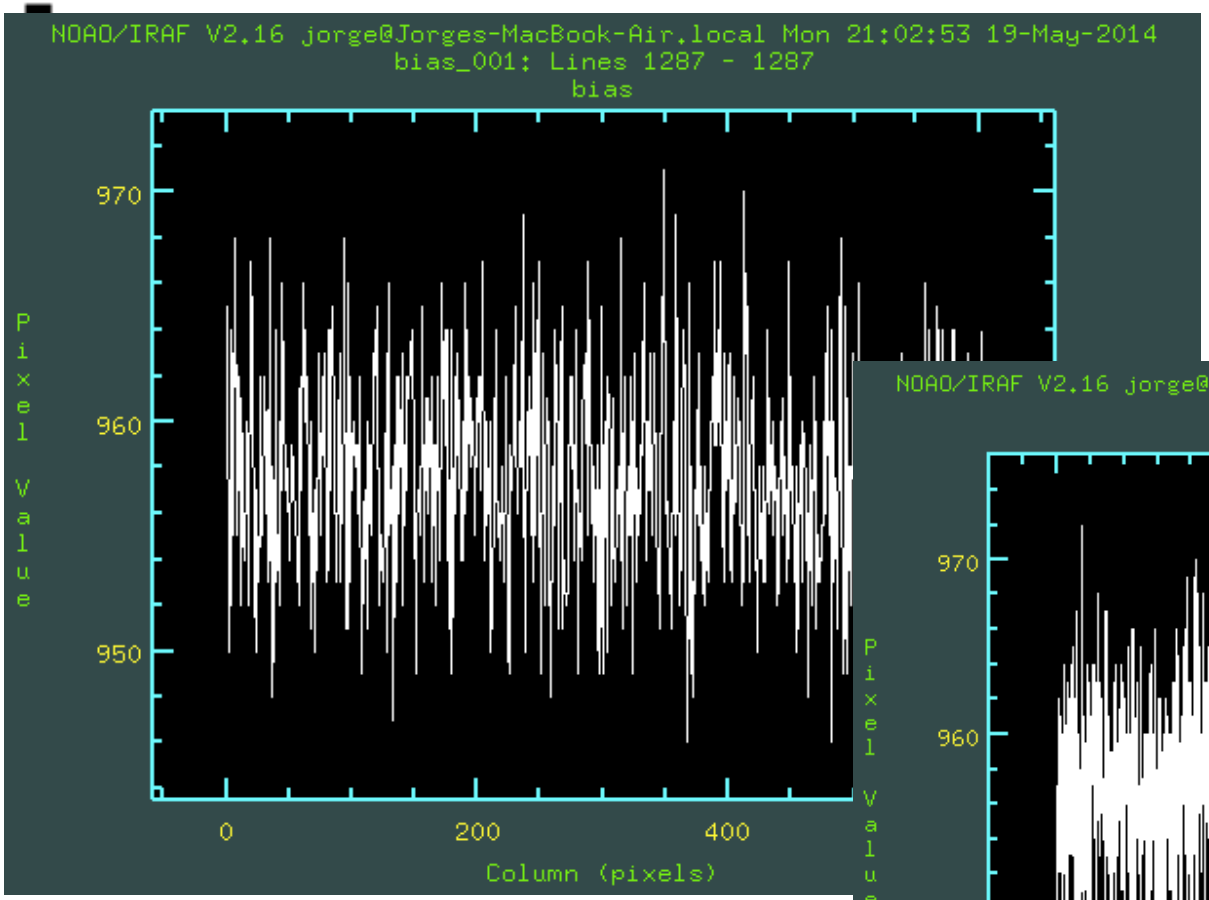
display bias_001 1 fill+

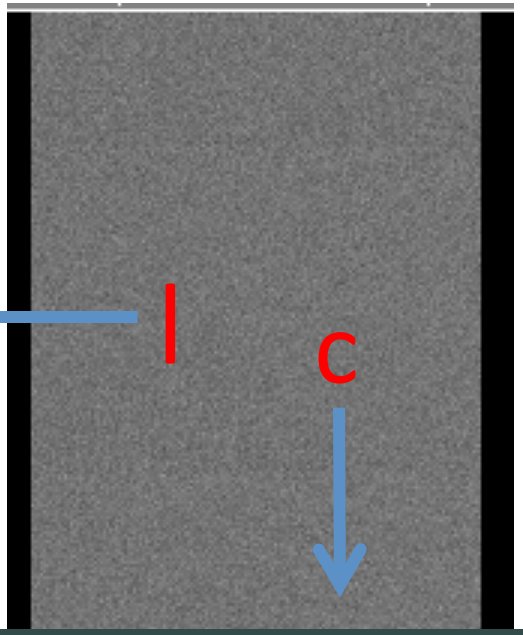
Frame # no ds9

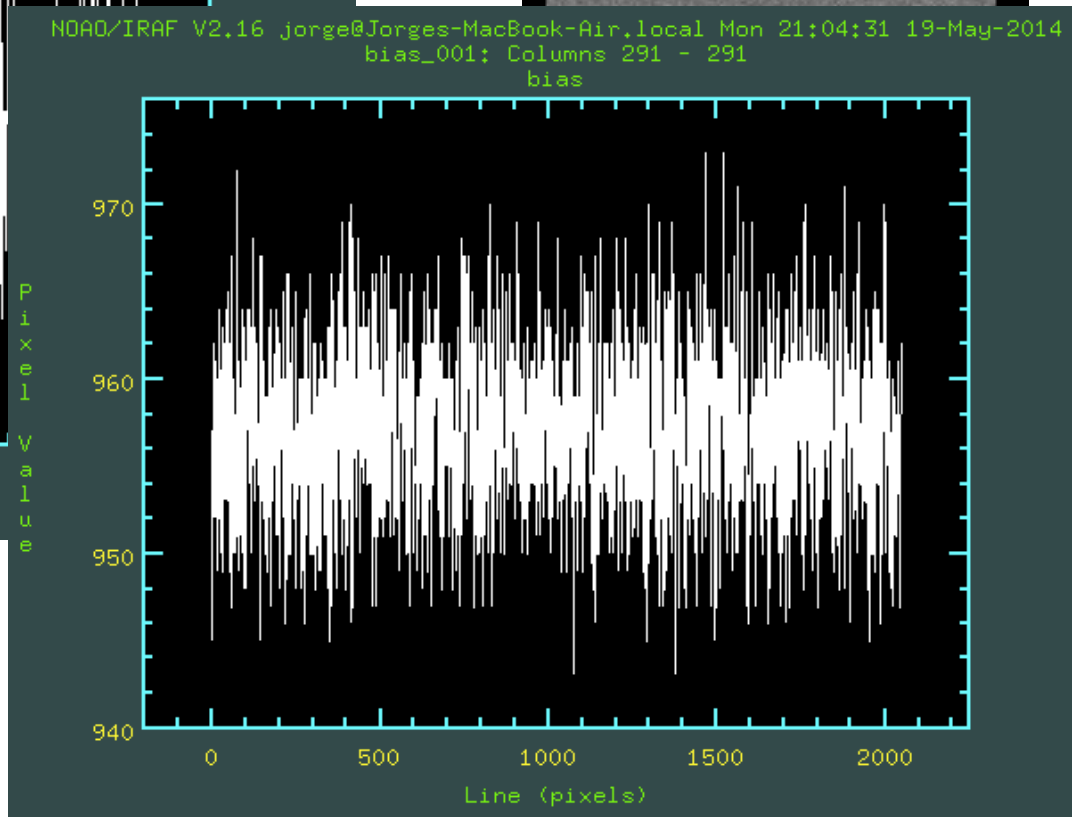
Display de toda a imagem


SAOImage ds9
File Edit View Frame Bin Zoom Scale Color Region WCS Analysis Help
File bias_001
Object bias
Value
WCS
Physical X Y
Image X Y
Frame 1 x 1.000 0.000 °
Y
X
file edit view frame bin zoom scale color region wcs
open save save image header page setup print
23 44 66 87 109 131 152 174

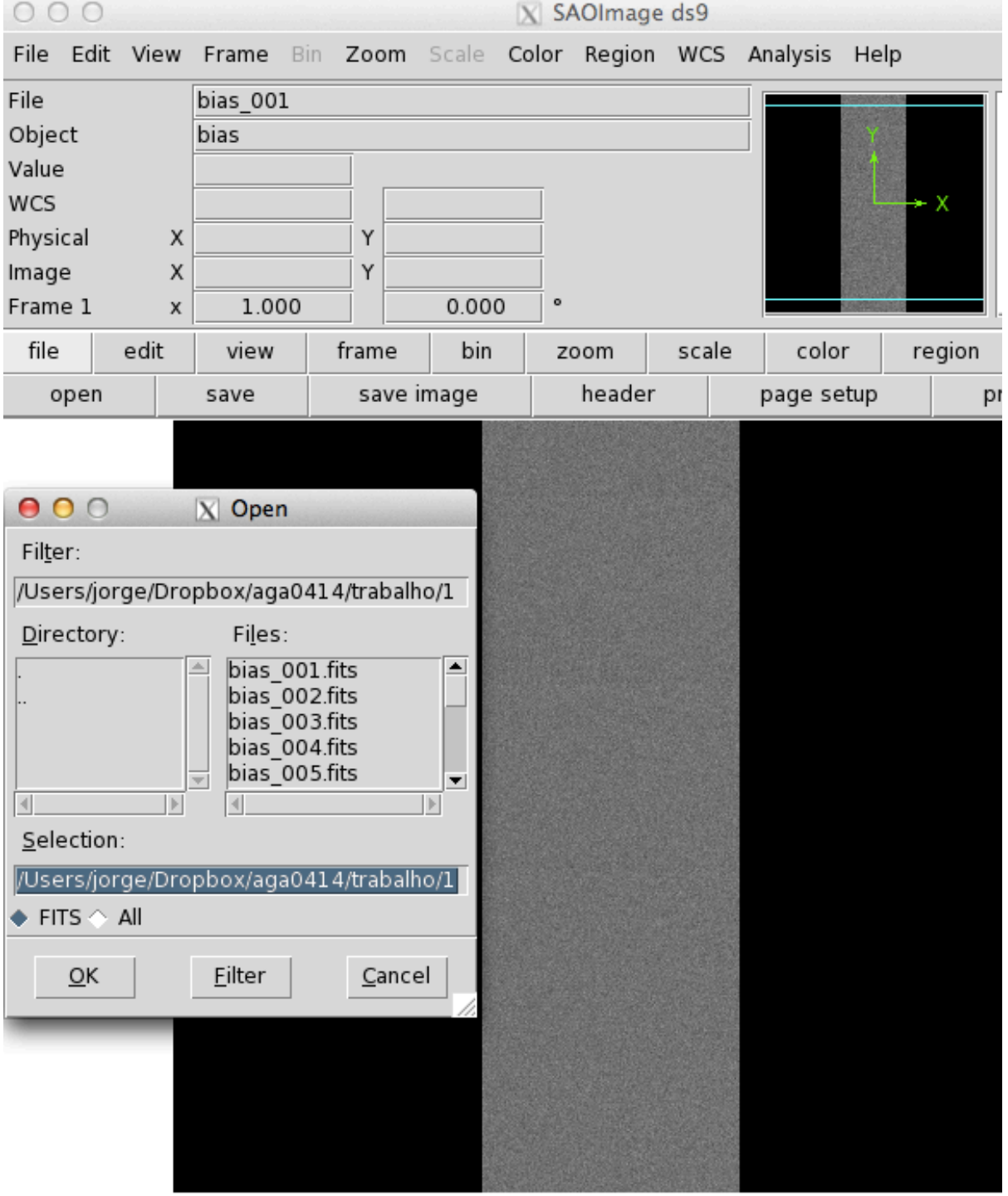
```
ecl> display bias_001 1 fill+
z1=943. z2=974.
ecl> imexamine
```

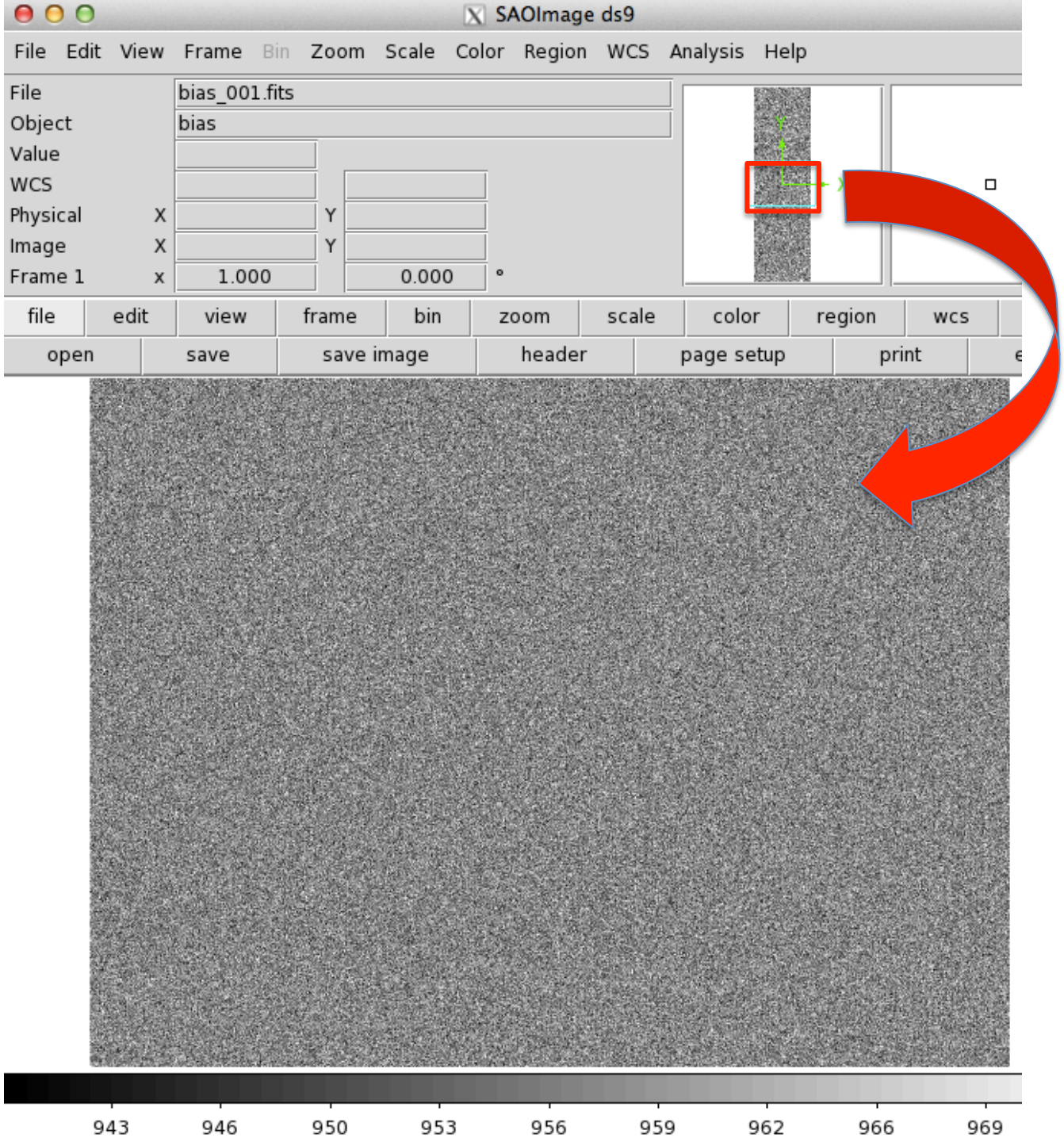


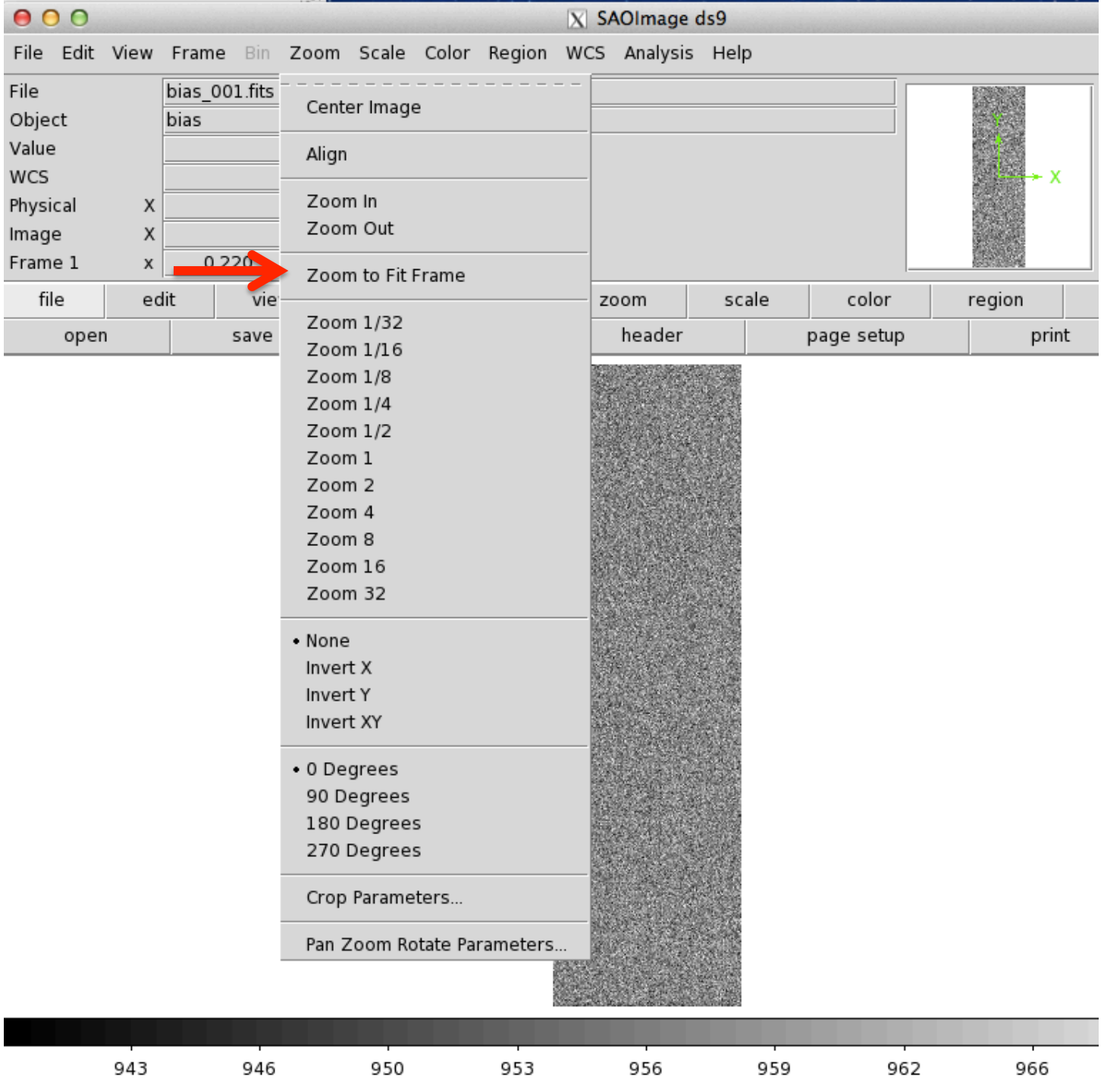


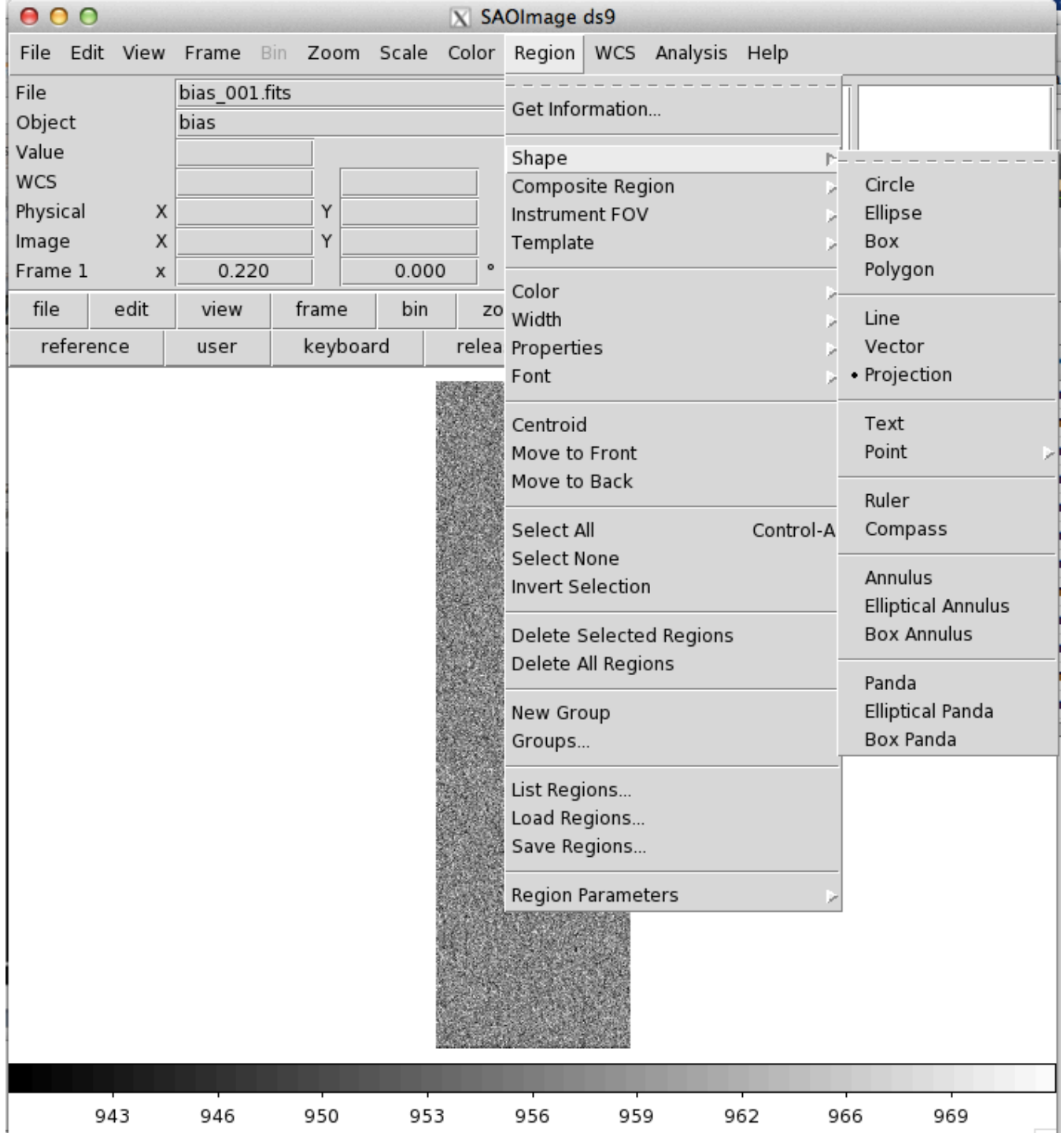


Outra opção (a minha preferida) é carregar a imagem direto do **ds9** e usar "**projection**" (pode não funcionar adequadamente se carregar a imagem com display)

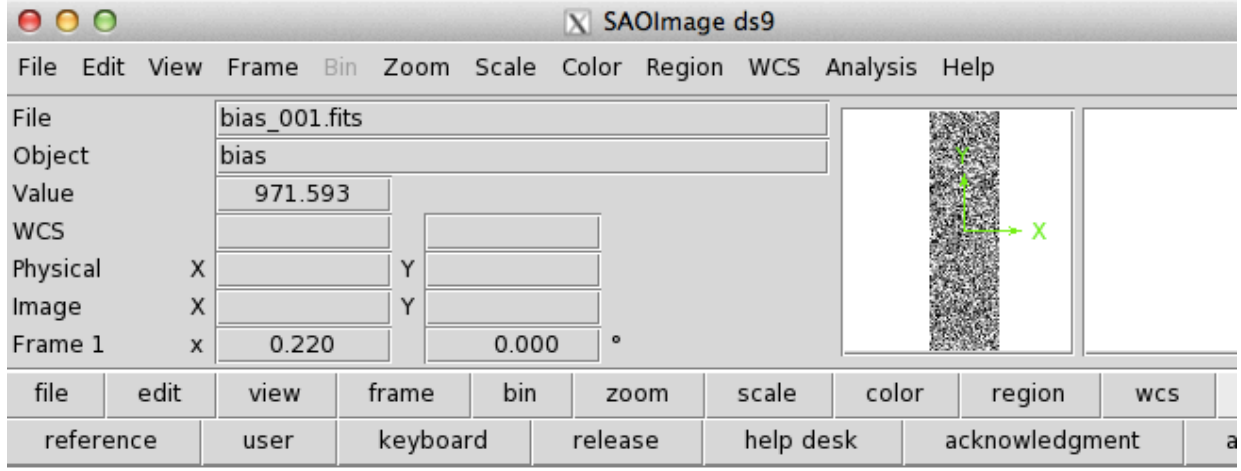


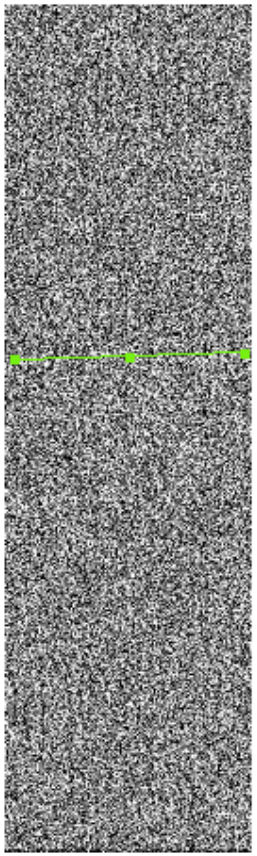

SAOImage ds9
File Edit View Frame Bin Zoom Scale Color Region WCS Analysis Help
File bias_001.fits
Object bias
Value
WCS
Physical X Y
Image X Y
Frame 1 x 1.000 0.000 °
file edit view frame bin zoom scale color region wcs
open save save image header page setup print
943 946 950 953 956 959 962 966 969

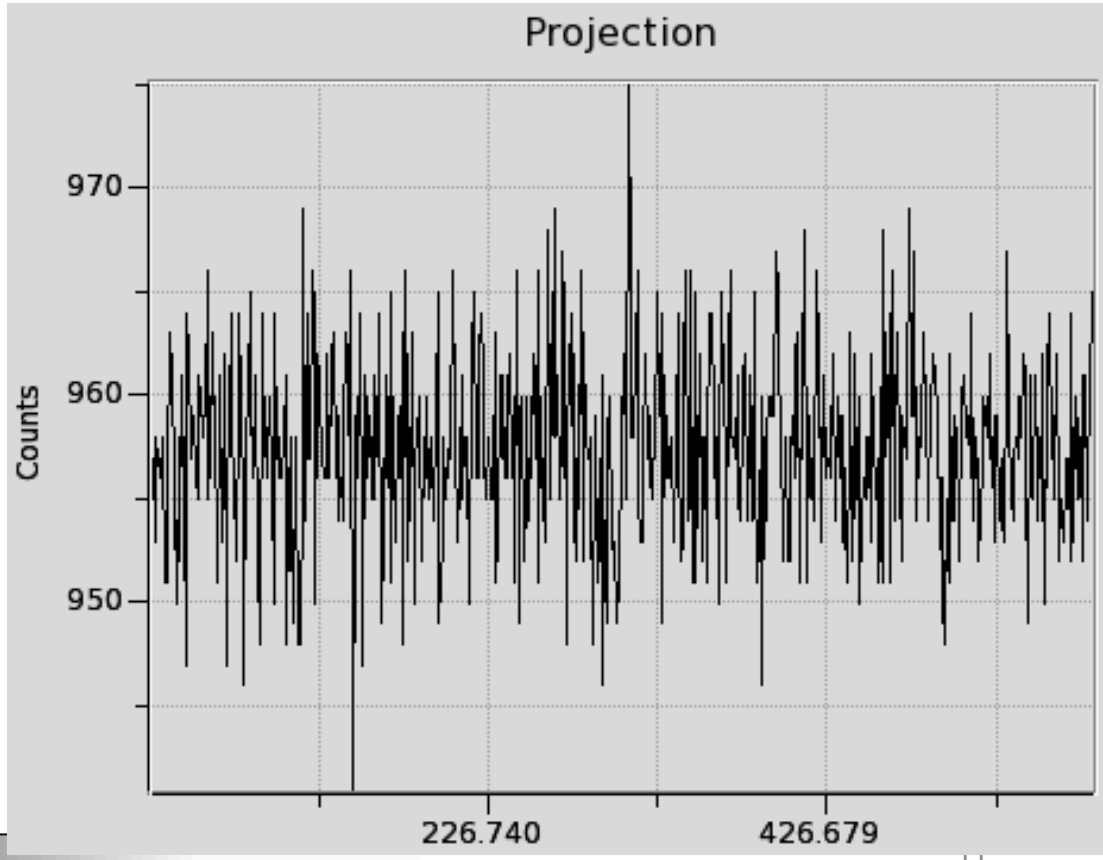

SAOImage ds9
File Edit View Frame Bin Zoom Scale Color Region WCS Analysis Help
File bias_001.fits
Object bias
Value
WCS
Physical X
Image X
Frame 1 x
Center Image
Align
Zoom In
Zoom Out
Zoom to Fit Frame
Zoom 1/32
Zoom 1/16
Zoom 1/8
Zoom 1/4
Zoom 1/2
Zoom 1
Zoom 2
Zoom 4
Zoom 8
Zoom 16
Zoom 32
None
Invert X
Invert Y
Invert XY
0 Degrees
90 Degrees
180 Degrees
270 Degrees
Crop Parameters...
Pan Zoom Rotate Parameters...
file edit
zoom scale color region
open save
header page setup print
943 946 950 953 956 959 962 966

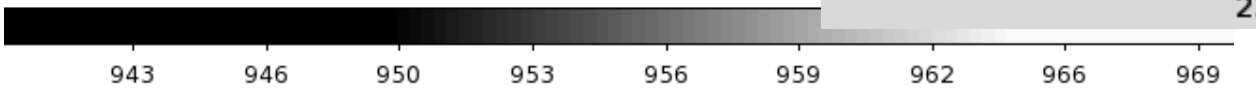


Region
Shape
Projection


SAOImage ds9
File Edit View Frame Bin Zoom Scale Color Region WCS Analysis Help
File bias_001.fits
Object bias
Value 971.593
WCS
Physical X Y
Image X Y
Frame 1 x 0.220 0.000 °
file edit view frame bin zoom scale color region wcs
reference user keyboard release help desk acknowledgment




Projection
970
960
950
Counts
226.740
426.679


943 946 950 953 956 959 962 966 969

ecl> imstat bias*

# IMAGE	NPIX	MEAN	STDDEV	MIN	MAX
bias_001.fits	1230848	957.3	4.613	934.	982.
bias_002.fits	1230848	957.3	4.628	933.	982.
bias_003.fits	1230848	957.2	4.628	934.	980.
bias_004.fits	1230848	957.2	4.627	932.	980.
bias_005.fits	1230848	957.3	4.608	934.	980.
bias_006.fits	1230848	957.3	4.626	935.	981.
bias_007.fits	1230848	957.4	4.613	935.	981.
bias_008.fits	1230848	957.3	4.632	932.	982.
bias_009.fits	1230848	957.3	4.625	935.	979.
bias_010.fits	1230848	957.3	4.612	932.	981.

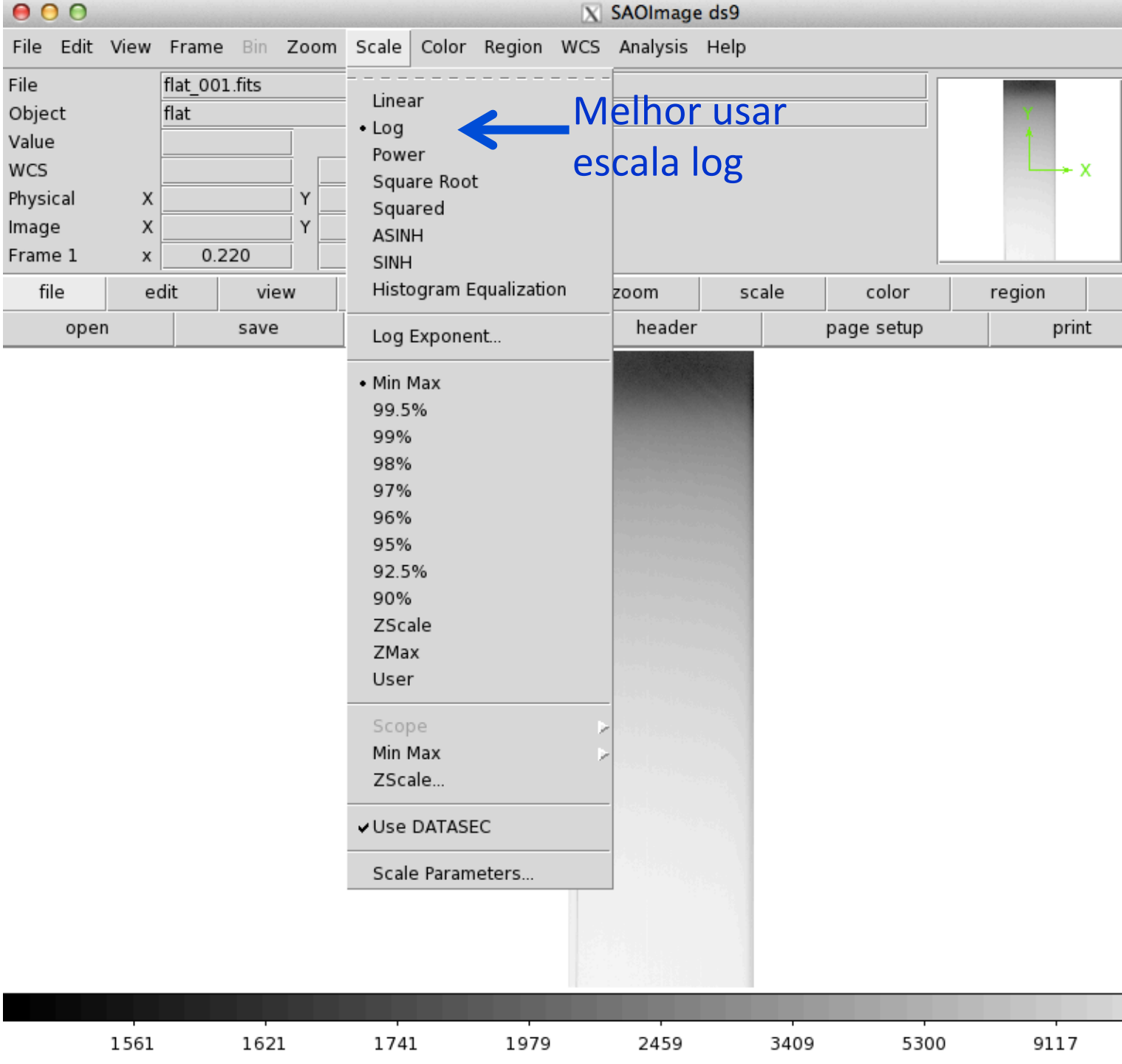
ecl> imcombine bias* bias.fits comb=median

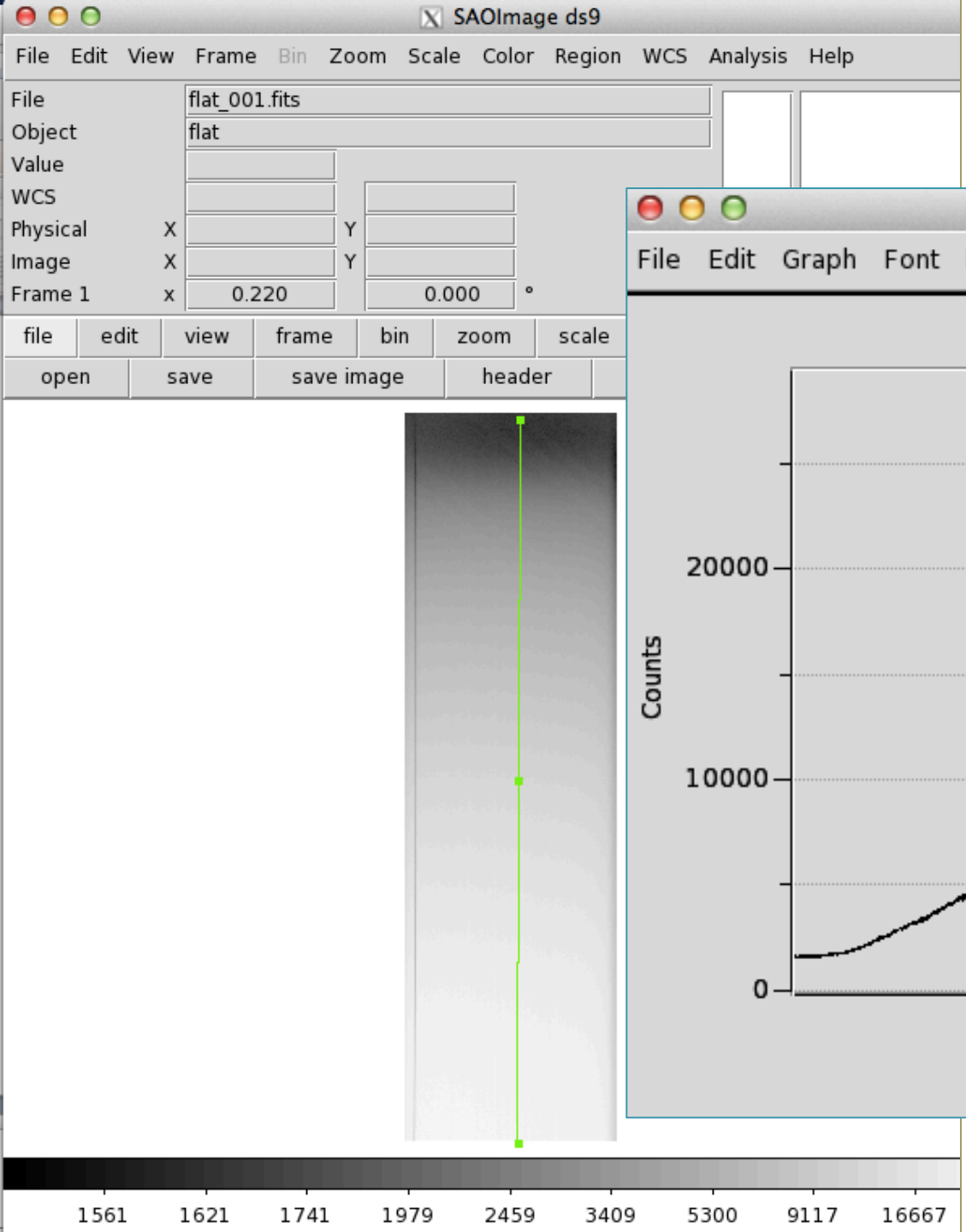
```
combine = median, scale = none, zero = none, weight = none
blank = 0.
        Images
bias_001.fits
bias_002.fits
bias_003.fits
bias_004.fits
bias_005.fits
bias_006.fits
bias_007.fits
bias_008.fits
bias_009.fits
bias_010.fits
Output image = bias.fits, ncombine = 10
```

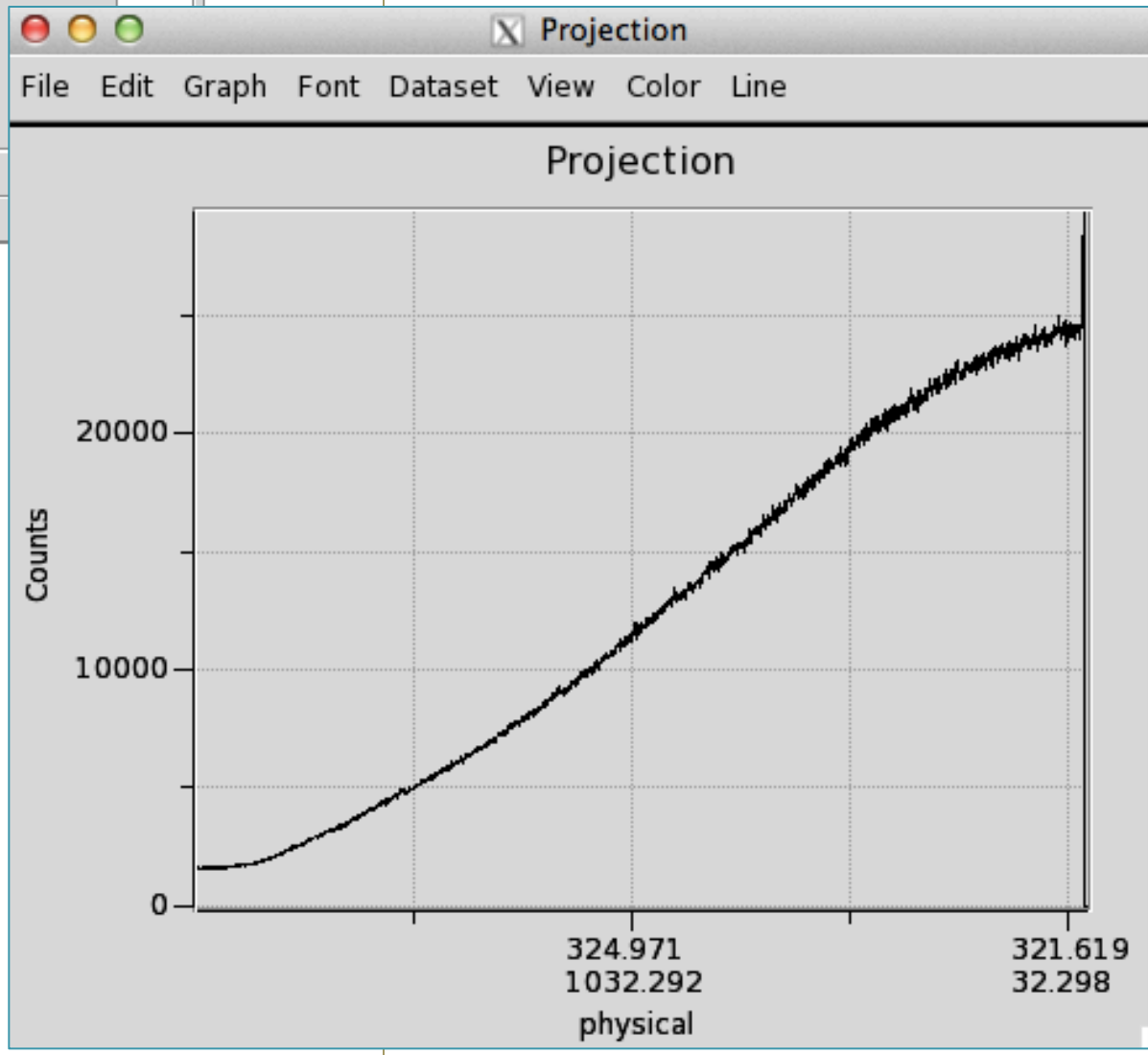
ecl> imstat bias.fits

# IMAGE	NPIX	MEAN	STDDEV	MIN	MAX
bias.fits	1230848	957.3	1.746	946.5	965.5

Check the flat




SAOImage ds9
File Edit View Frame Bin Zoom Scale Color Region WCS Analysis Help
File flat_001.fits
Object flat
Value
WCS
Physical X Y
Image X Y
Frame 1 x 0.220 0.000 °
file edit view frame bin zoom scale
open save save image header
1561 1621 1741 1979 2459 3409 5300 9117 16667


Projection
File Edit Graph Font Dataset View Color Line
Projection
Counts
20000
10000
0
324.971
1032.292
321.619
32.298
physical

Combinar flats em flat.fits

```
ecl> imstat flat*
#                IMAGE      NPIX      MEAN    STDDEV       MIN       MAX
        flat_001.fits   1230848     12000.     7659.     1531.     31731.
        flat_002.fits   1230848     11998.     7658.     1526.     31716.
        flat_003.fits   1230848     11953.     7628.     1533.     31642.
        flat_004.fits   1230848     12009.     7662.     1525.     31772.
        flat_005.fits   1230848     12043.     7682.     1523.     31817.
        flat_006.fits   1230848     12061.     7691.     1529.     31828.
        flat_007.fits   1230848     12054.     7687.     1512.     31944.
        flat_008.fits   1230848     12095.     7711.     1540.     31903.
        flat_009.fits   1230848     12138.     7739.     1542.     31927.
        flat_010.fits   1230848     12107.     7718.     1526.     31933.
```

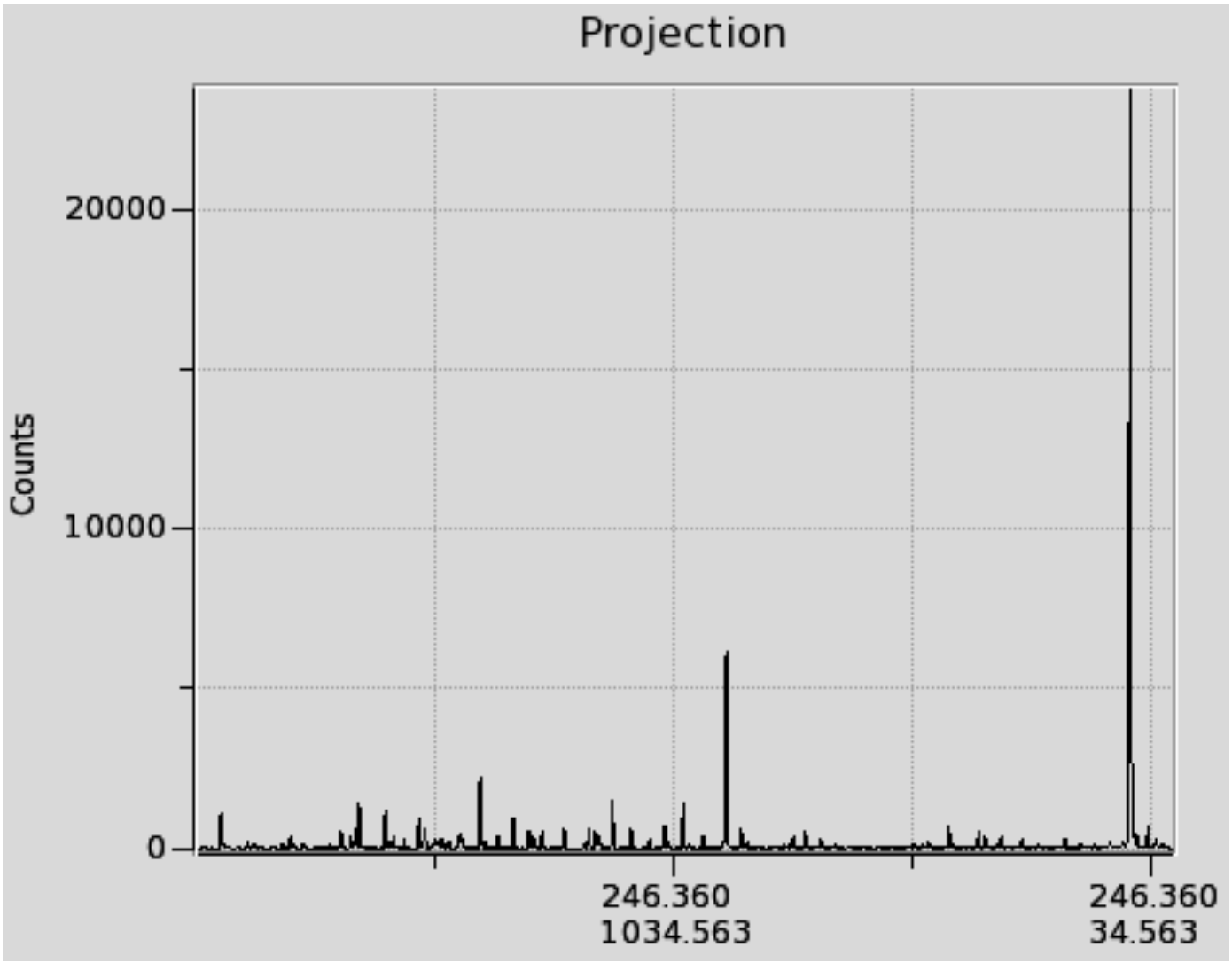
```
ecl> imcombine flat* flat.fits combine=median
May 20 10:23: IMCOMBINE
  combine = median, scale = none, zero = none, weight = none blank = 0.
        Images
  flat_001.fits
  flat_002.fits
  flat_003.fits
  flat_004.fits
  flat_005.fits      Output image = flat.fits, ncombine = 10
  flat_006.fits
  flat_007.fits
  flat_008.fits
  flat_009.fits
  flat_010.fits
```

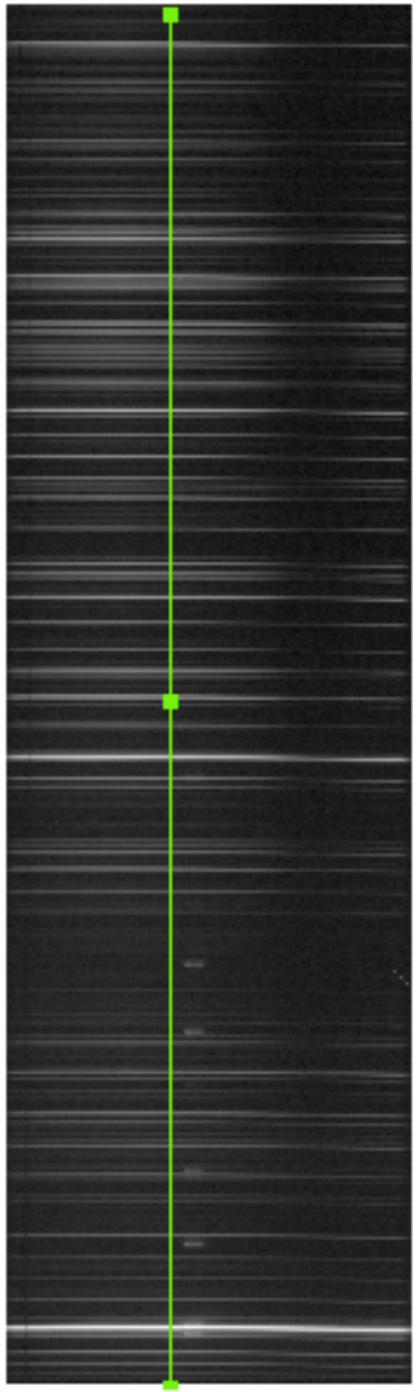
flat-bias e normalizar flat

```
ecl> imarith flat - bias flatb.fits


ecl> imstat flatb.fits fields=midpt,mean
#     MIDPT      MEAN
     10045.    11088.


ecl> imarith flatb / 10045 flatn.fits


ecl> imstat flatn fields=midpt,mean,stddev,min,max
#     MIDPT      MEAN    STDDEV       MIN       MAX
         1.     1.104    0.7648   0.05829     3.073
```

HeAr - bias

```
ecl> imarith he-ar_001.fits - bias hear.fits
```





Verificar estrelas observadas

hselect HD*,MP* $I,RA,DEC,exptime,title

```
ecl> hselect HD*,MP* $I,RA,DEC,exptime,title
boolean expression governing selection: yes
HD036079.fits   05:28:14        -20:45:34       8,00000 HD036079
HD036673.fits   05:32:43        -17:49:20       8,00000 HD036673
HD045289.fits   06:24:24        -42:50:51       200,00000       HD045289
MP0190.fits     04:53:24        +02:34:28       1000,00000      HD036673
```

ecl> hedit MP0190.fits title ”MP0190" verify- update+

```
MP0190.fits,i_title: HD036673 -> MP0190
MP0190.fits updated
```

Tirar o bias das estrelas HD

```
HD036079.fits
HD036673.fits
HD045289.fits
```

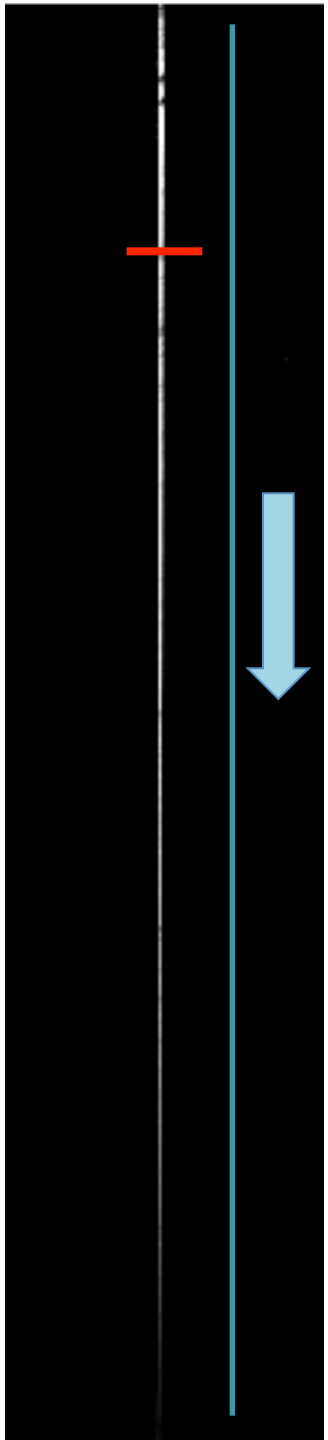
imarith HD*.fits - bias.fits HD*%.fits%b.fits%

```
HD036079b.fits
HD036673b.fits
HD045289b.fits
```

Flat fielding

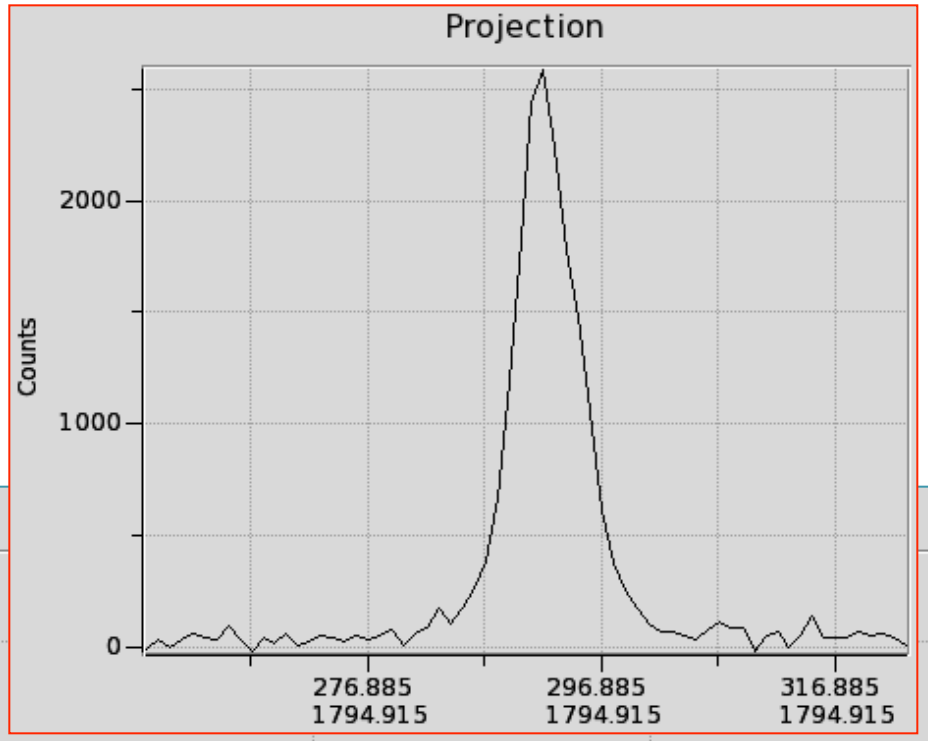
imarith HD*b.fits / flatn.fits HD*%b.fits%f.fits%

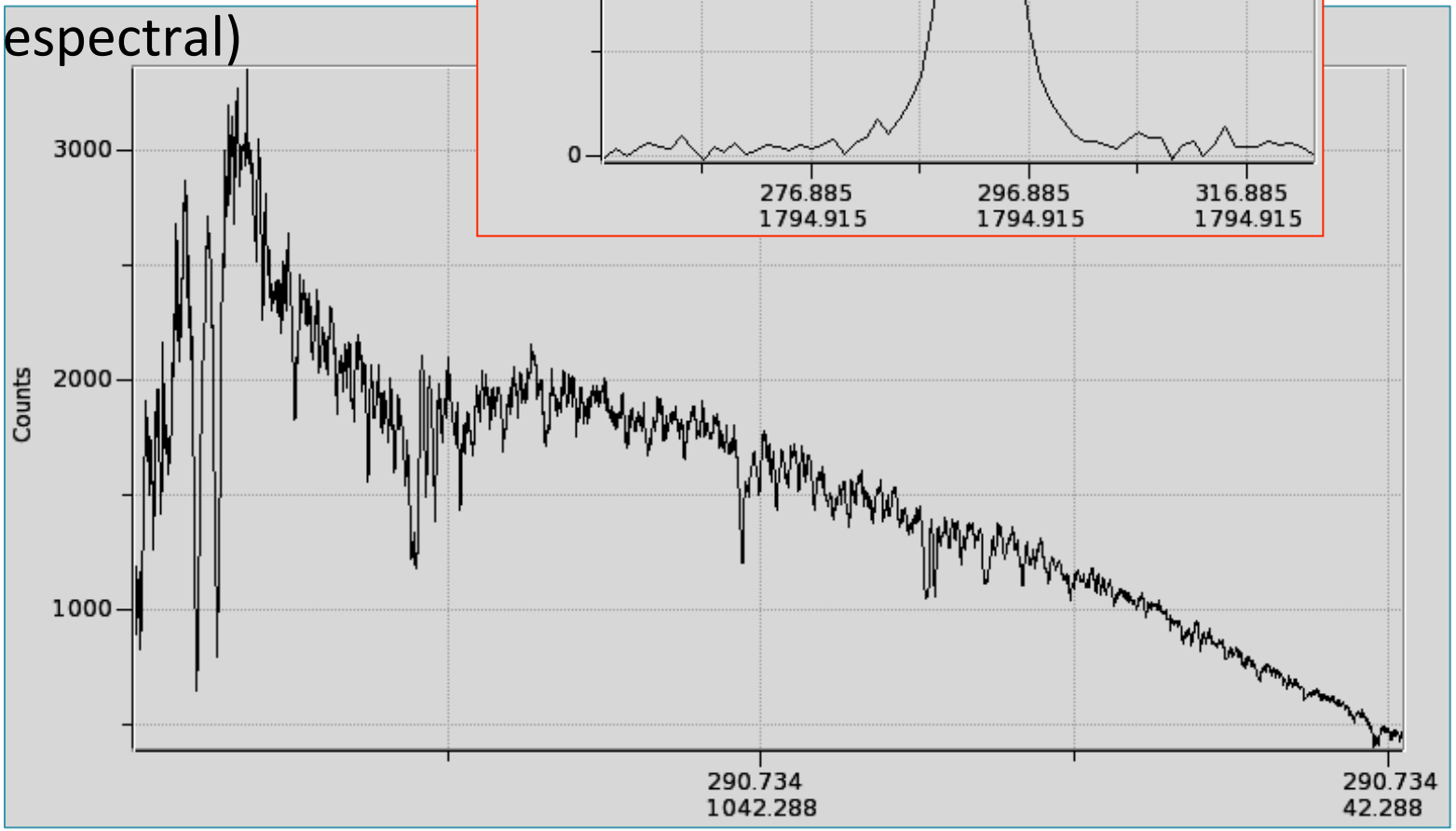
```
HD036079f.fits
HD036673f.fits
HD045289f.fits
```

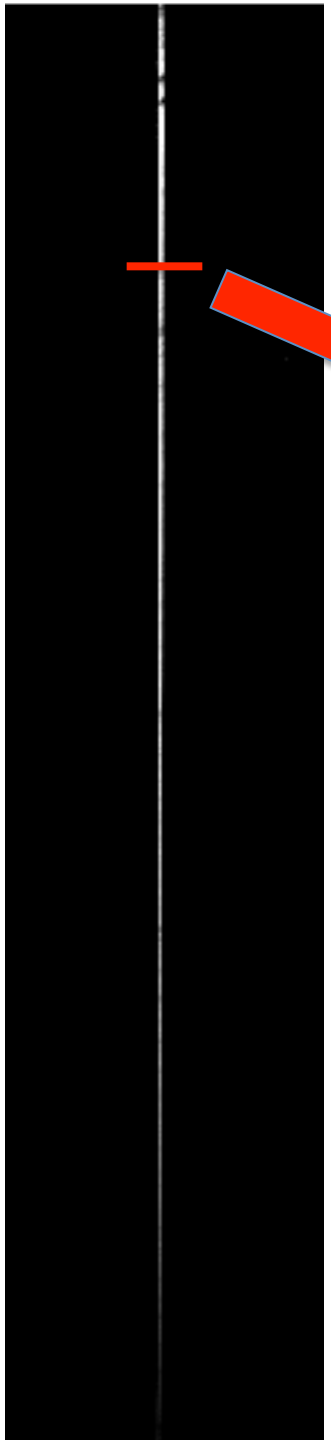


Direção espacial (fenda)

Dispersão (direção espectral)

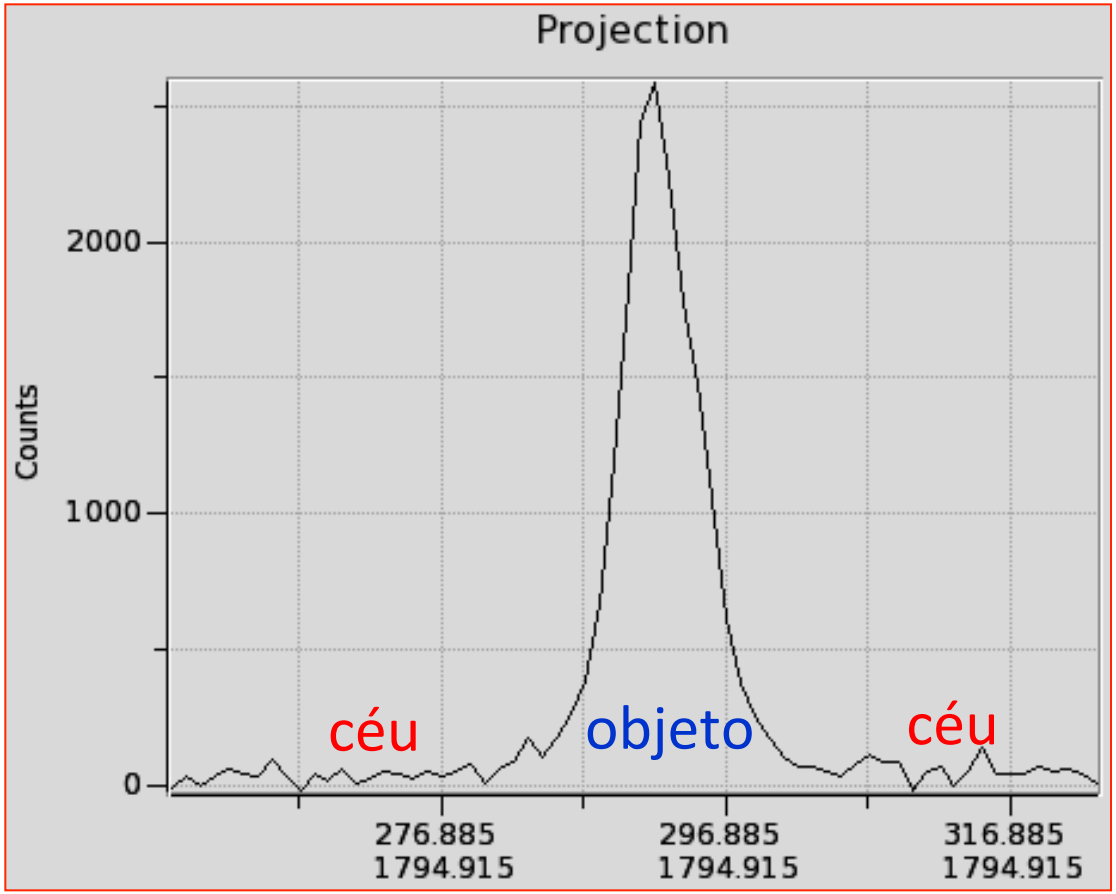






Extração do espectro

(simplesmente a soma das contagens dentro do perfil do espectro)



Extração com o **apall**, que é parte do noao.twodspec.apextract

noao> two

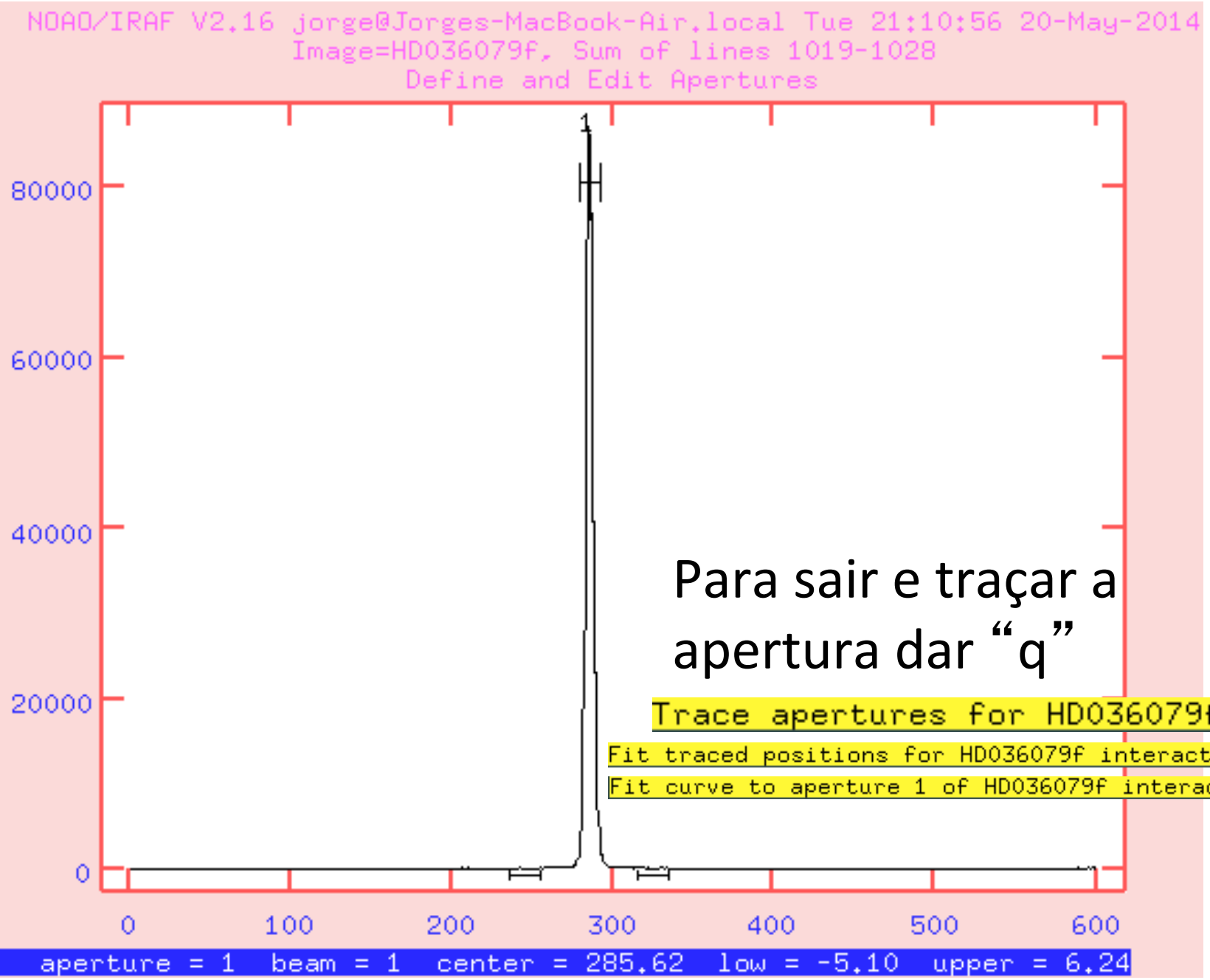
apextract. longslit.

twodspec> ap

apextract> dispax=2

ap> apall HD*f.fits format=oned extras- b_sampl="-50:-30,30:50" ylevel=0.05 backgro=median clean+ sat=100000 readnoise=18.0 gain=4.0 t_order=6

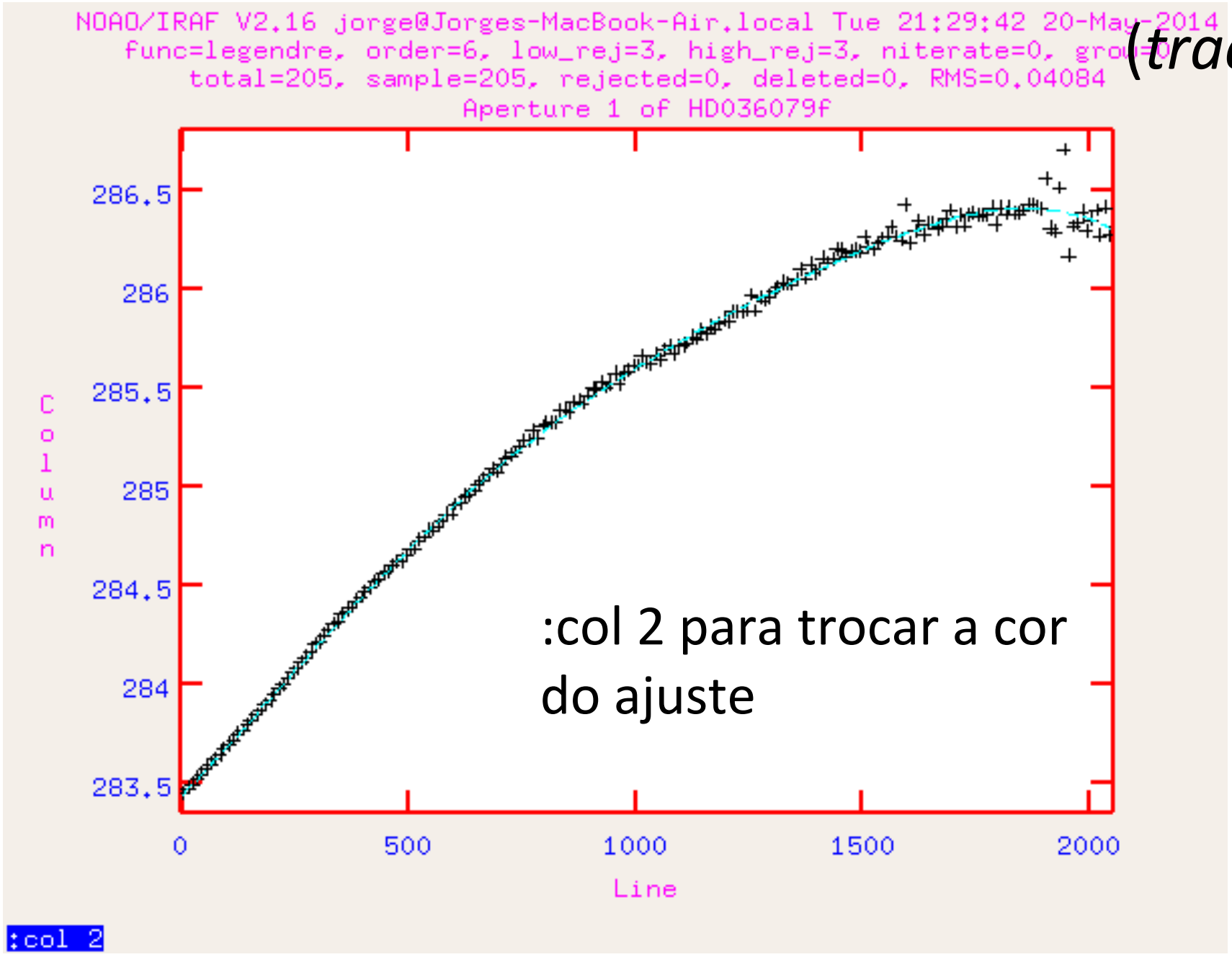
```
Find apertures for HD036079f?  (yes):
Number of apertures to be found automatically: 1
Resize apertures for HD036079f?  (yes):
Edit apertures for HD036079f?  (yes):
```



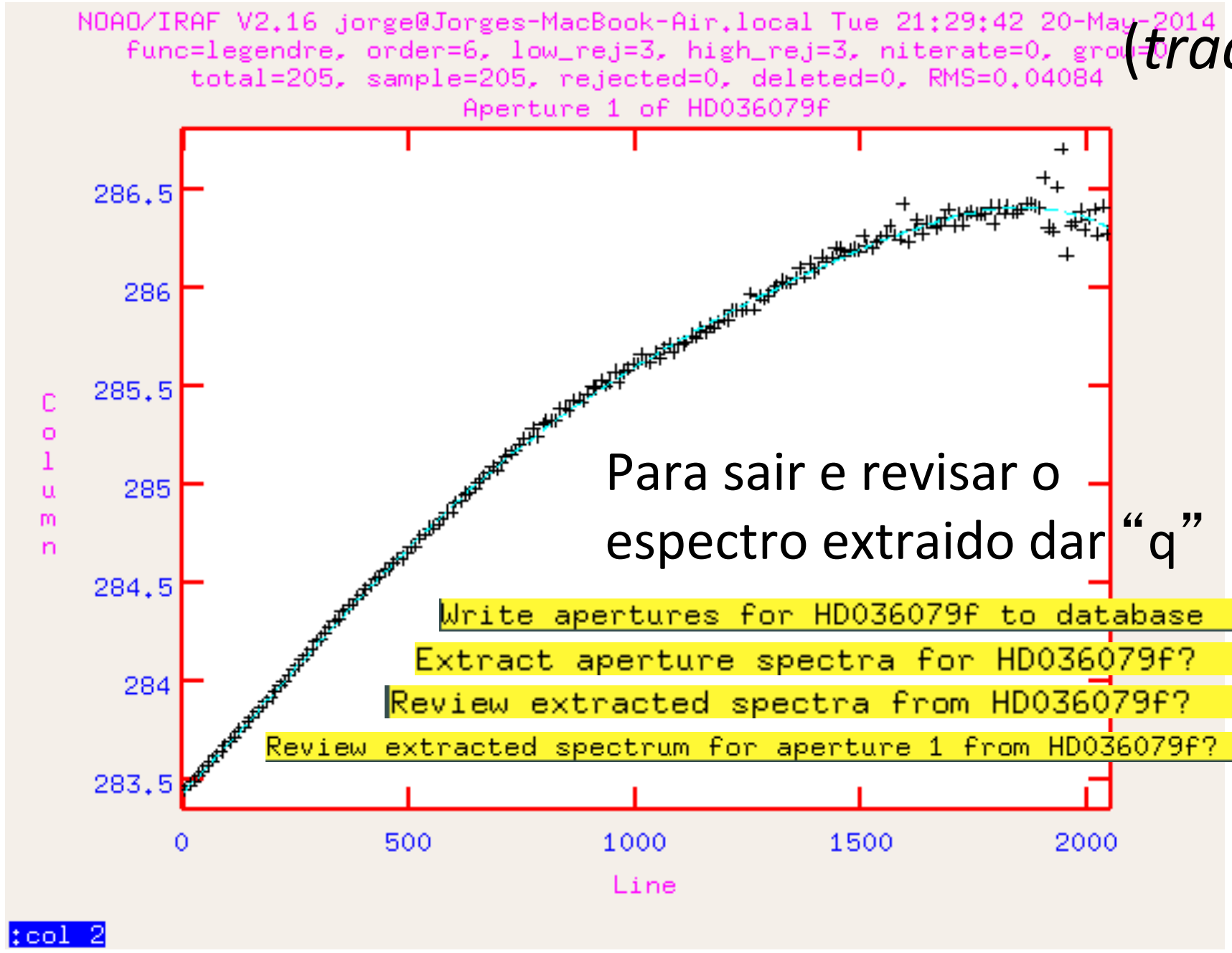
Para sair e traçar a apertura dar “q”

```
Trace apertures for HD036079f?  (yes):
Fit traced positions for HD036079f interactively?  (yes):
Fit curve to aperture 1 of HD036079f interactively  (yes):
```

Ajuste do máximo da posição do espectro (*tracing*)



Ajuste do máximo da posição do espectro (*tracing*)



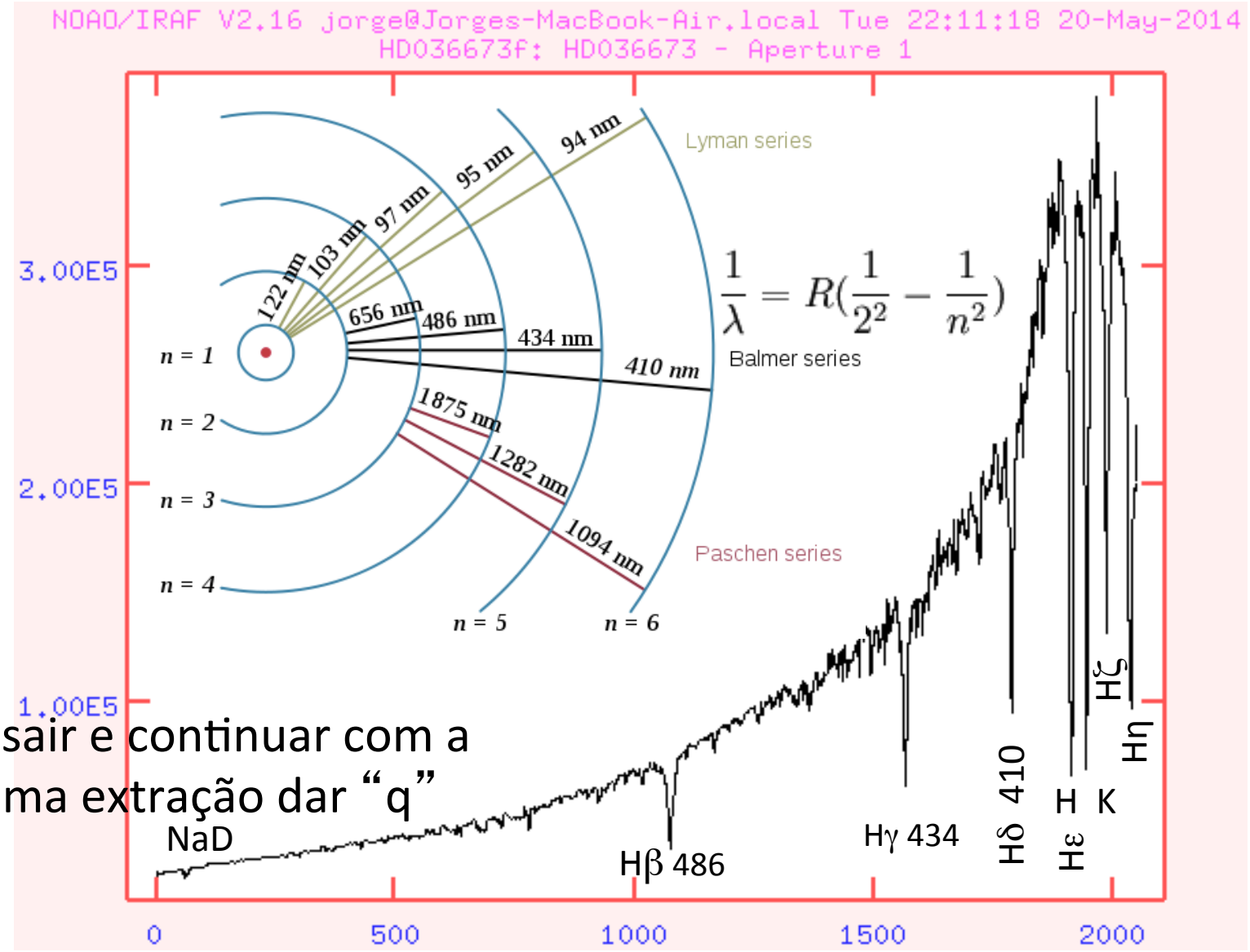
Para sair e revisar o espectro extraido dar "q"

Exemplo de espectro reduzido da HD036079

Contagens em função do numero de pixel


```
Output image name [use # to skip output] (HD036079f):
Find apertures for HD036673f?  (yes):
```

Exemplo de espectro reduzido da HD036673



Para sair e continuar com a próxima extração dar "q"

```
Output image name [use # to skip output] (HD036673f):
Find apertures for HD045289f?  (yes):
```

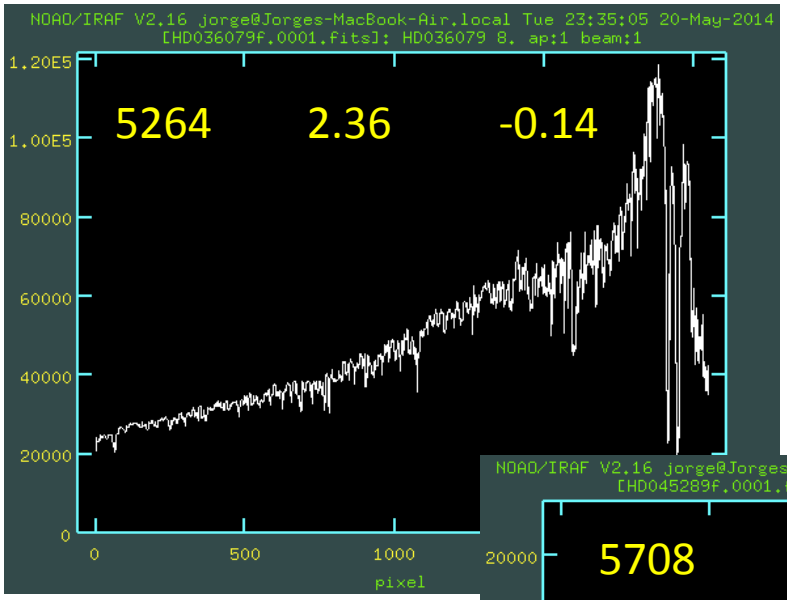
Exemplo de espectro reduzido da HD045289

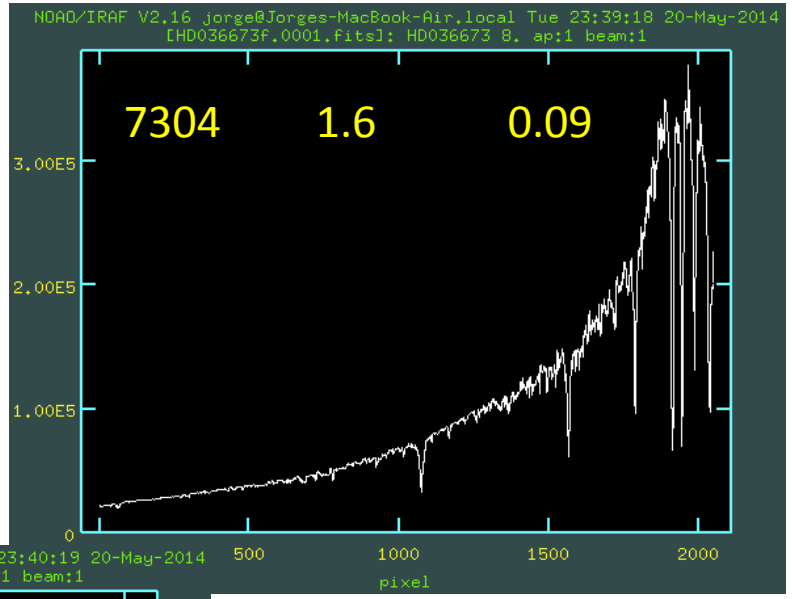
Visualizar os espectros com splot

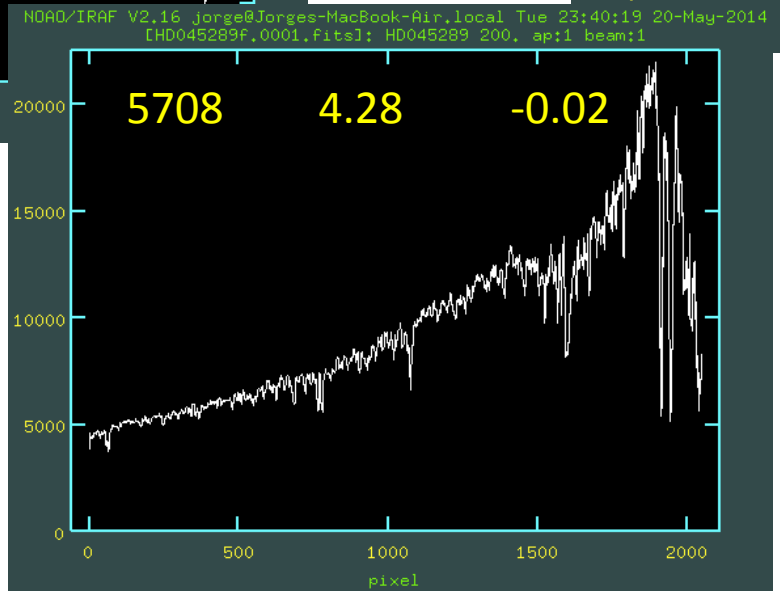
Usar o **splot** (noao.onedspec)

onedspec> splot HD*f.0001.fits

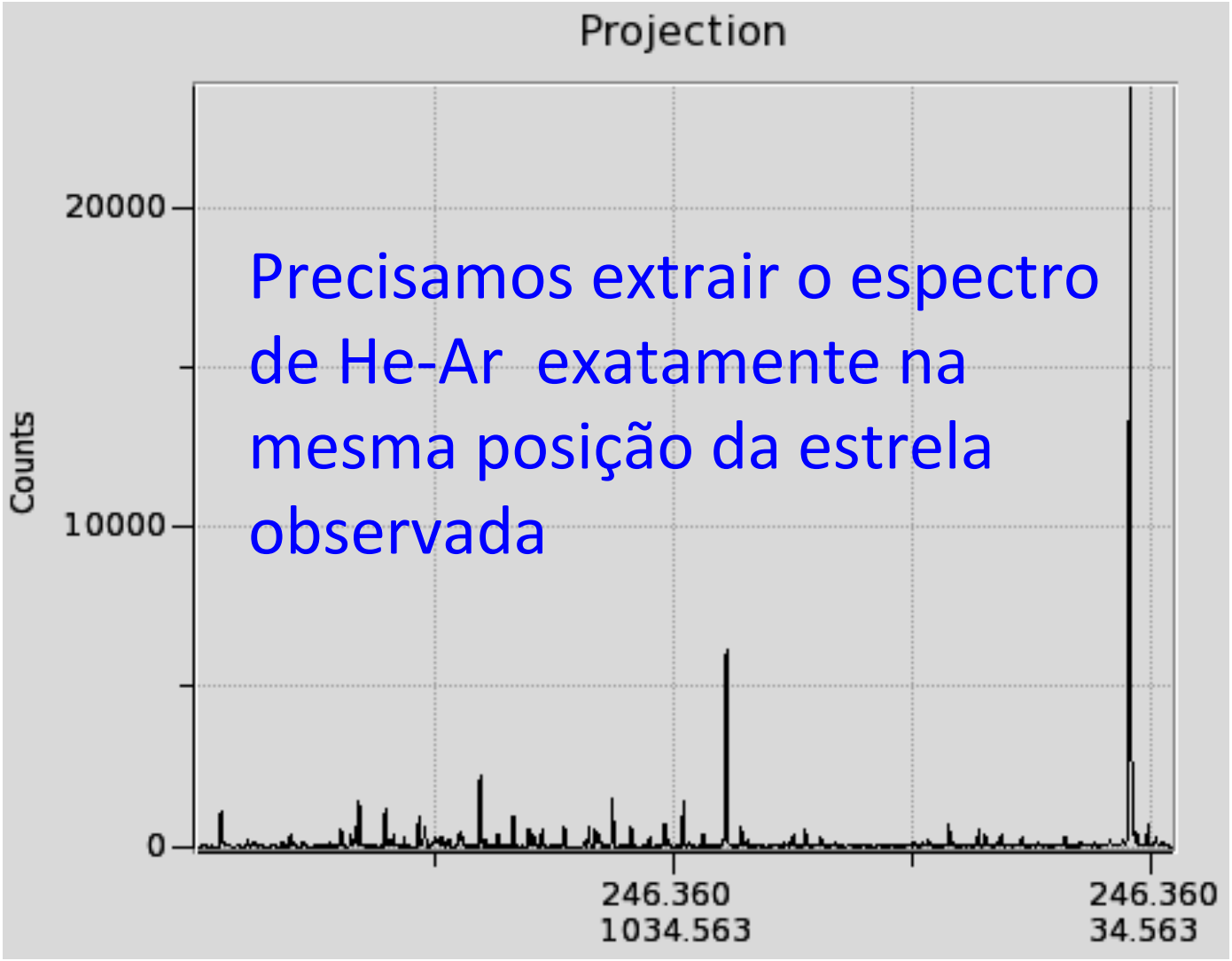
Para visualizar o seguinte espectro dar "q"



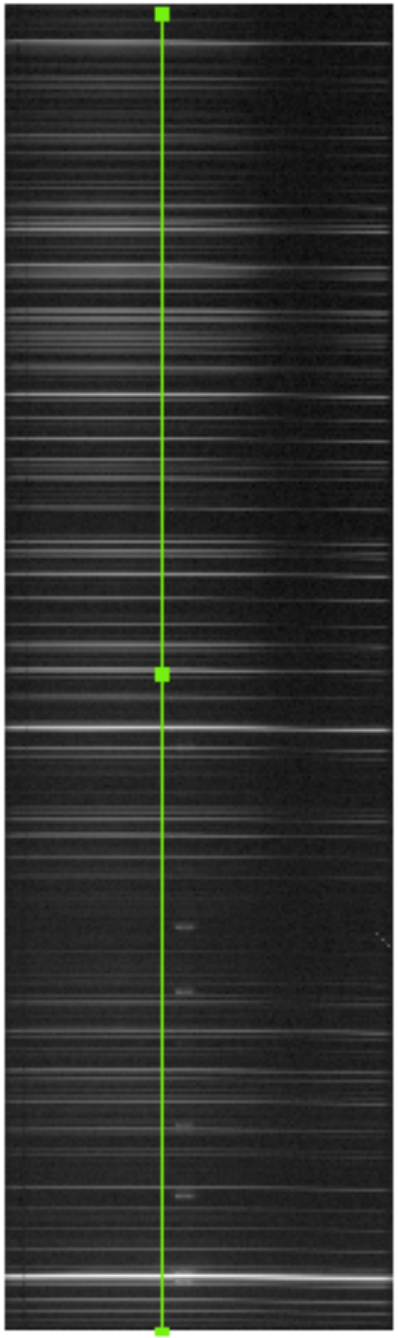




Calibração em comprimento de onda: He-Ar *(arquivo hear.fits)*



Precisamos extrair o espectro de He-Ar exatamente na mesma posição da estrela observada



Extração do espectro de He-Ar na mesma posição do objeto de referência

apall hear.fits out=hear_estrela.fits ref=estrela.fits
inter- recen- trace- extras- backgro=none

- **hear.fits**: imagem de He-Ar
- **out=hear_comp.fits**: espectro de He-Ar a ser extraído
- **ref =estrela.fits** é o nome do arquivo da estrela (antes da extração com o apall)

Preparar arquivos de lampada He-Ar

> ls -1 *f.fits > lista_in

> !more lista_in

```
HD036079f.fits
HD036673f.fits
HD045289f.fits
```

> !sed “s/HD/hear_HD/g” lista_in > lista_out

> !more lista_out

```
hear_HD036079f.fits
hear_HD036673f.fits
hear_HD045289f.fits
```

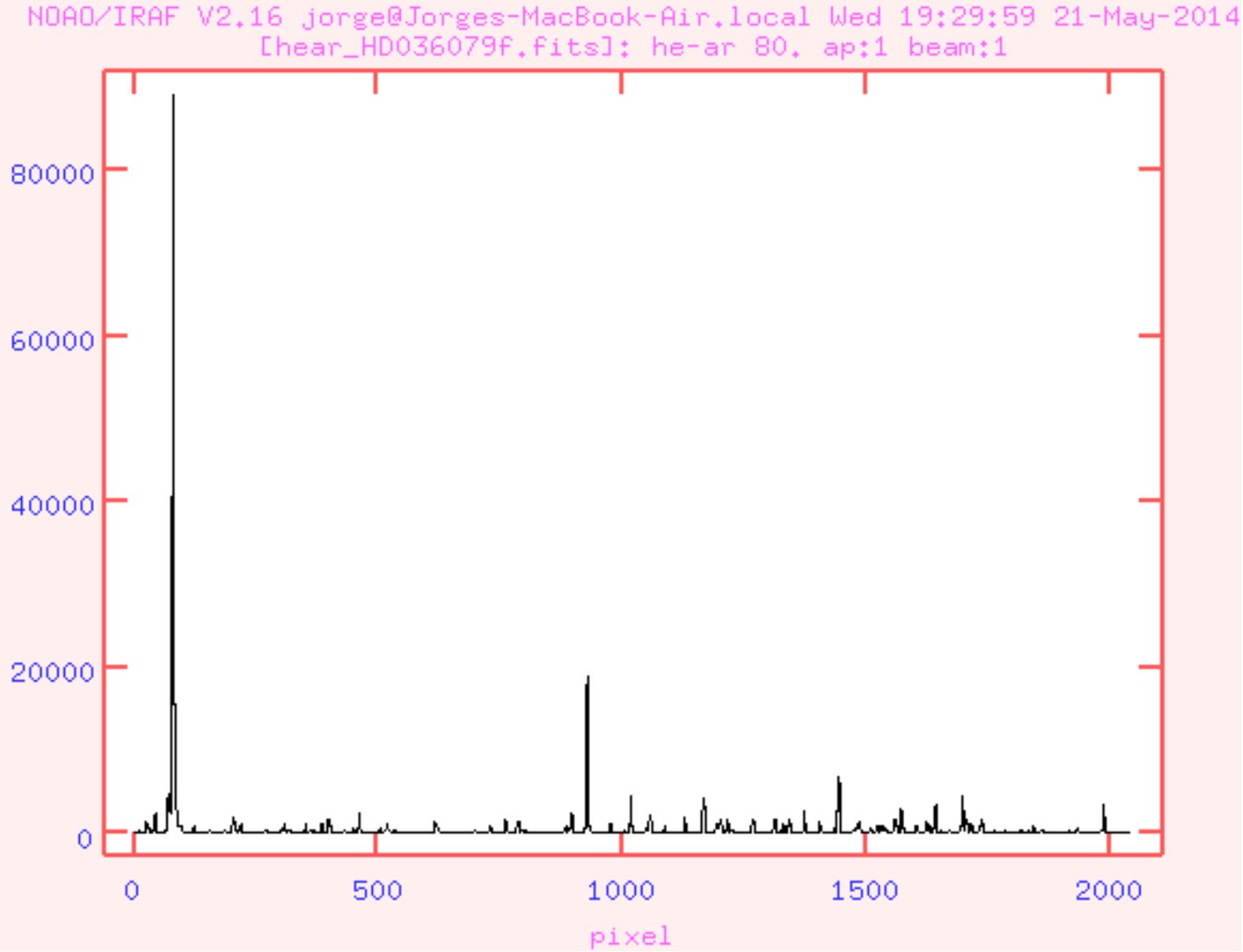
> !printf "hear.fits\n%.0s" {1..3} > lista_hear

> !more lista_hear

```
hear.fits
hear.fits
hear.fits
```

apall @lista_hear out=@lista_out ref=@lista_in inter- recen- trace- extras- backgro=none clean- sat=100000 readnoise=18.0 gain=4.0 t_order=6

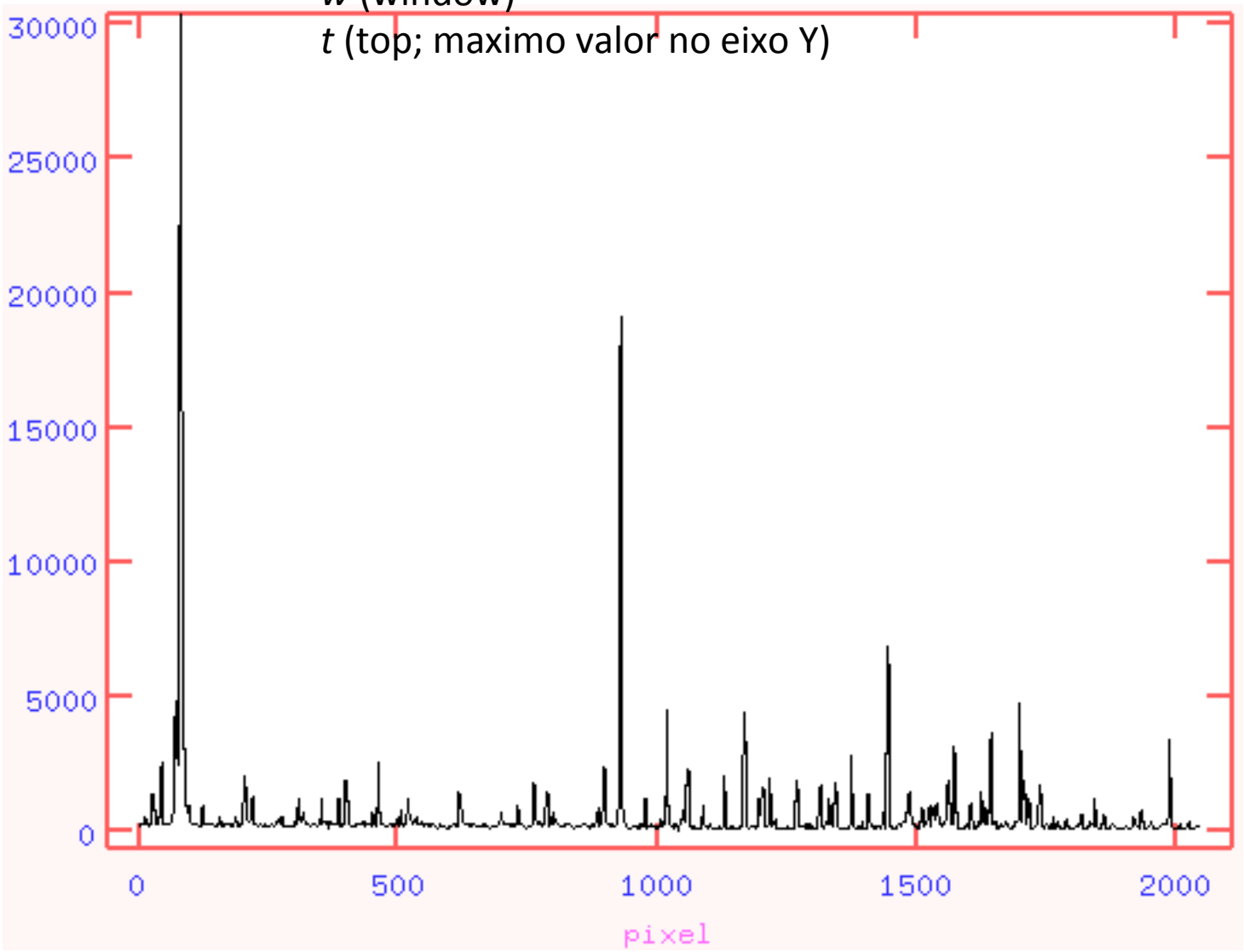
onedspec> splot hear_HD*

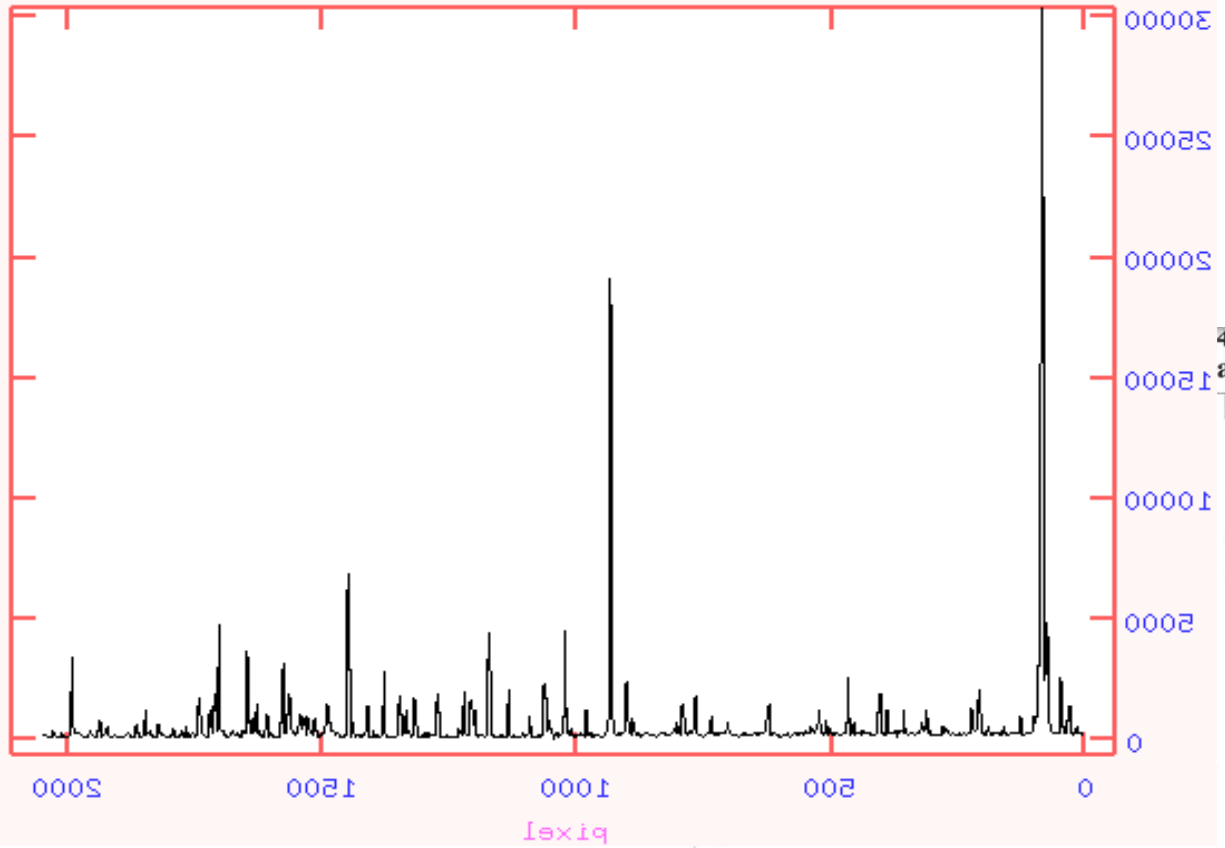


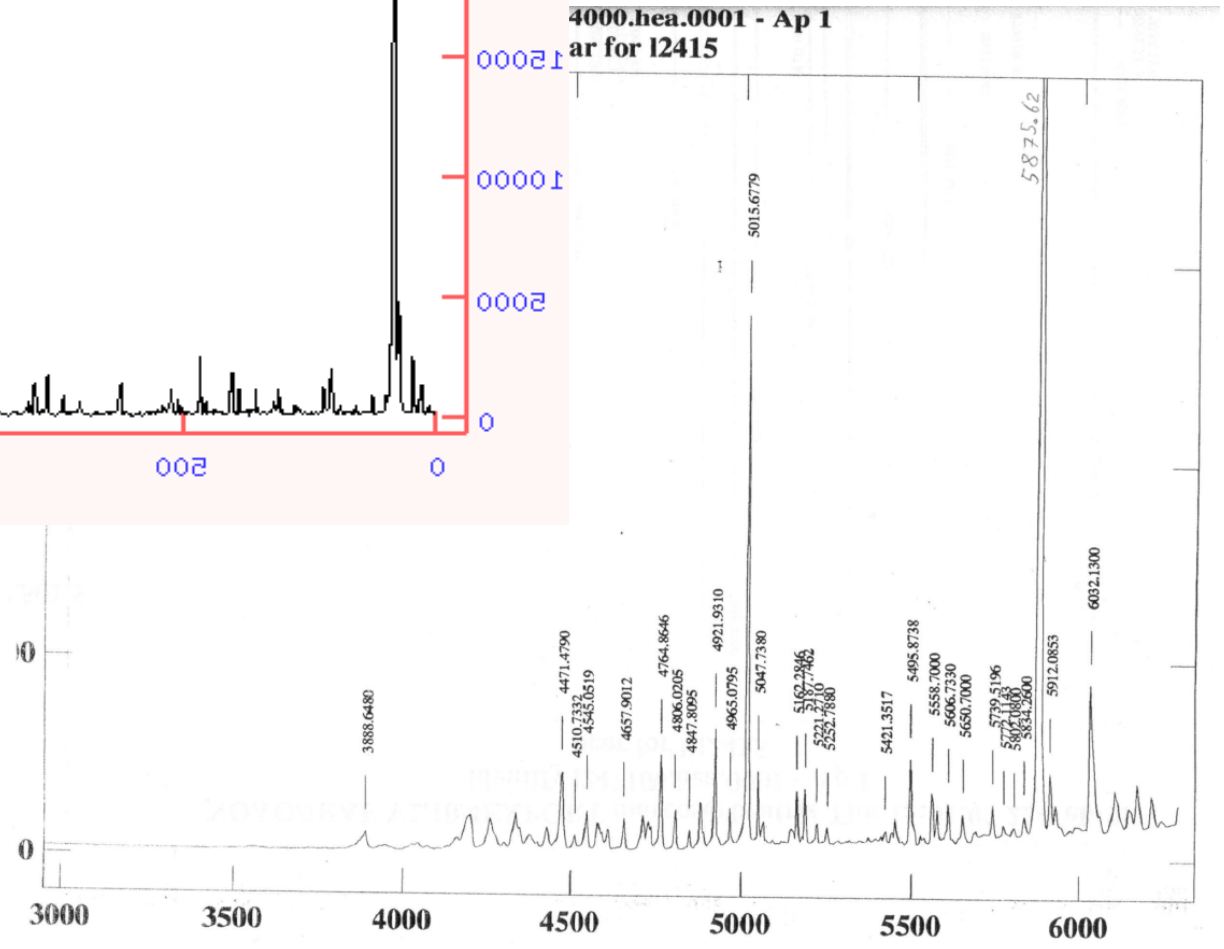
onedspec> splot hear_HD*

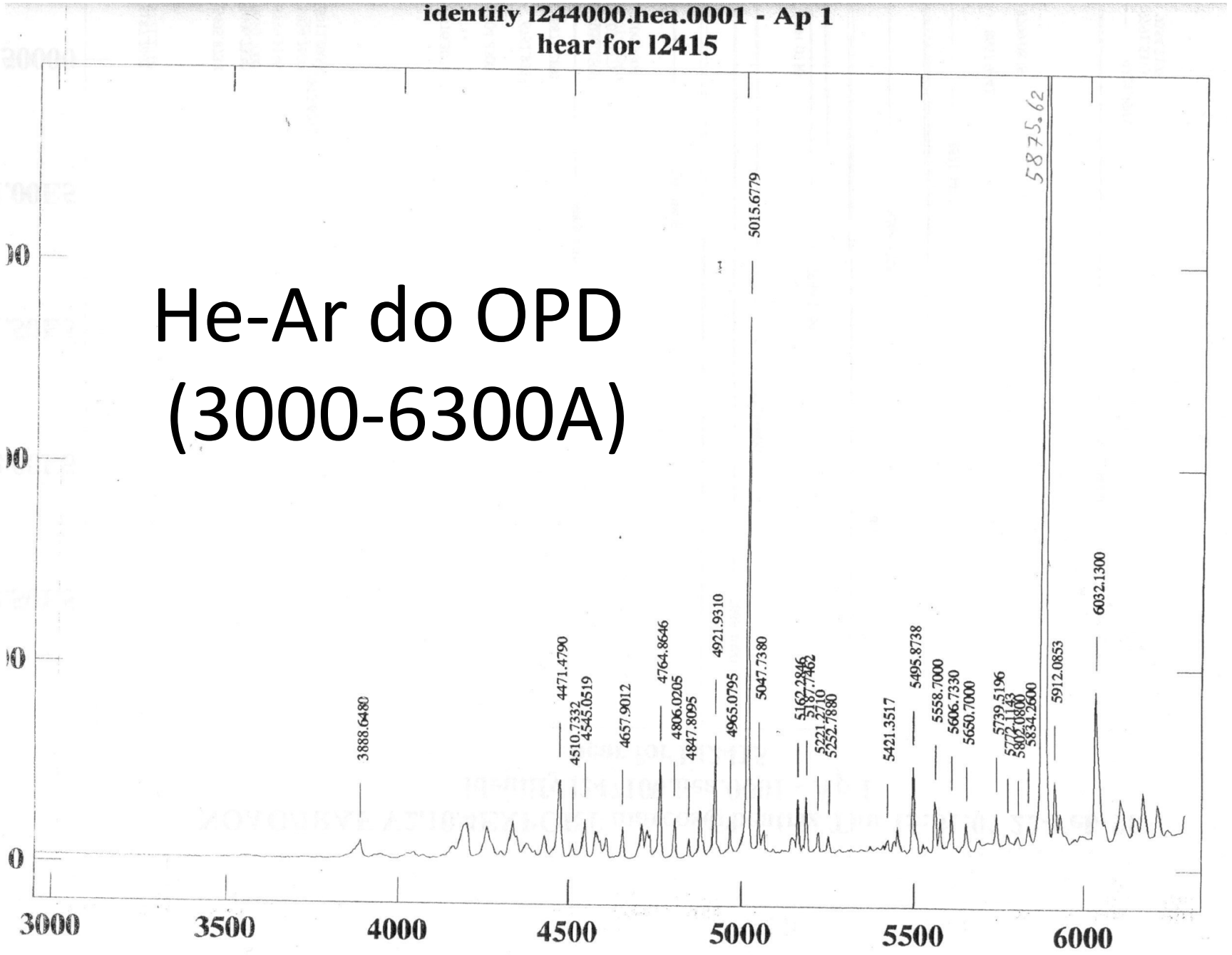
w (window)

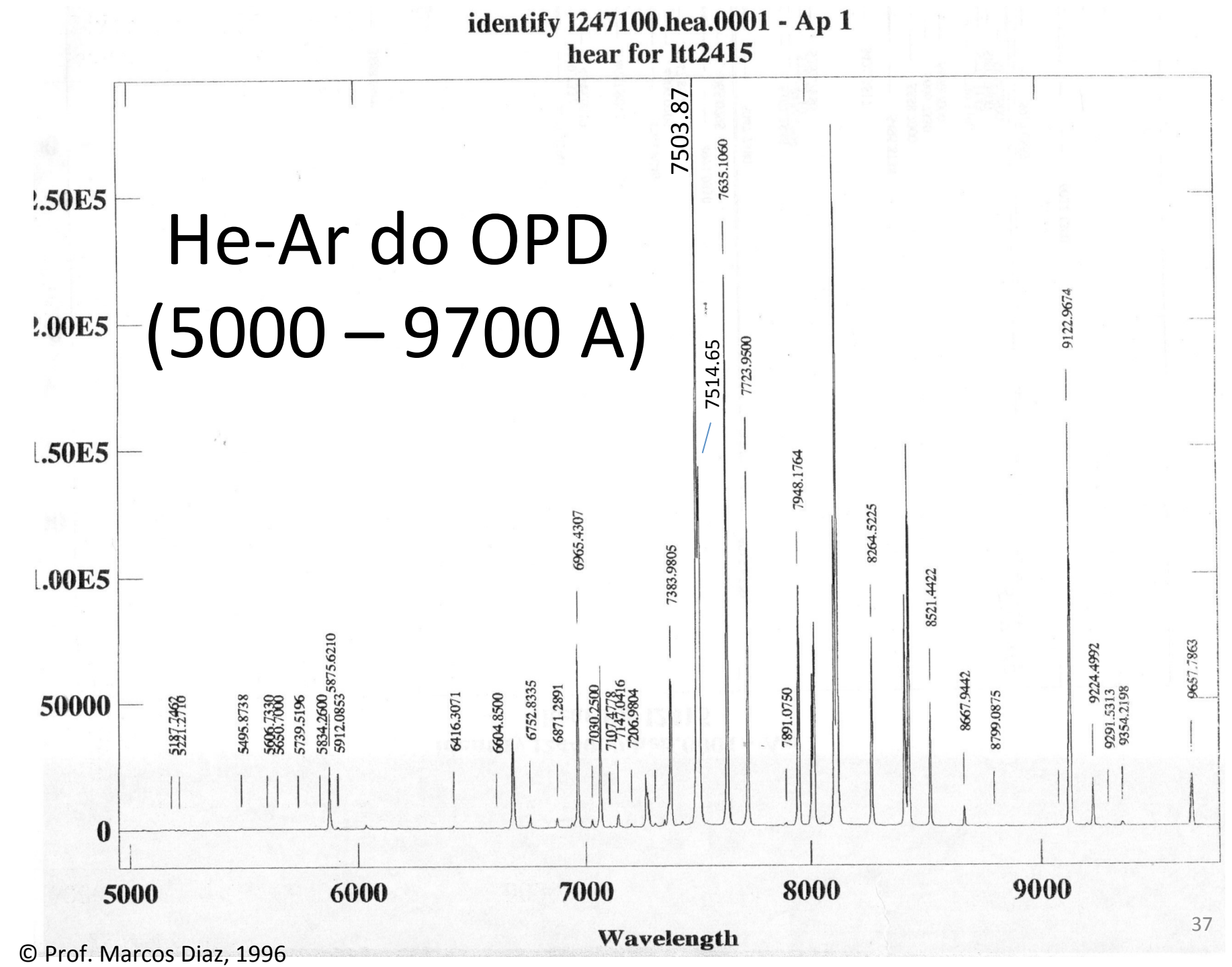
t (top; maximo valor no eixo Y)



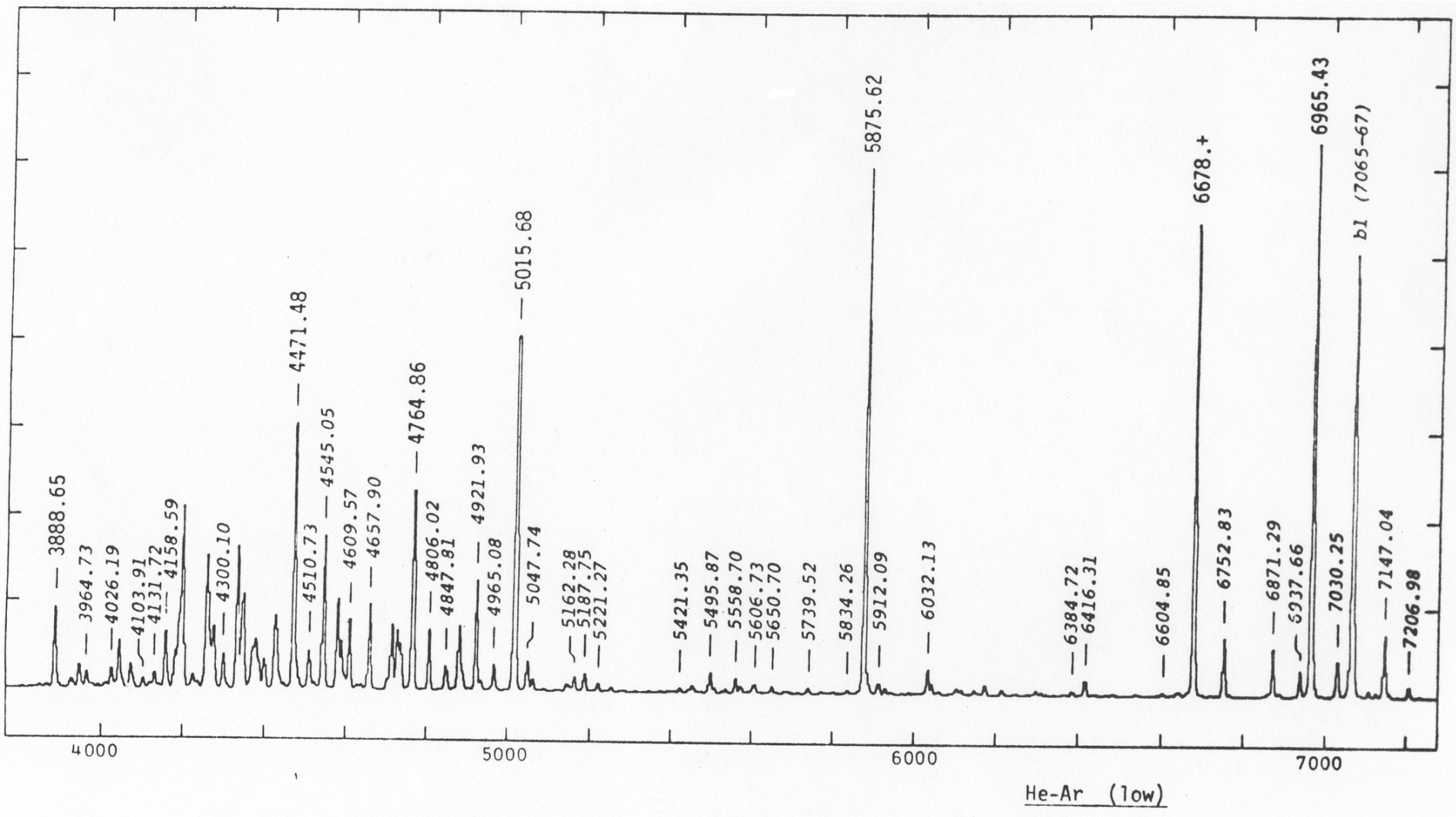

30000
25000
20000
15000
10000
5000
0
2000
1500
1000
500
0
pixel


4000.hea.0001 - Ap 1
ar for l2415
5875.62
5015.6779
6032.1300
5912.0853
5495.8738
5421.3517
5047.7380
4965.0795
4921.9310
4764.8646
4657.9012
4471.4790
3888.6480
3000
3500
4000
4500
5000
5500
6000

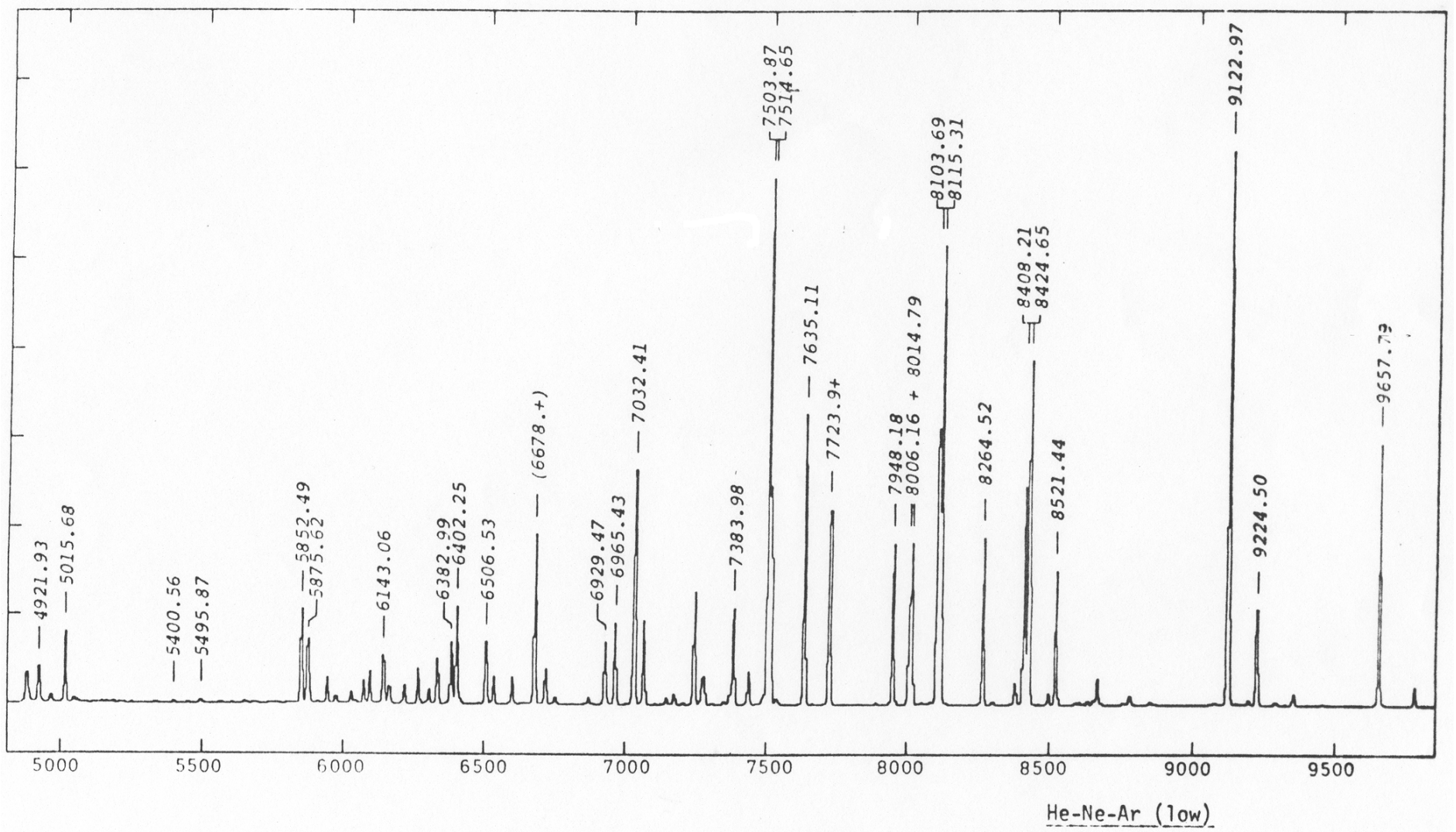




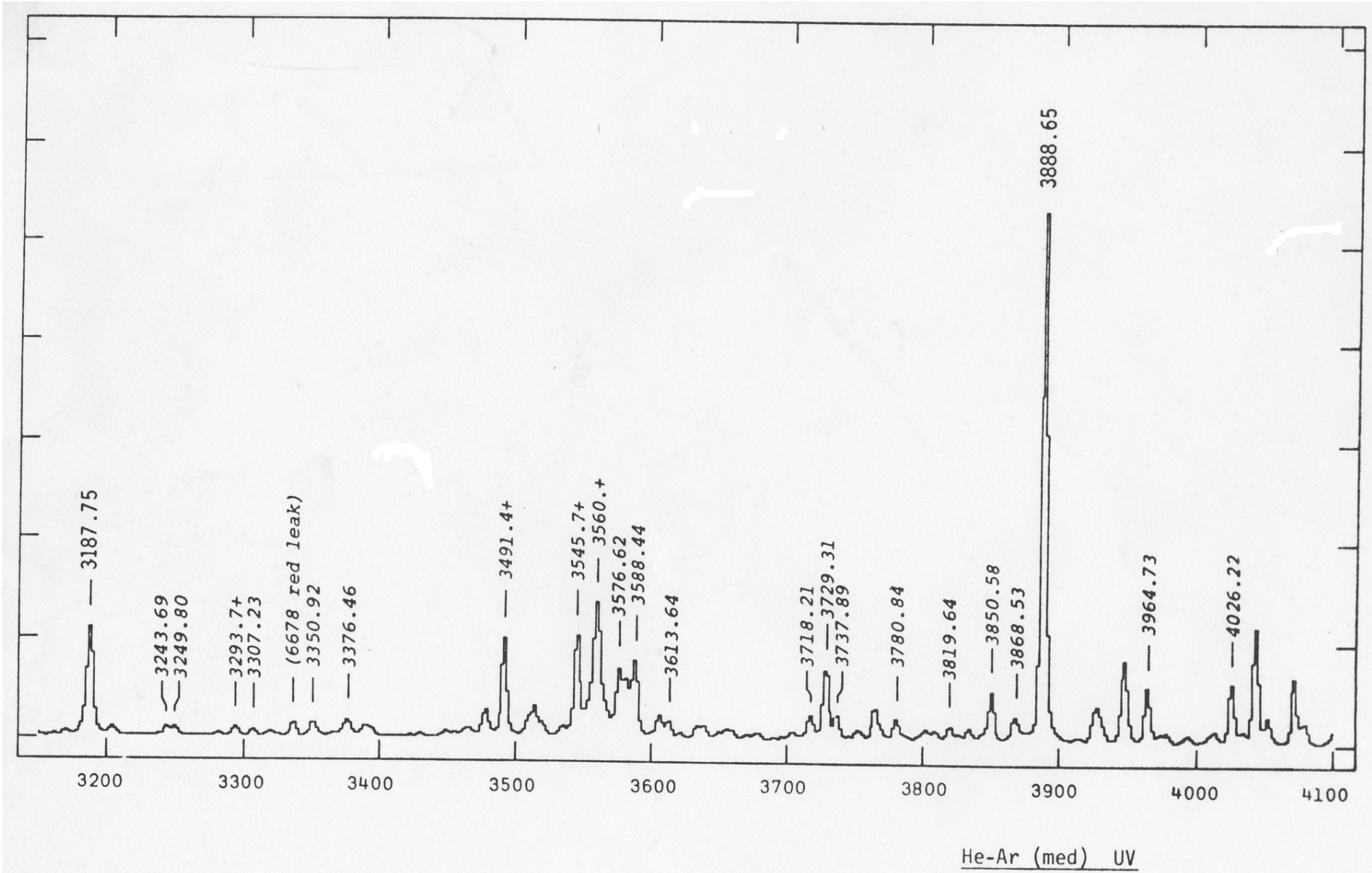
He-Ar do CTIO (3800-7200A)
(low resolution)



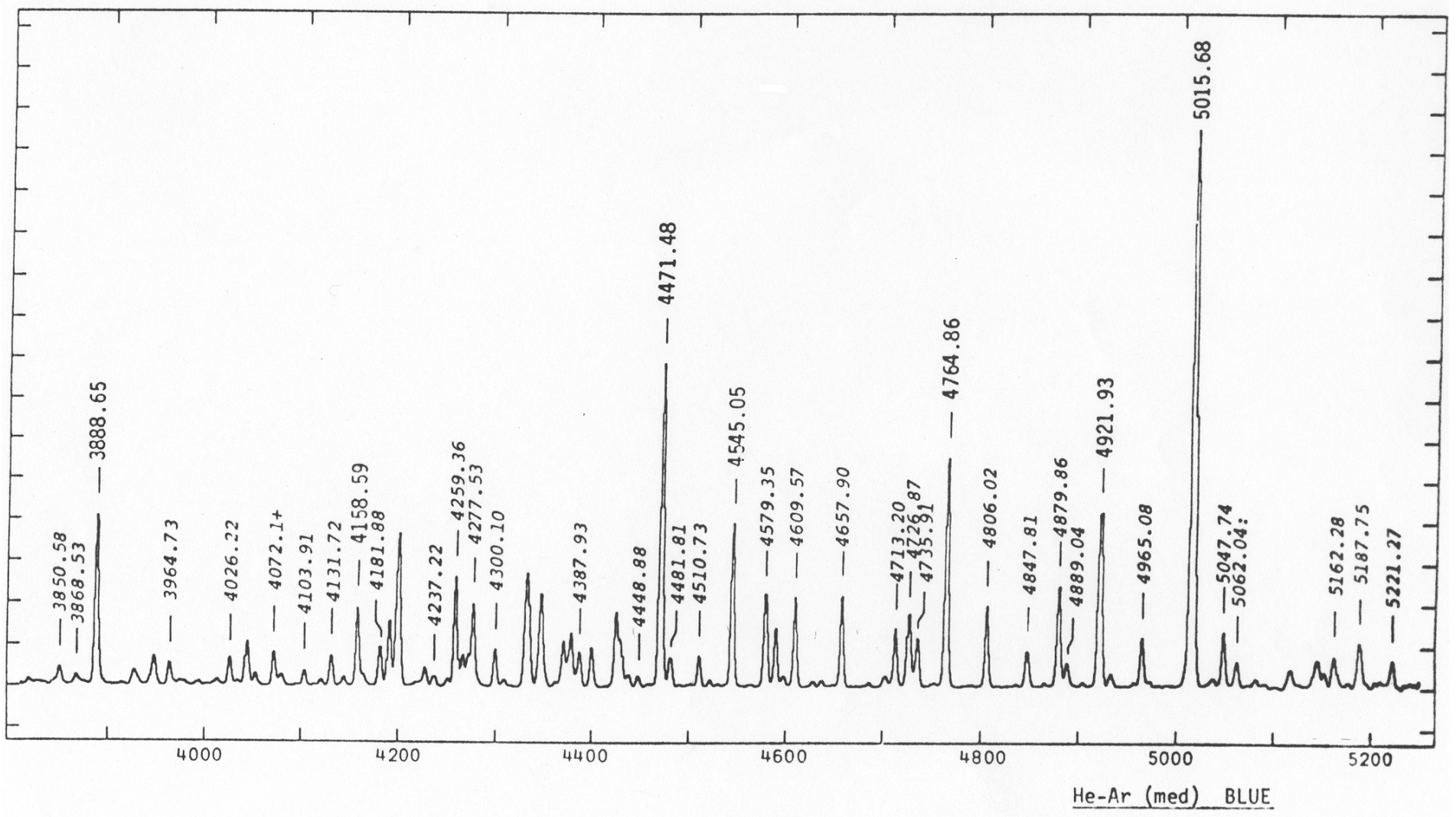
He-Ar-Ne do CTIO (4900-9700A)
(low resolution)



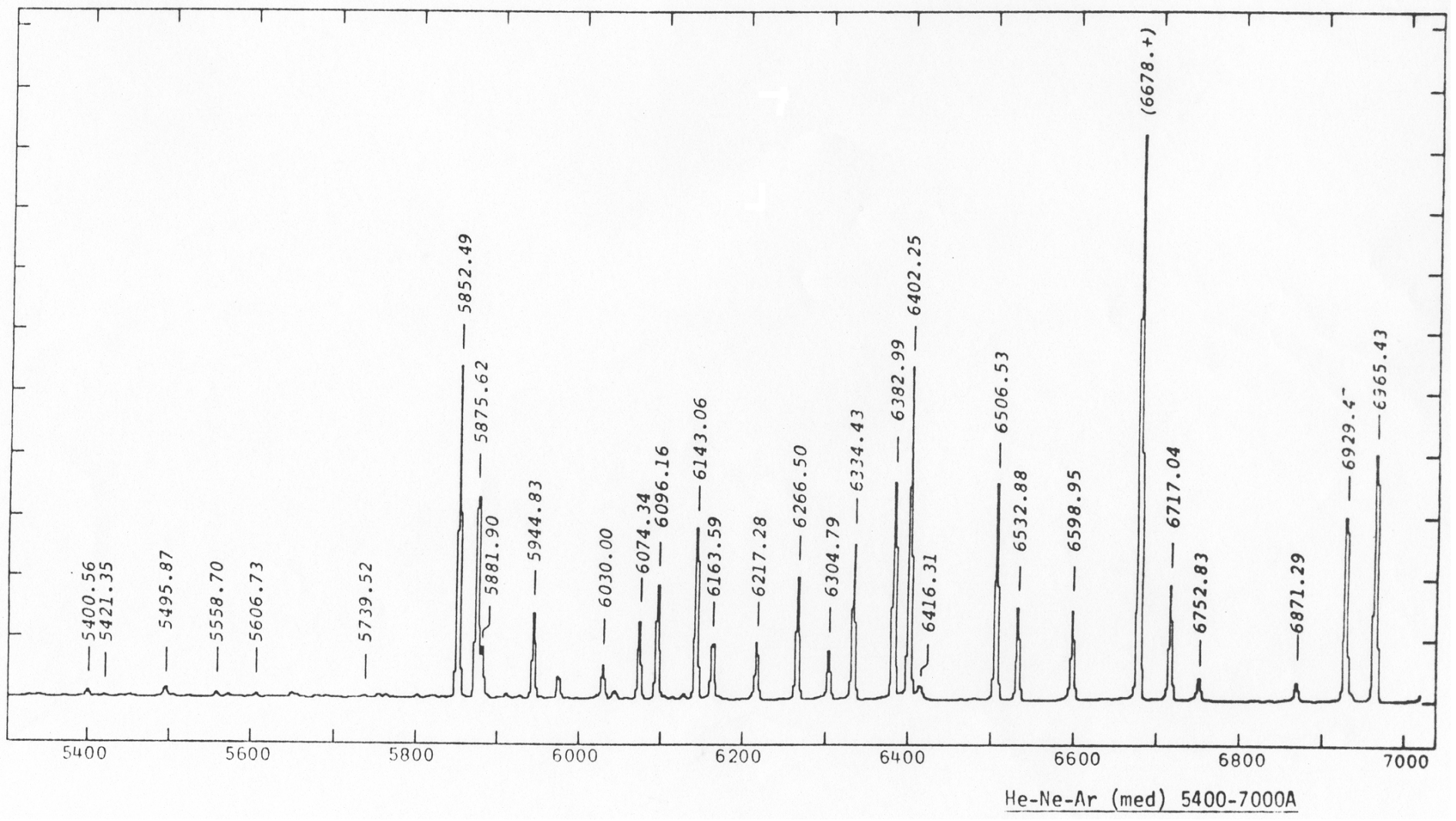
He-Ar do CTIO (3100-4100A)
(medium resolution)



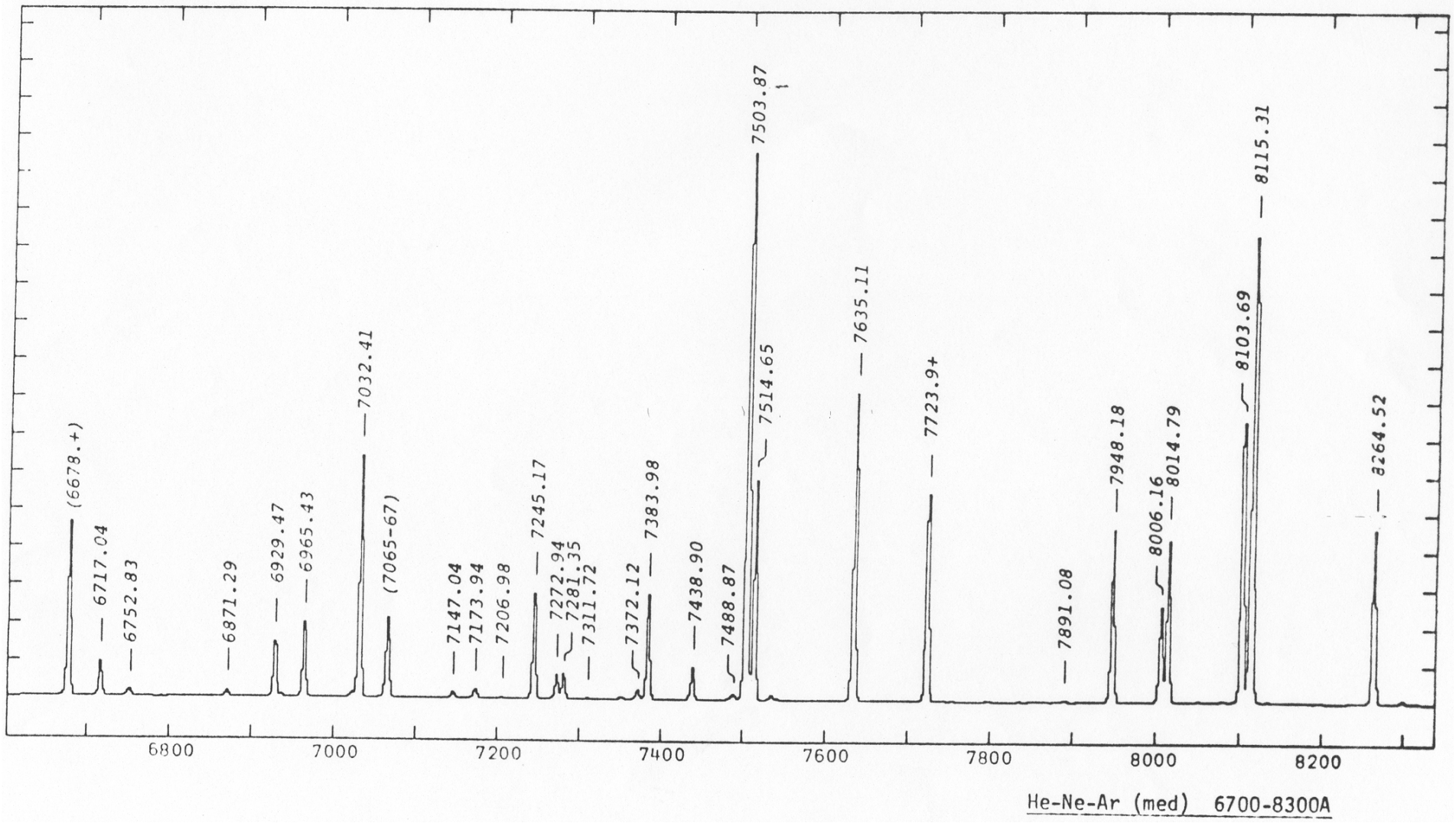
He-Ar do CTIO (3800-5250A)
(medium resolution)



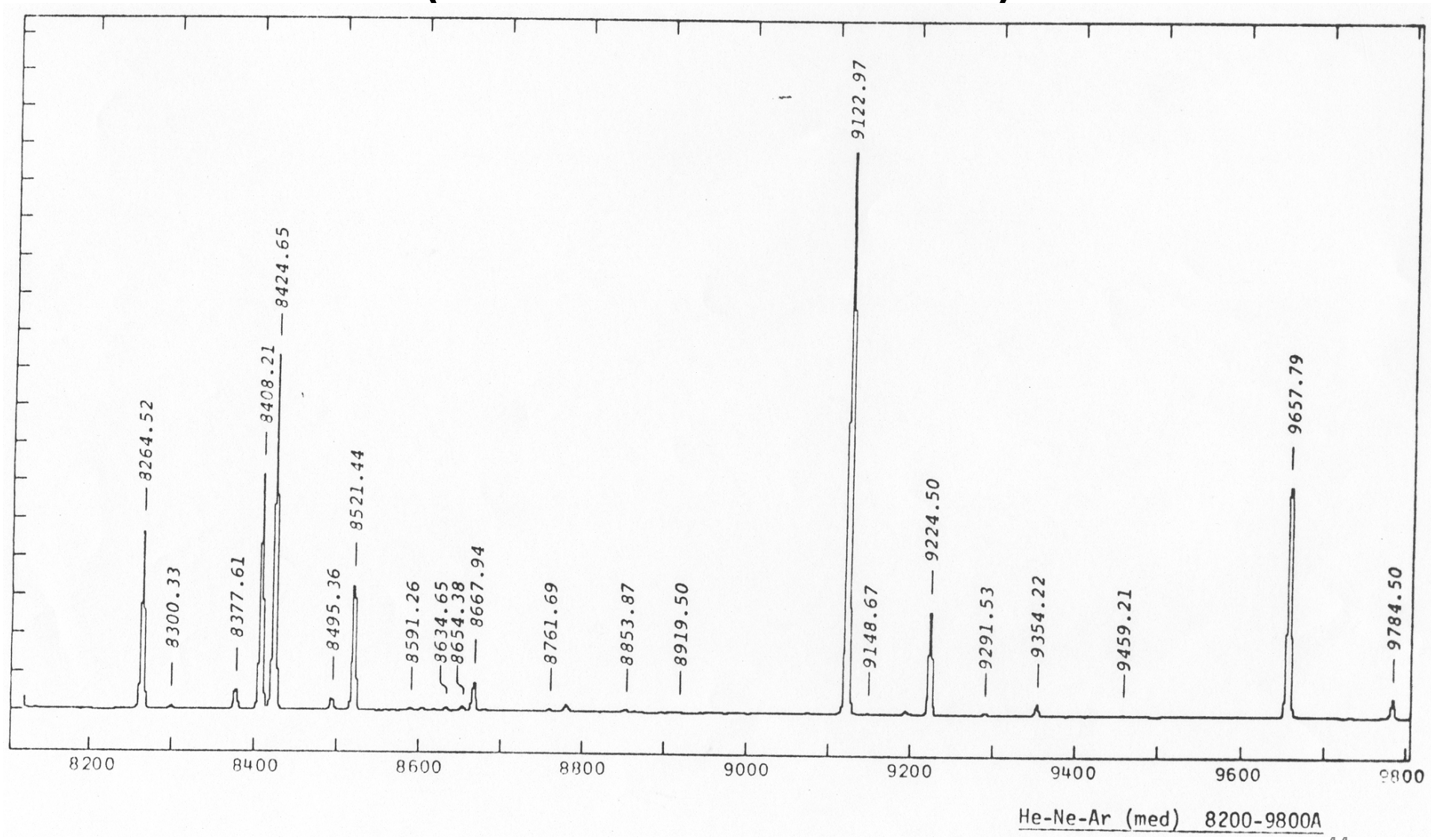
He-Ar-Ne do CTIO (5300-7000A)
(medium resolution)



He-Ar-Ne do CTIO (6700-8300A)
(medium resolution)



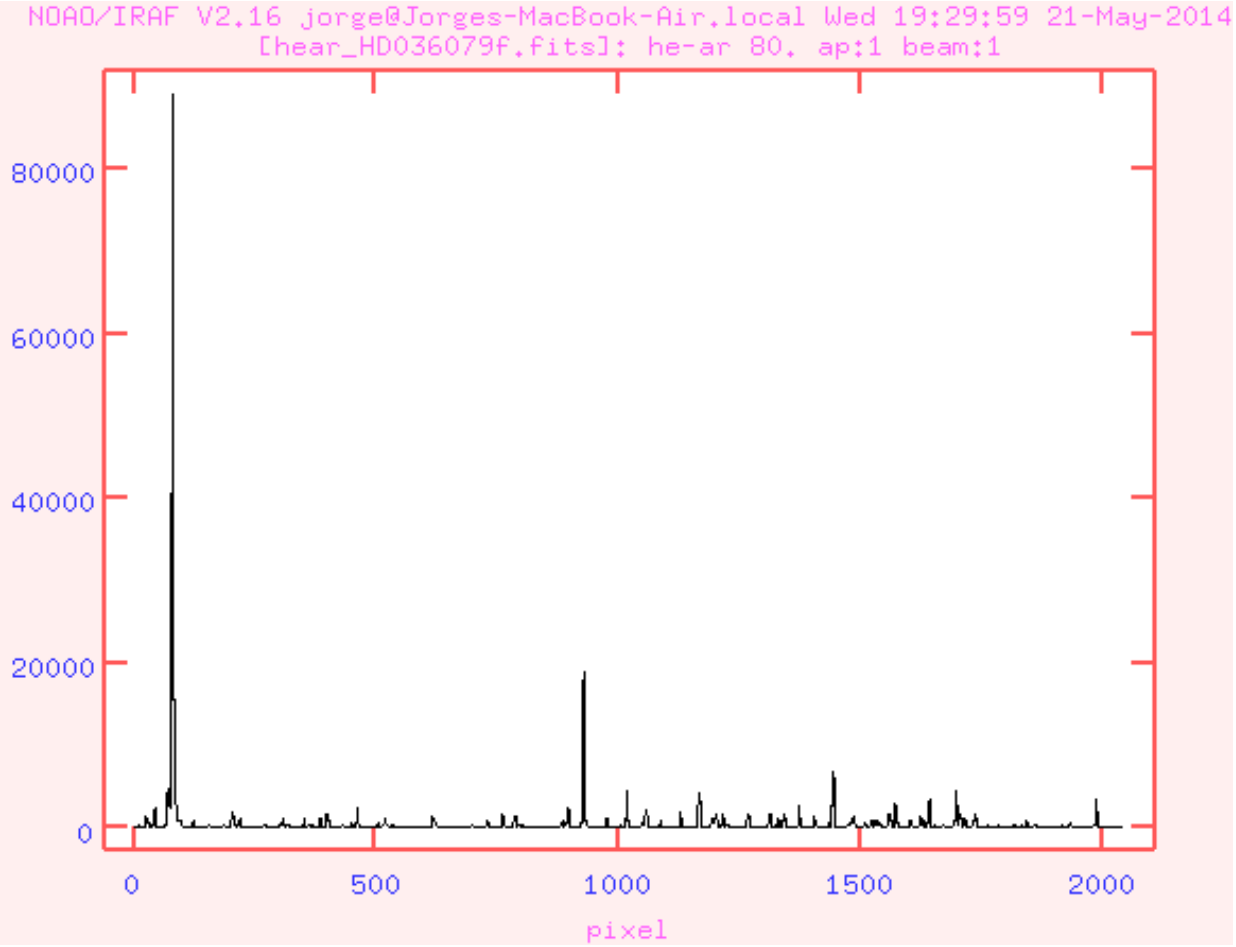
He-Ar-Ne do CTIO (8200-9800A)
(medium resolution)



Identificação de linhas

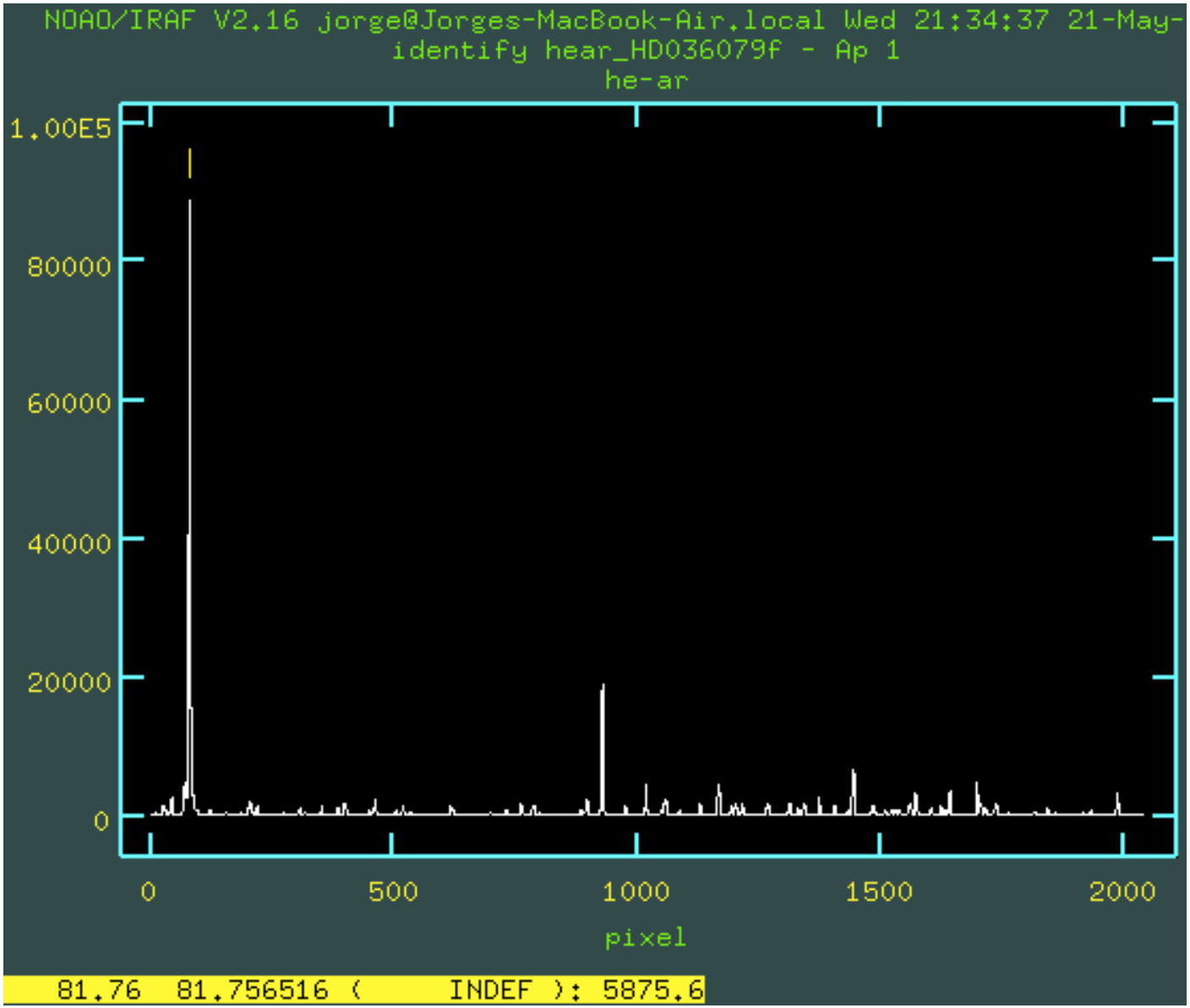
ap> ls -1 hear_*

hear_HD036079f.fits
hear_HD036673f.fits
hear_HD045289f.fits



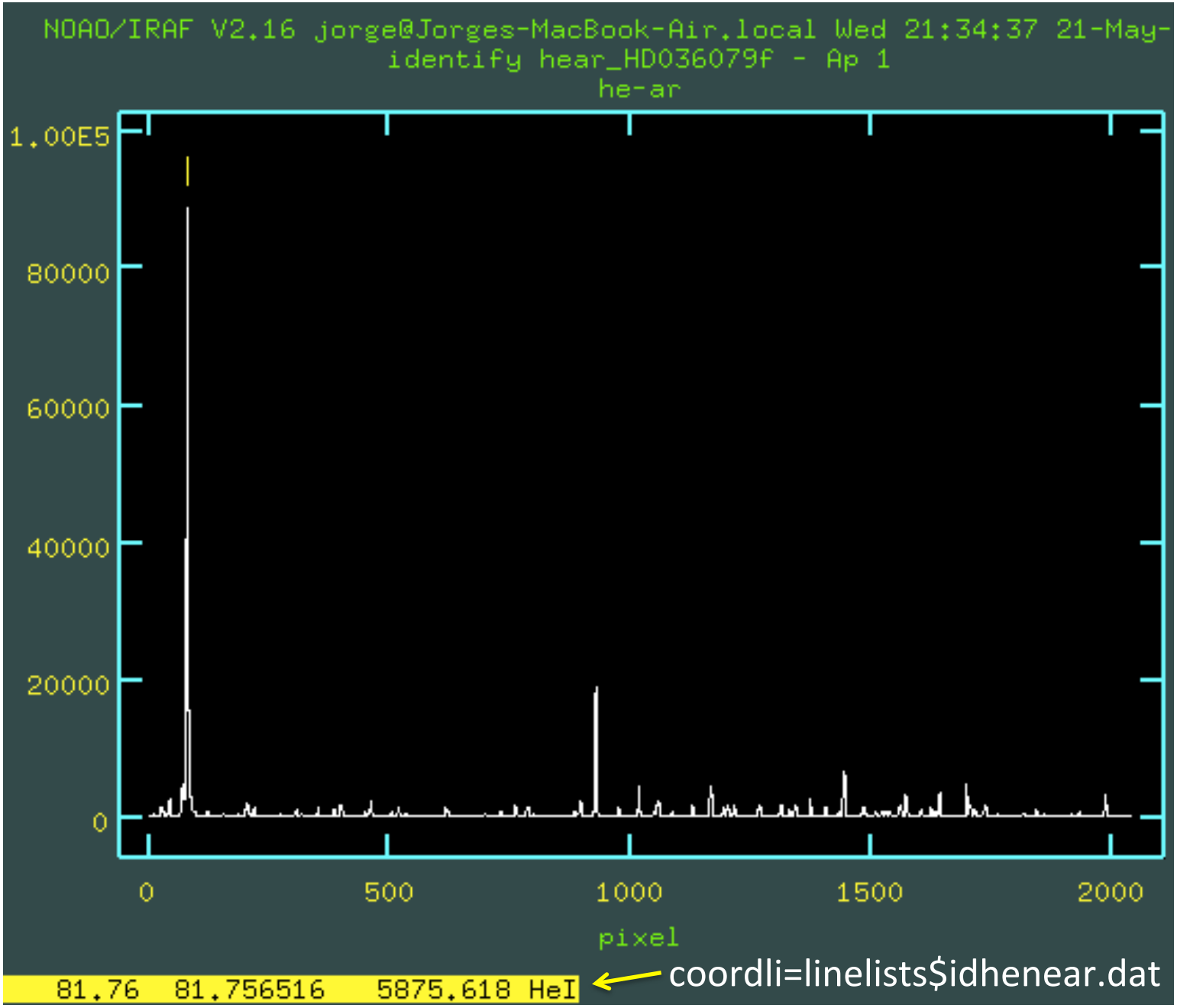
Identificação de linhas

ap> identify hear_HD036079f.fits coordli=linelists$idhenear.dat

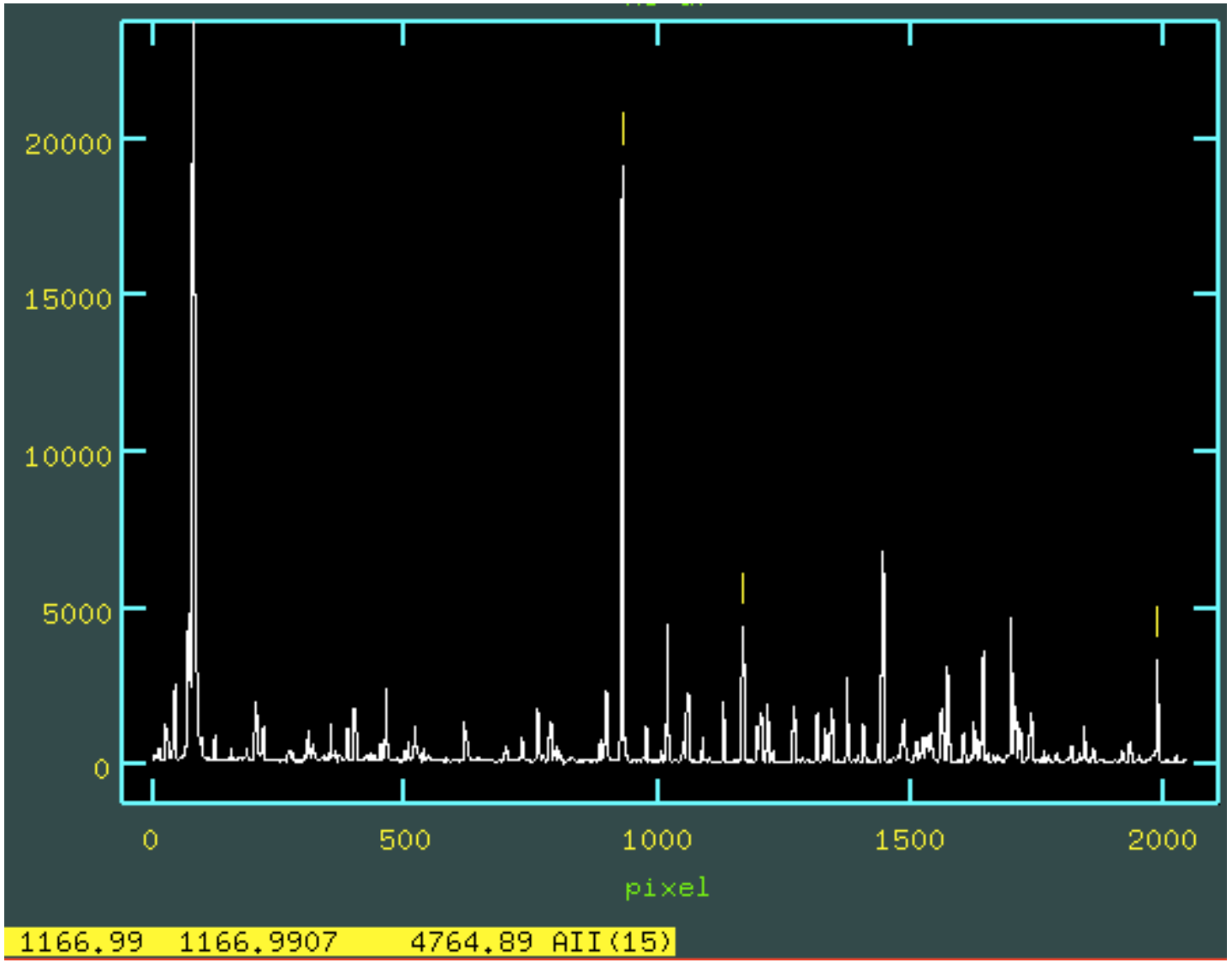


Lista de linhas de He-Ne-Ar do IRAF

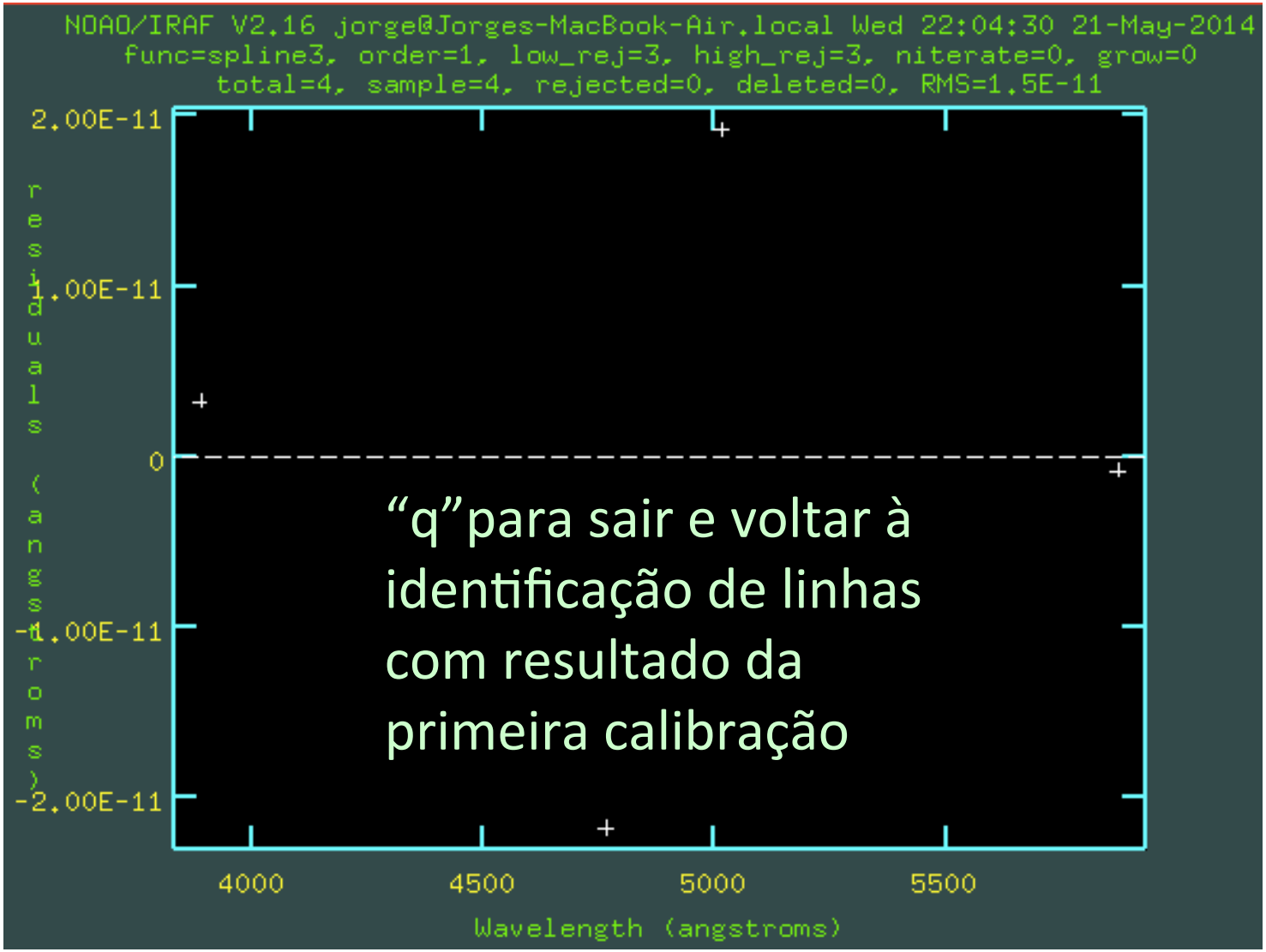
Marcar a linha com "**m**", dar o comprimento de onda e *return (enter)*


NOAO/IRAF V2.16 jorge@Jorges-MacBook-Air.local Wed 21:34:37 21-May-
identify hear_HD036079f - Ap 1
he-ar
1.00E5
80000
60000
40000
20000
0
0
500
1000
1500
2000
pixel
81.76 81.756516 5875.618 HeI
coordli=linelists$idhenear.dat

Após identificar pelo menos 4 linhas bem espaçadas dar "f" (*fit*)

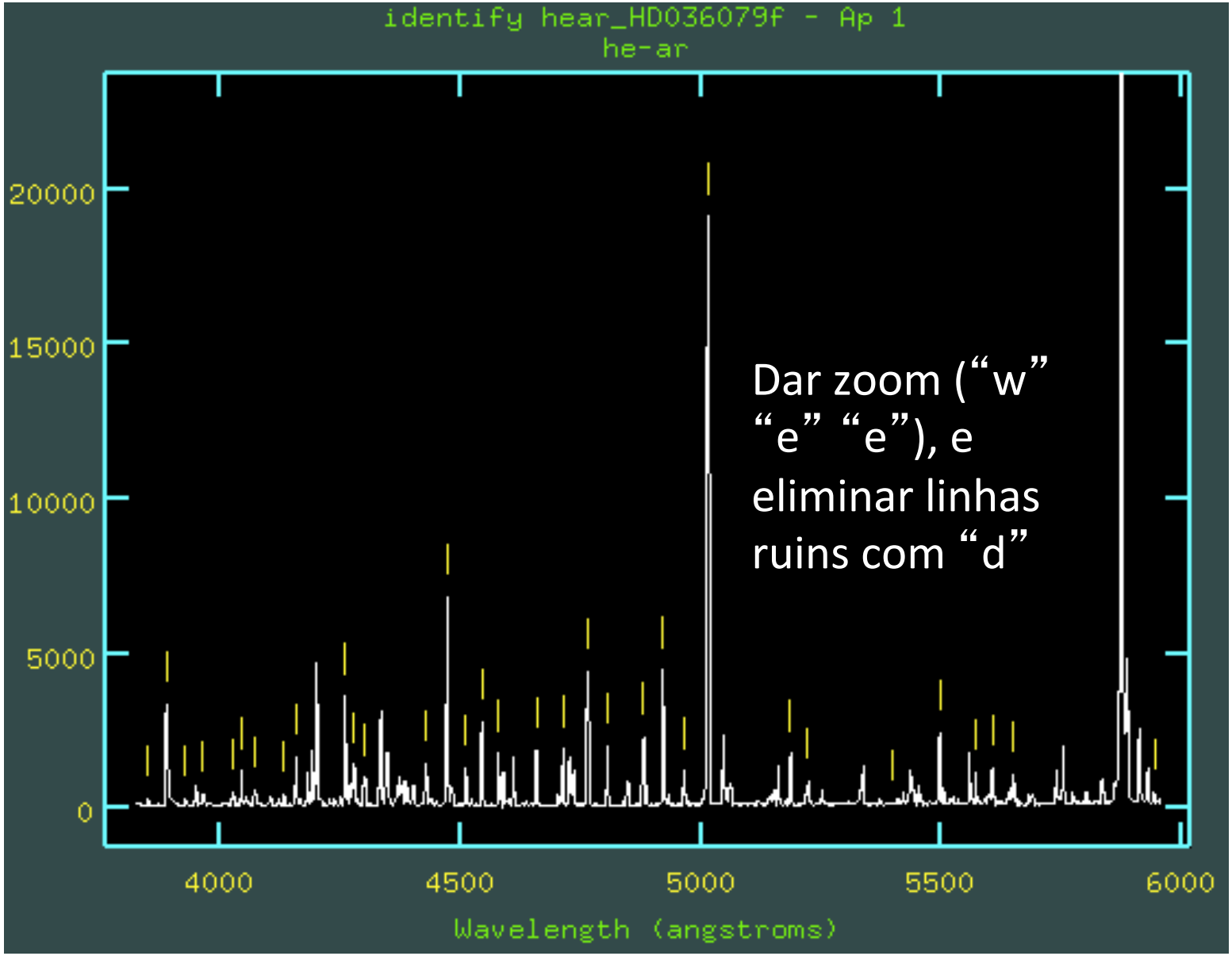


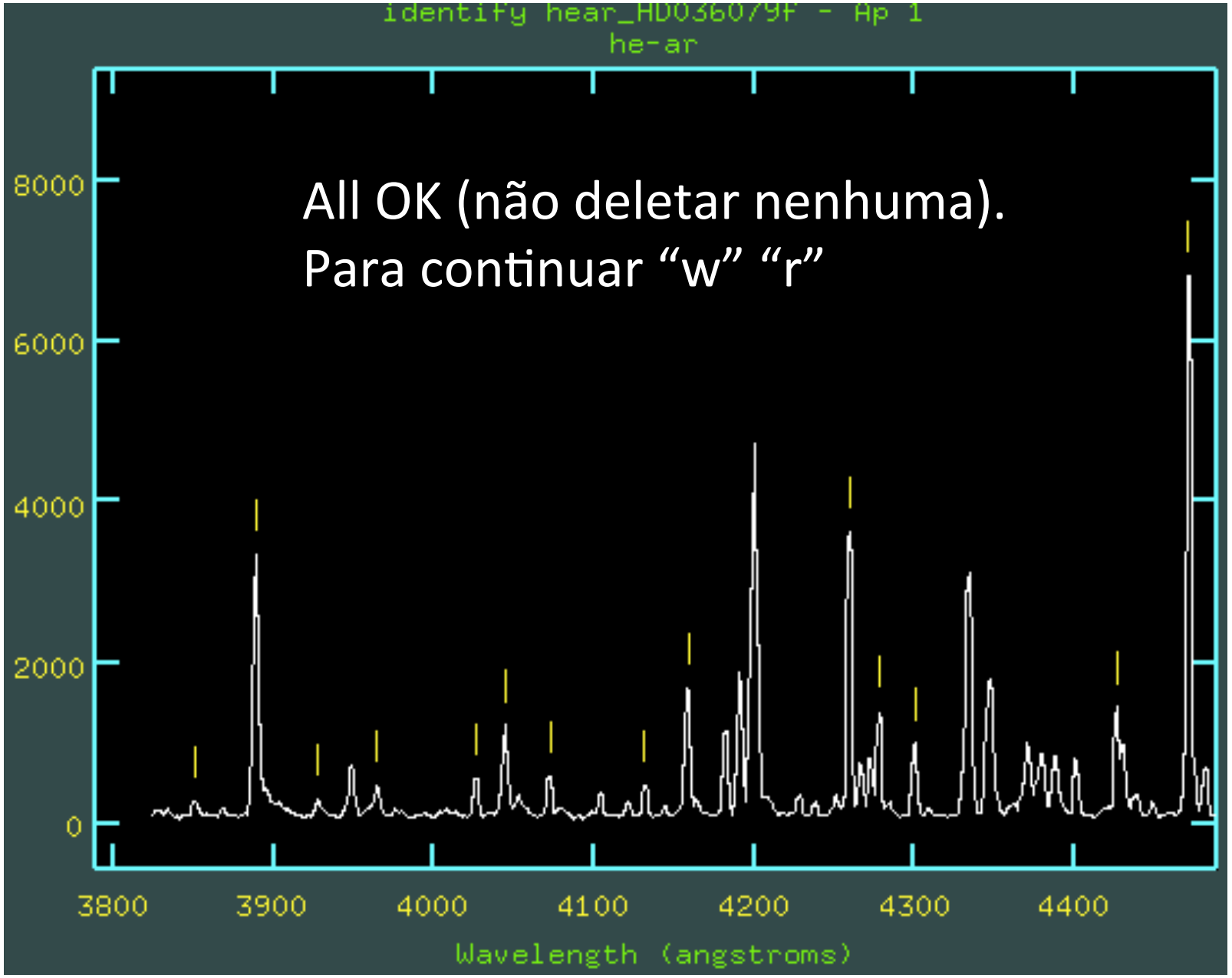
Residuos do ajuste de pixel vs. comprimento de onda

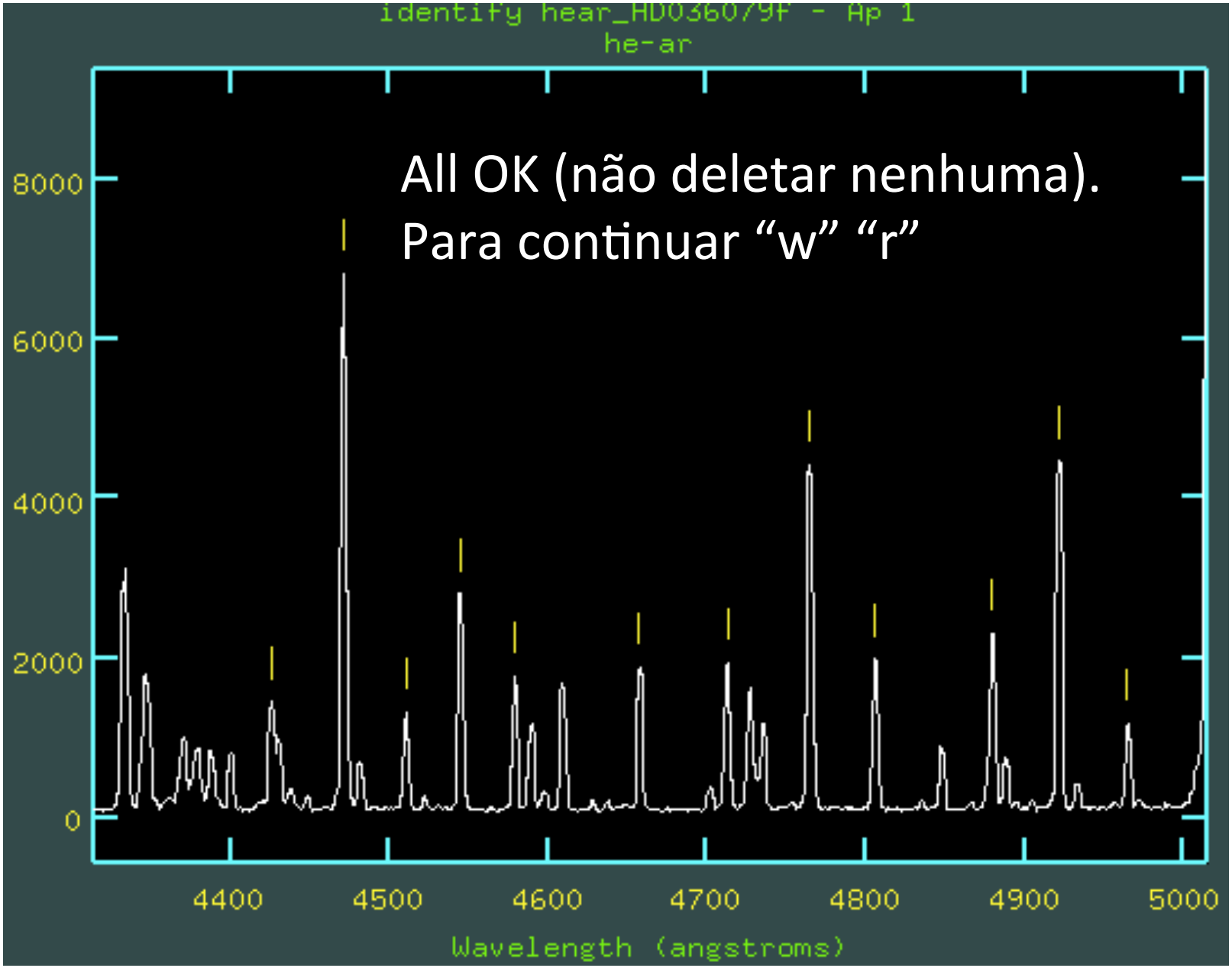


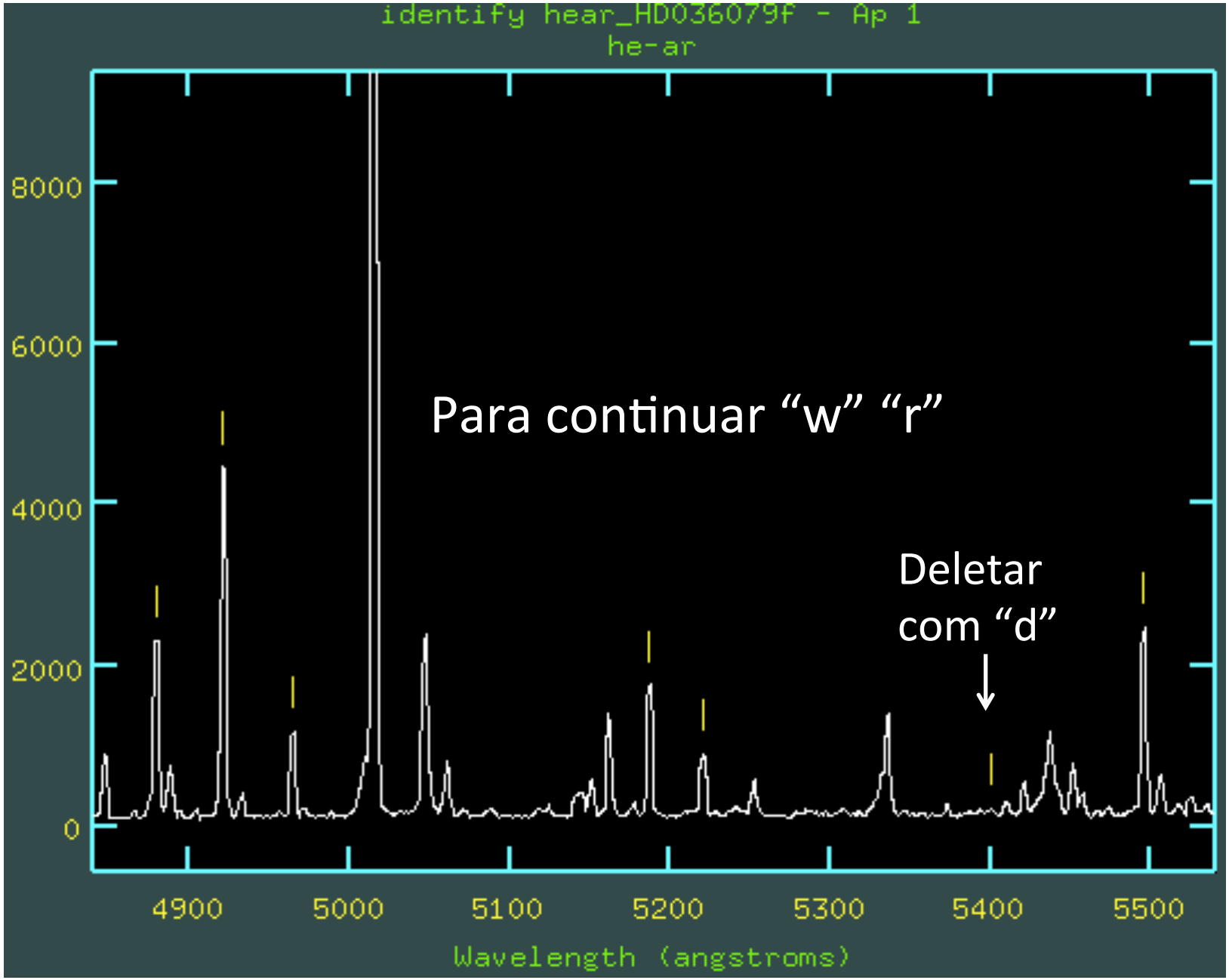
“Guess” da calibração em comprimento de onda

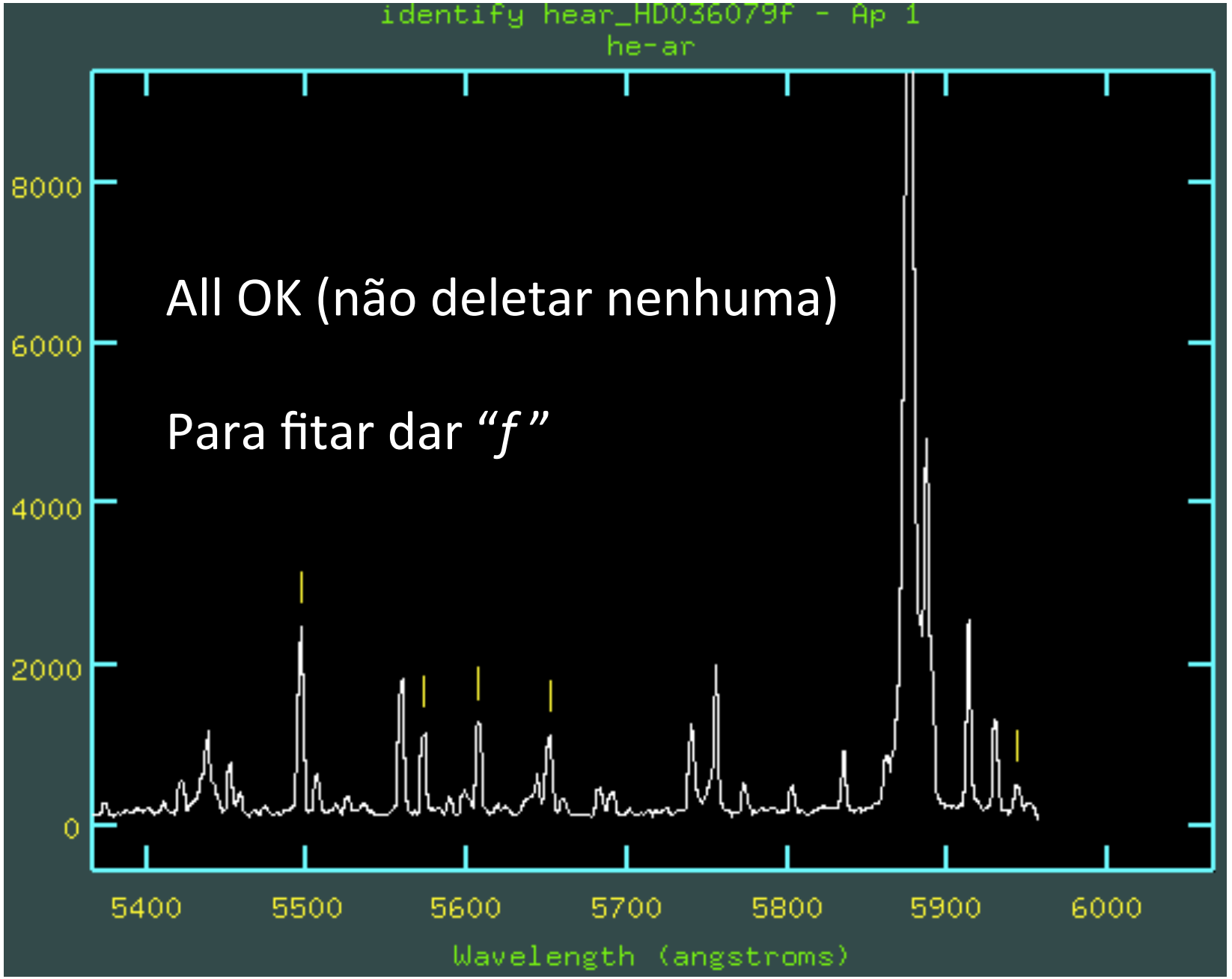
Linhas identificadas automaticamente

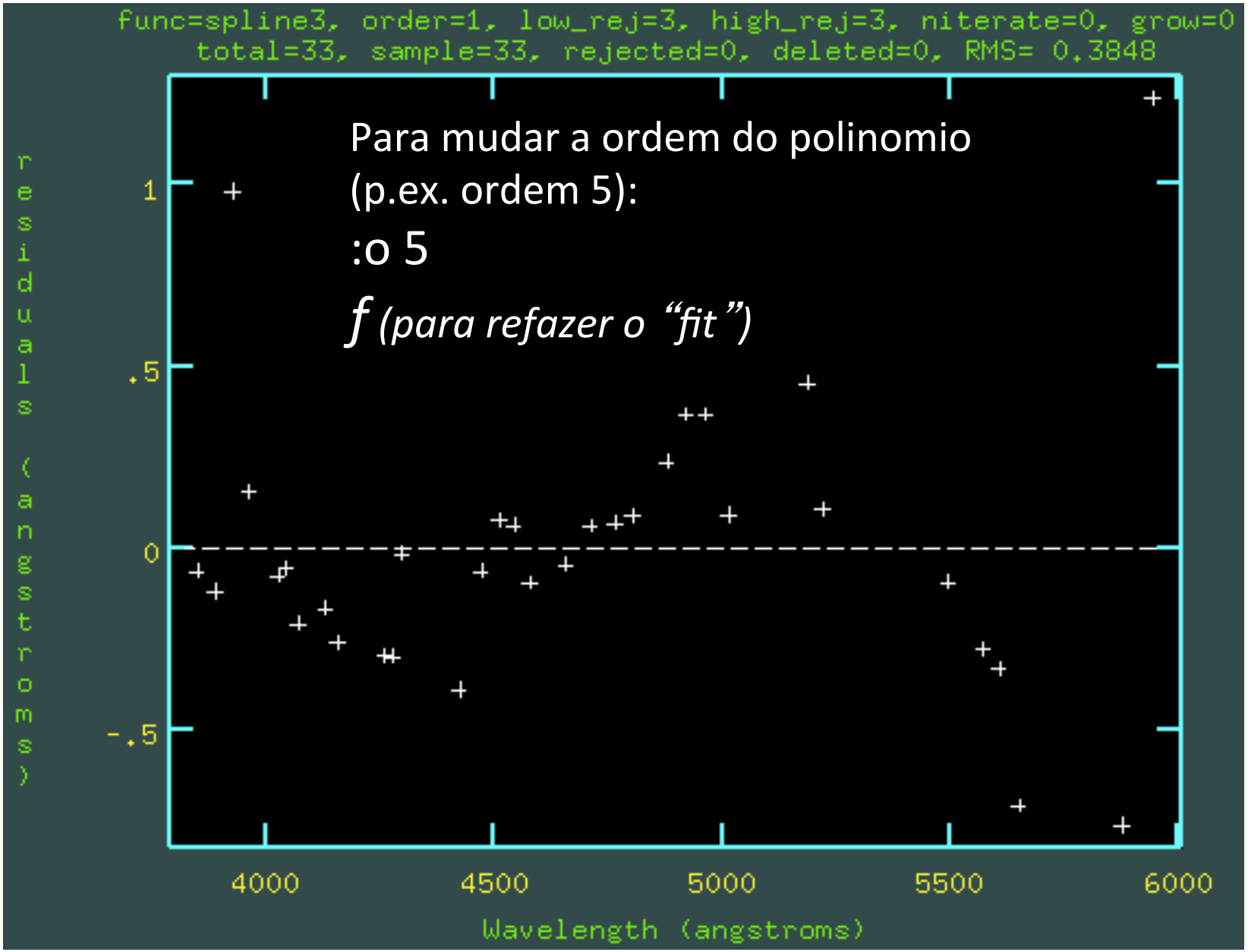


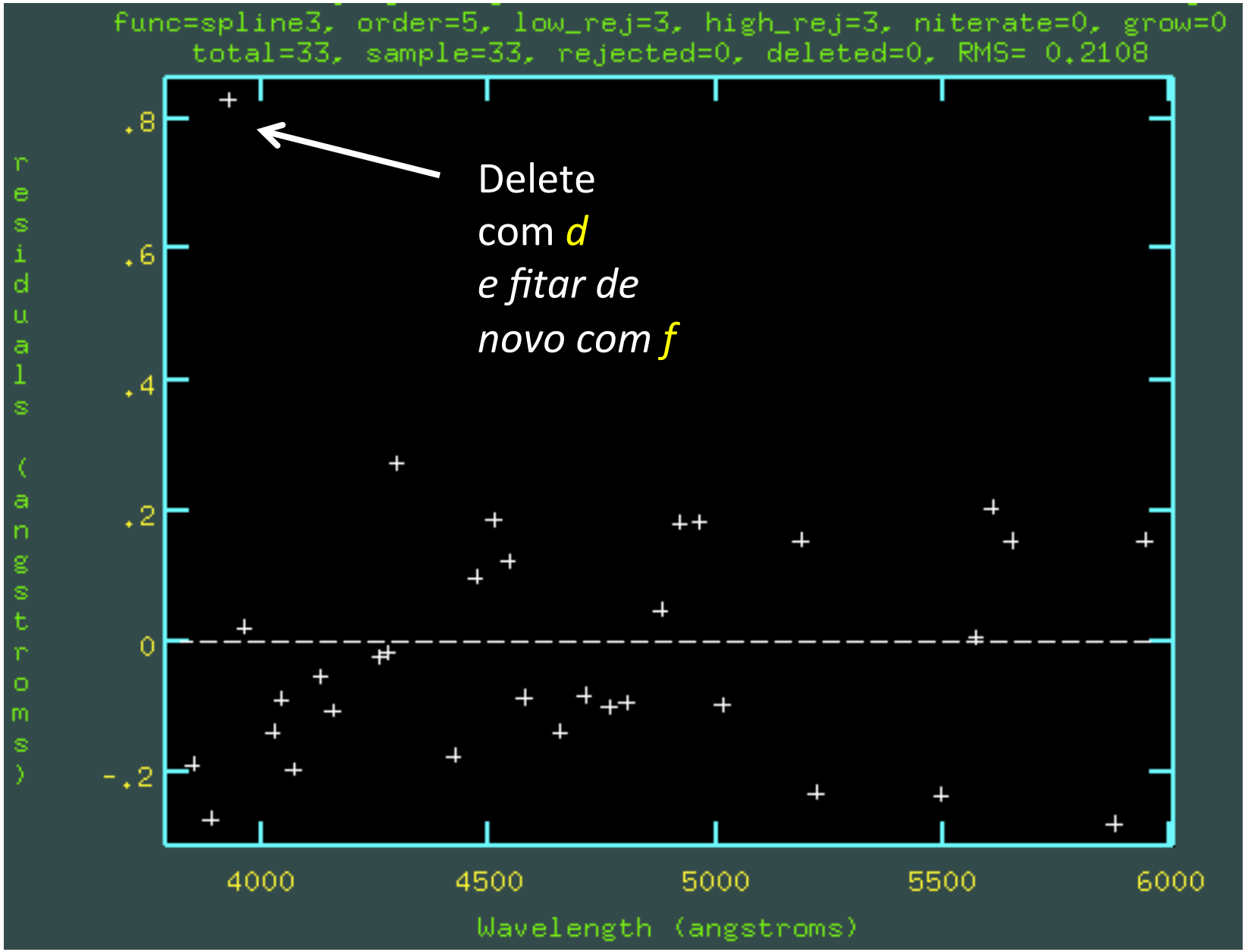

identify hear_HD036079f - Ap 1
he-ar
All OK (não deletar nenhuma).
Para continuar “w” “r”
8000
6000
4000
2000
0
3800
3900
4000
4100
4200
4300
4400
Wavelength (angstroms)

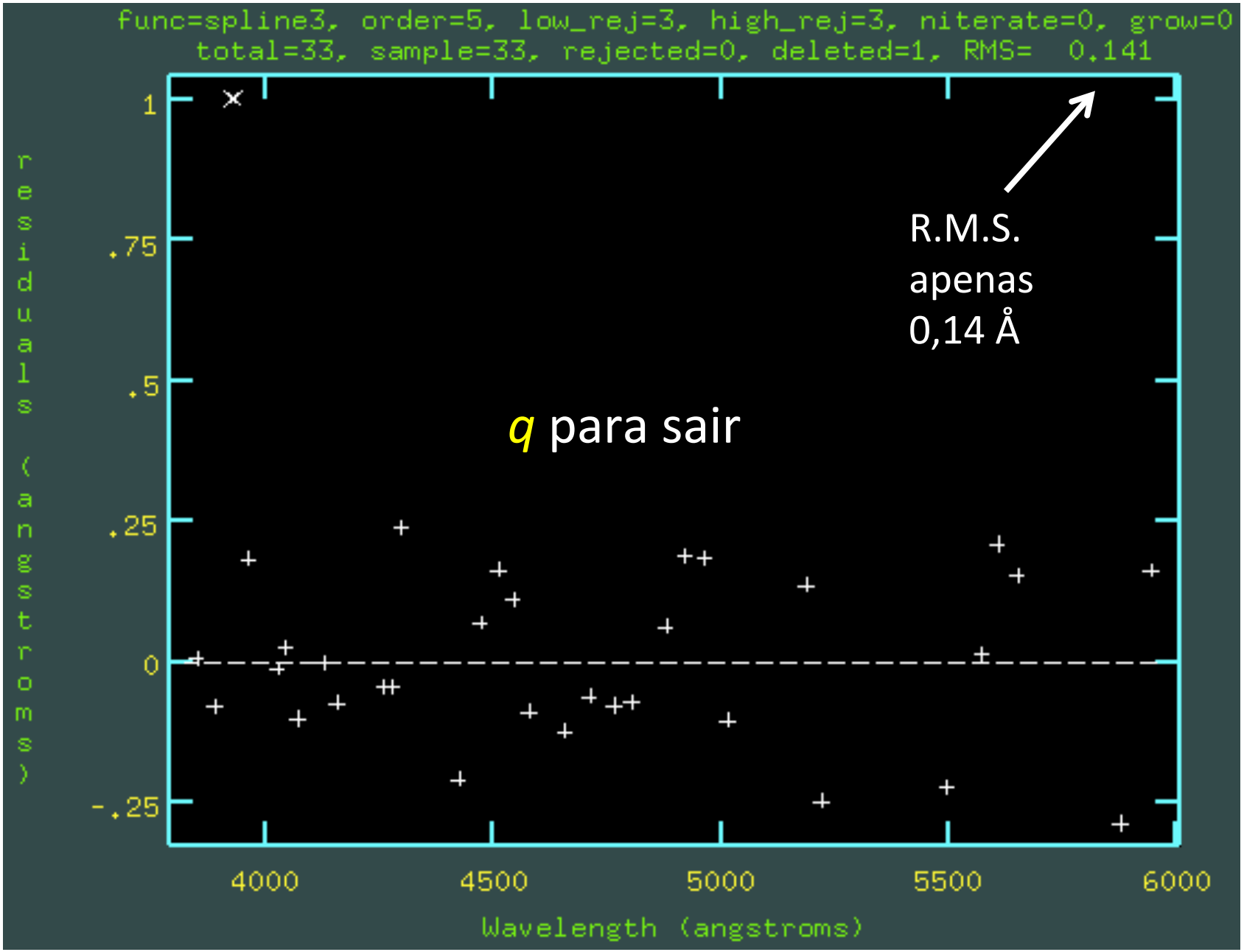

identify hear_HD036079f - Ap 1
he-ar
All OK (não deletar nenhuma).
Para continuar “w” “r”
8000
6000
4000
2000
0
4400
4500
4600
4700
4800
4900
5000
Wavelength (angstroms)

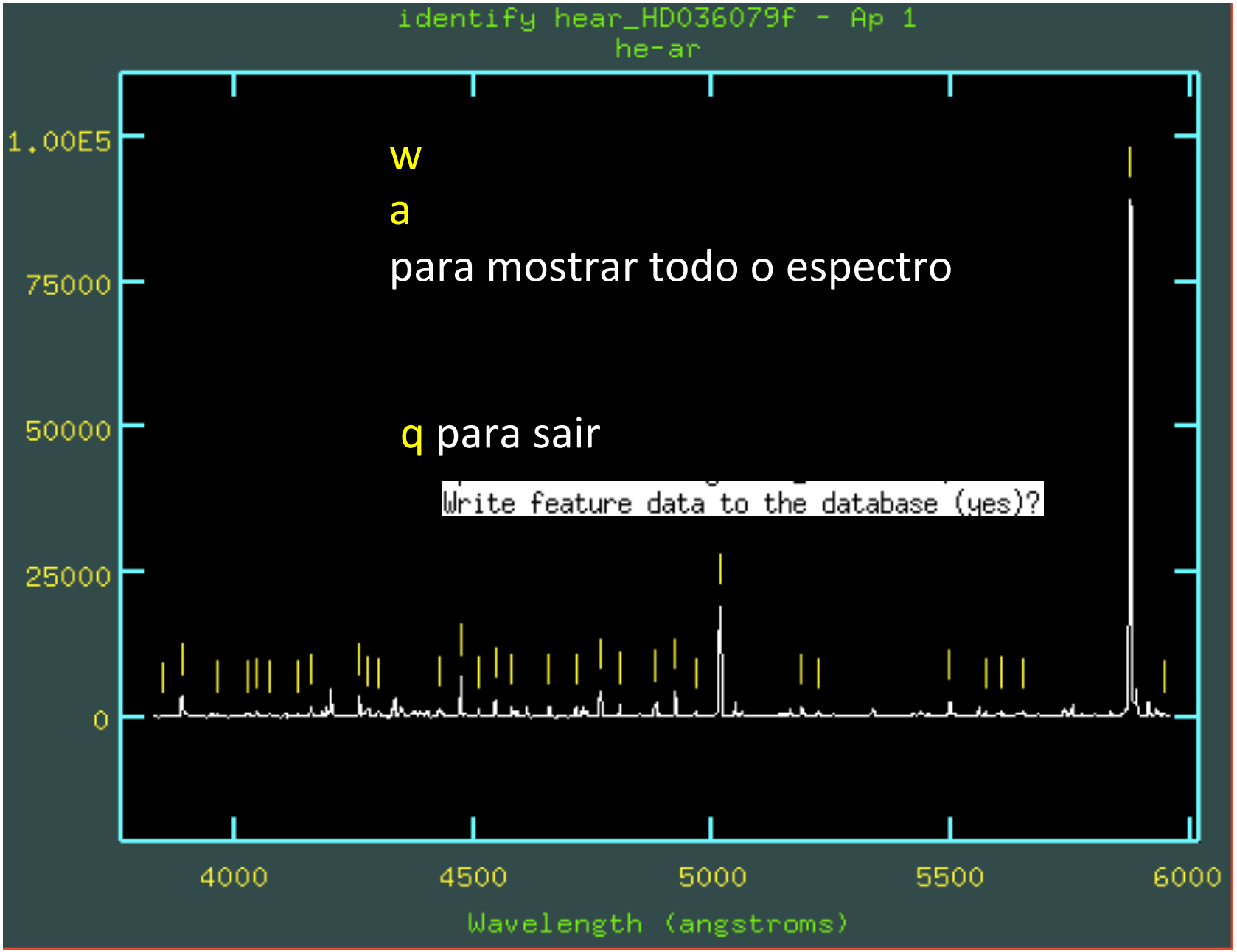

identify hear_HD036079f - Ap 1
he-ar
8000
6000
4000
2000
0
Para continuar “w” “r”
Deletar
com “d”
4900
5000
5100
5200
5300
5400
5500
Wavelength (angstroms)


identify hear_HD036079f - Ap 1
he-ar
8000
6000
4000
2000
0
All OK (não deletar nenhuma)
Para fitar dar “f”
5400
5500
5600
5700
5800
5900
6000
Wavelength (angstroms)


func=spline3, order=1, low_rej=3, high_rej=3, niterate=0, grow=0
total=33, sample=33, rejected=0, deleted=0, RMS= 0.3848
Para mudar a ordem do polinomio
(p.ex. ordem 5):
:o 5
f (para refazer o "fit")
residuals (angstroms)
1
.5
0
-.5
4000
4500
5000
5500
6000
Wavelength (angstroms)


func=spline3, order=5, low_rej=3, high_rej=3, niterate=0, grow=0
total=33, sample=33, rejected=0, deleted=0, RMS= 0.2108
residuals (angstroms)
.8
.6
.4
.2
0
-.2
4000
4500
5000
5500
6000
Wavelength (angstroms)
Delete
com d
e fitar de
novo com f


func=spline3, order=5, low_rej=3, high_rej=3, niterate=0, grow=0
total=33, sample=33, rejected=0, deleted=1, RMS= 0.141
residuals (angstroms)
1
.75
.5
.25
0
-.25
4000
4500
5000
5500
6000
Wavelength (angstroms)
R.M.S.
apenas
0,14 Å
q para sair


identify hear_HD036079f - Ap 1
he-ar
1.00E5
75000
50000
25000
0
w
a
para mostrar todo o espectro
q para sair
Write feature data to the database (yes)?
4000
4500
5000
5500
6000
Wavelength (angstroms)

ecl> !more database/idhear_HD036079f

```
begin   identify hear_HD036079f - Ap 1
        id       hear_HD036079f
        task     identify
        image    hear_HD036079f - Ap 1
        aperture          1
        aplow    283.25
        aphigh   286.85
        units    Angstroms
        features         32
          13.36 5944.67304  5944.8342   4.0 1 1 NeI(1)
          81.76 5875.90795   5875.618   4.0 1 1 HeI
         307.84 5650.55171   5650.703   4.0 1 1 AI(12)
         351.94 5606.52455   5606.732   4.0 1 1 AI
         385.88 5572.53501   5572.548   4.0 1 1 AI
         461.78  5496.0989   5495.872   4.0 1 1 AI(14)
         730.06 5221.51883    5221.27   4.0 1 1 AI
         762.83 5187.61148   5187.746   4.0 1 1 AI
         928.05 5015.78031   5015.675   4.0 1 1 HeI
         976.69 4964.93737    4965.12   4.0 1 1 AII(14)
        1017.94 4921.74167   4921.929   4.0 1 1 HeI
        1057.87 4879.83806     4879.9   4.0 1 1 AII(14)
        1127.94 4806.14317    4806.07   4.0 1 1 AII(6)
```

Pixel #

Computed wavelength

Laboratory wavelength

species

tail serve para visualizar as ultimas linhas do arquivo (no caso a seguir, the last 22 lines)

```
onedspec> !tail -22 database/idhear_HD036079f
        function spline3
        order 5
        sample *
        naverage 1
        niterate 0
        low_reject 3.
        high_reject 3.
        grow 0.
        coefficients    12
                3.
                5.
                1.
                2048.
                1063.1812771222
                992.1992068207723
                925.1840099637536
                854.9771910623752
                783.419179499576
                710.5804652246801
                637.434633320564
                563.534930446175
```

No arquivo idhear_HD036079f temos os coeficientes do polinomio do ajuste pixel vs comprimento de onda

Apenas precisamos identificar uma vez as linhas de He-Ar em uma estrela, para as outras estrelas pode ser feito automaticamente

Identificar automaticamente os outros He-Ar, usando como referencia a identificação na HD036079f:

> reidentify hear_HD036079f hear_HD* nlost=2 inter-

Verificar:

```
onedspec> ls -1 database/id*
database/idhear_HD036079f
database/idhear_HD036673f
database/idhear_HD045289f
```

Para aplicar a calibração em comprimento de onda, primeiro precisamos salvar no cabeçalho a informação de qual é a lampada de calibração de referência

Os espectros reduzidos das estrelas são *.0001.fits:

```
onedspec> ls *.0001.fits
HD036079f.0001.fits     HD036673f.0001.fits     HD045289f.0001.fits
```

Os espectros de calibração em lambda são:

```
onedspec> ls hear_HD*
hear_HD036079f.fits     hear_HD036673f.fits     hear_HD045289f.fits
```

Para a primeira estrela seria :

refspec HD036079f.0001.fits reference=hear_HD036079f.fits sort=none group=none

mas podemos fazer isso para todas as estrelas usando listas

> ls -1 *.0001.fits > listared_in

```
HD036079f.0001.fits
HD036673f.0001.fits
HD045289f.0001.fits
```

> ls -1 hear_HD* > listahear_in

```
hear_HD036079f.fits
hear_HD036673f.fits
hear_HD045289f.fits
```

>!sed 's/HD/refspec HD/g' listared_in > lista1

>!sed 's/hear/reference=hear/g;s/fits/fits sort=none group=none'/g listahear_in > lista2

>!paste -d " " lista1 lista2 > lista_refspec

espaço

VERIFICAR:

> !more lista_refspec

```
refspec HD036079f.0001.fits reference=hear_HD036079f.fits sort=none group=none
refspec HD036673f.0001.fits reference=hear_HD036673f.fits sort=none group=none
refspec HD045289f.0001.fits reference=hear_HD045289f.fits sort=none group=none
```

Assinar o He-Ar de referência:

(salva no header o He-Ar a ser aplicado)

cl < lista_refspec

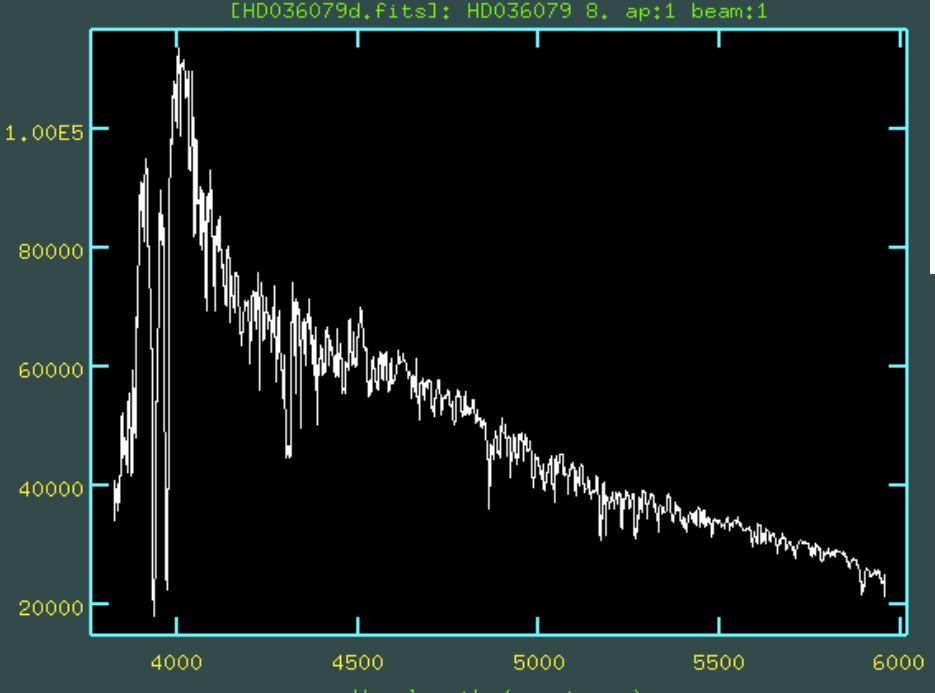
```
[HD036079f.0001] refspec1='hear_HD036079f'   Accept assignment? (no|yes|YES): YES
[HD036079f.0001] refspec1='hear_HD036079f'
[HD036673f.0001] refspec1='hear_HD036673f'   Accept assignment? (no|yes|YES): YES
[HD036673f.0001] refspec1='hear_HD036673f'
[HD045289f.0001] refspec1='hear_HD045289f'   Accept assignment? (no|yes|YES): YES
[HD045289f.0001] refspec1='hear_HD045289f'
```

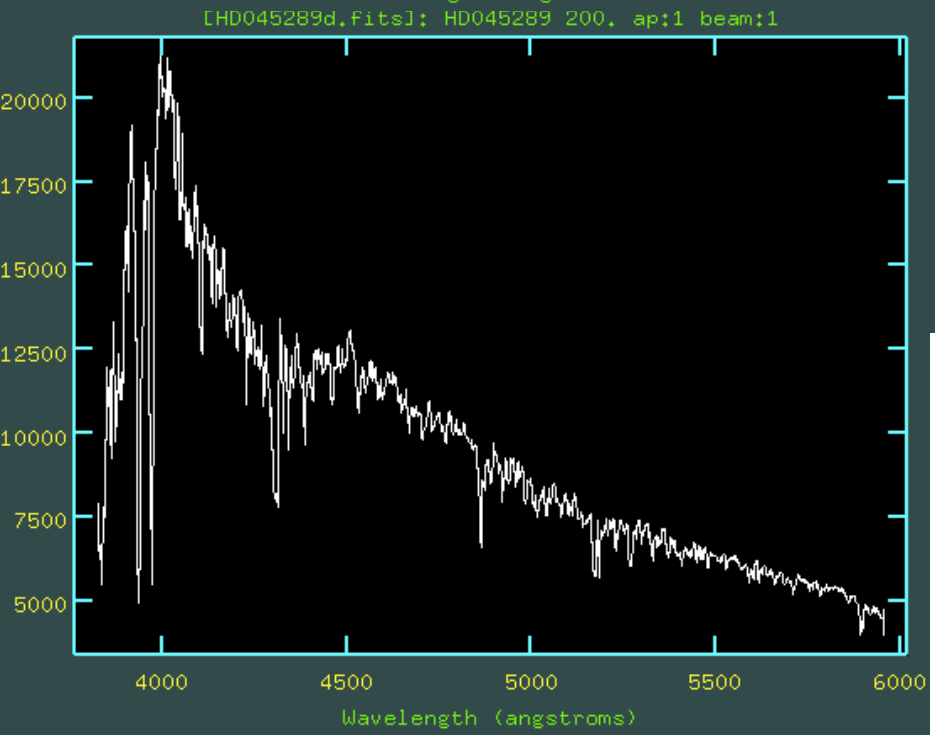
Aplicar a calibração em lambda:

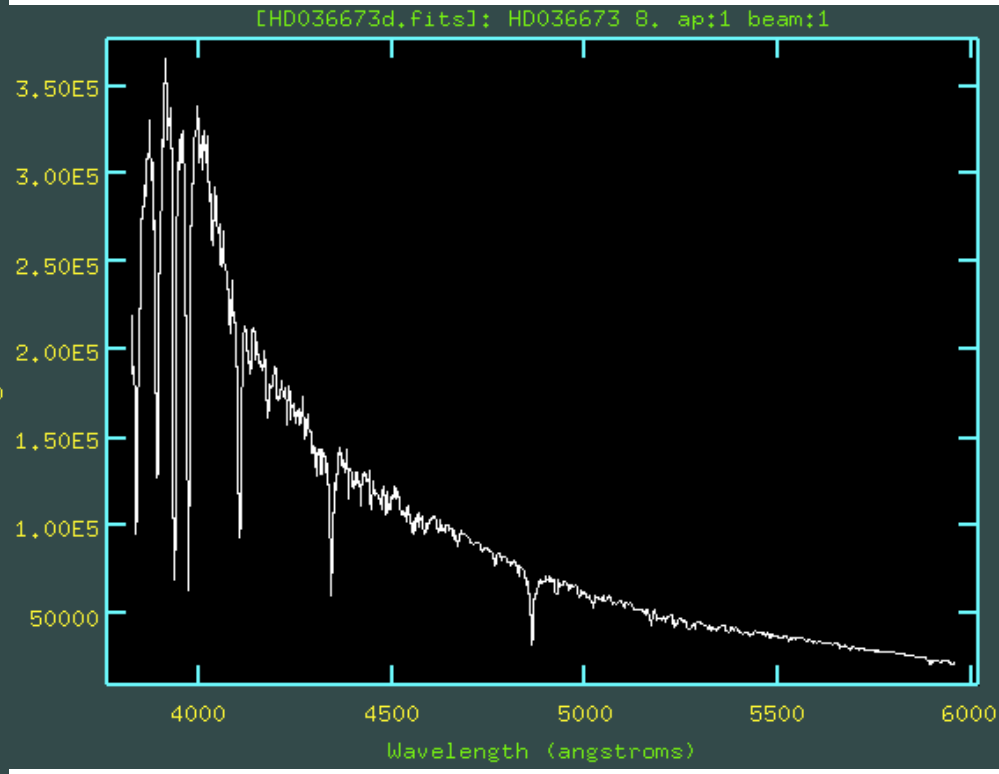
ap> dispcor *f.0001.fits *%f.0001.fits%d.fits%

```
HD036079f.0001.fits: REFSPEC1 = 'hear_HD036079f 1.'
HD036079d.fits: ap = 1, w1 = 3823.854, w2 = 5957.162, dw = 1.042163, nw = 2048
HD036673f.0001.fits: REFSPEC1 = 'hear_HD036673f 1.'
HD036673d.fits: ap = 1, w1 = 3823.725, w2 = 5956.925, dw =  1.04211, nw = 2048
HD045289f.0001.fits: REFSPEC1 = 'hear_HD045289f 1.'
HD045289d.fits: ap = 1, w1 =  3823.66, w2 = 5956.661, dw = 1.042013, nw = 2048
```

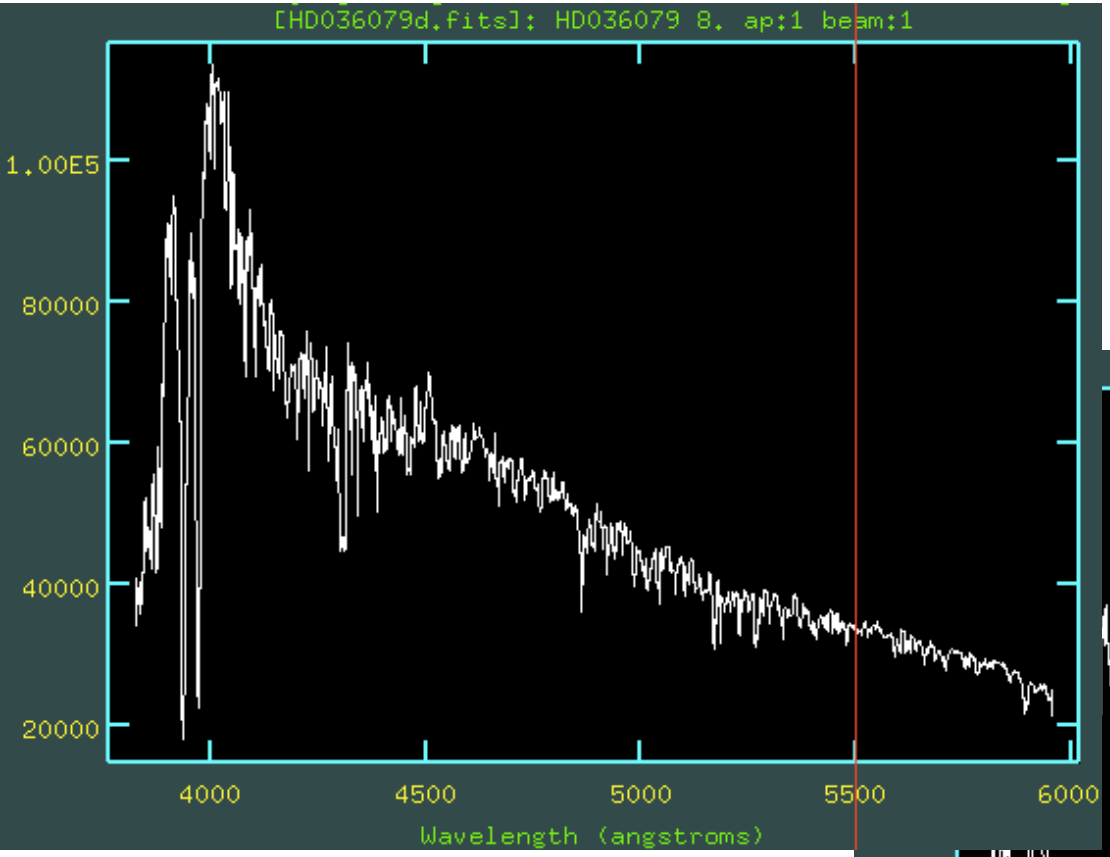
splot HD*d.fits





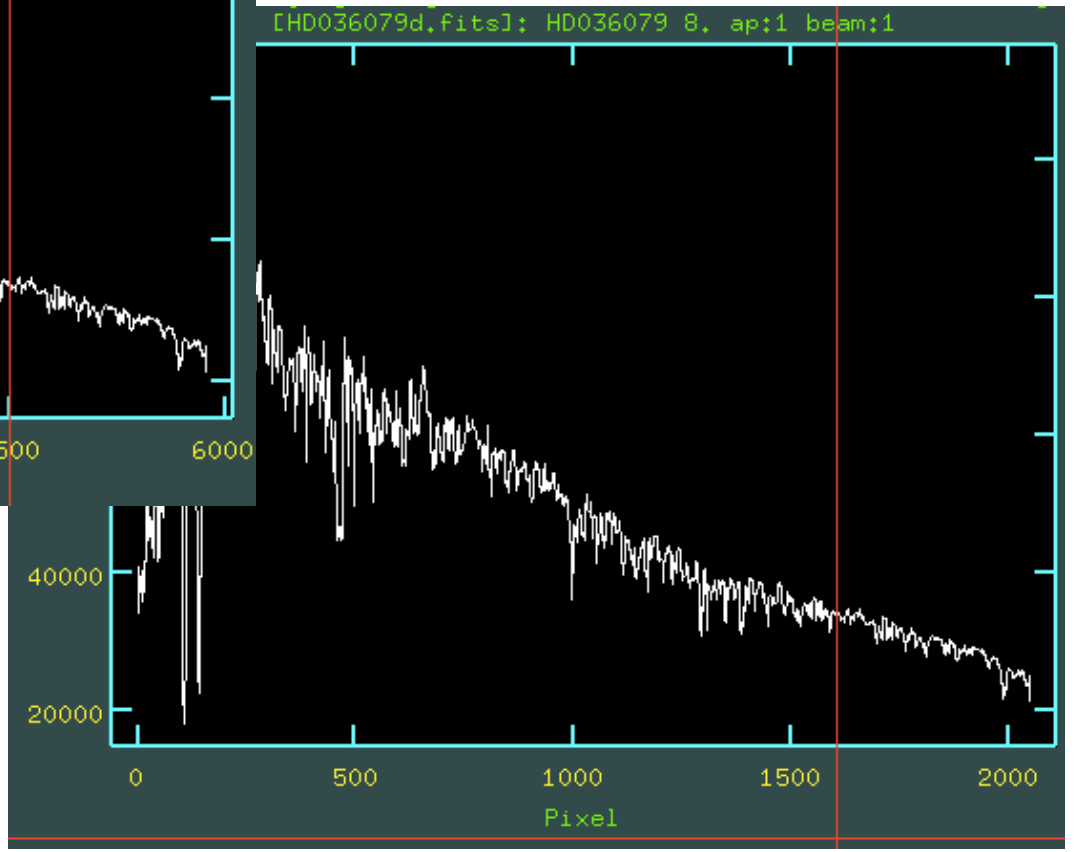


Se quiser pode normalizar em fluxo relativo (p. ex. em 5500A) ou em fluxo absoluto



usar $:

5500 A → pixel 1605



> imstat HD*d.fits[1600:1610] fields="midpt” > medtempo

!sed 1d medtempo > mediana (para tirar 1a linha de comentario)

!ls -1 *d.fits > listad1

!sed 's/HD/imarith HD/g;s/fits/fits /g' listad1 > listad2

!paste -d "/" listad2 mediana > listad3

!sed 's/d.fits/n.fits/g' listad1 > listad4

!paste -d “ ” listad3 listad4 > listan

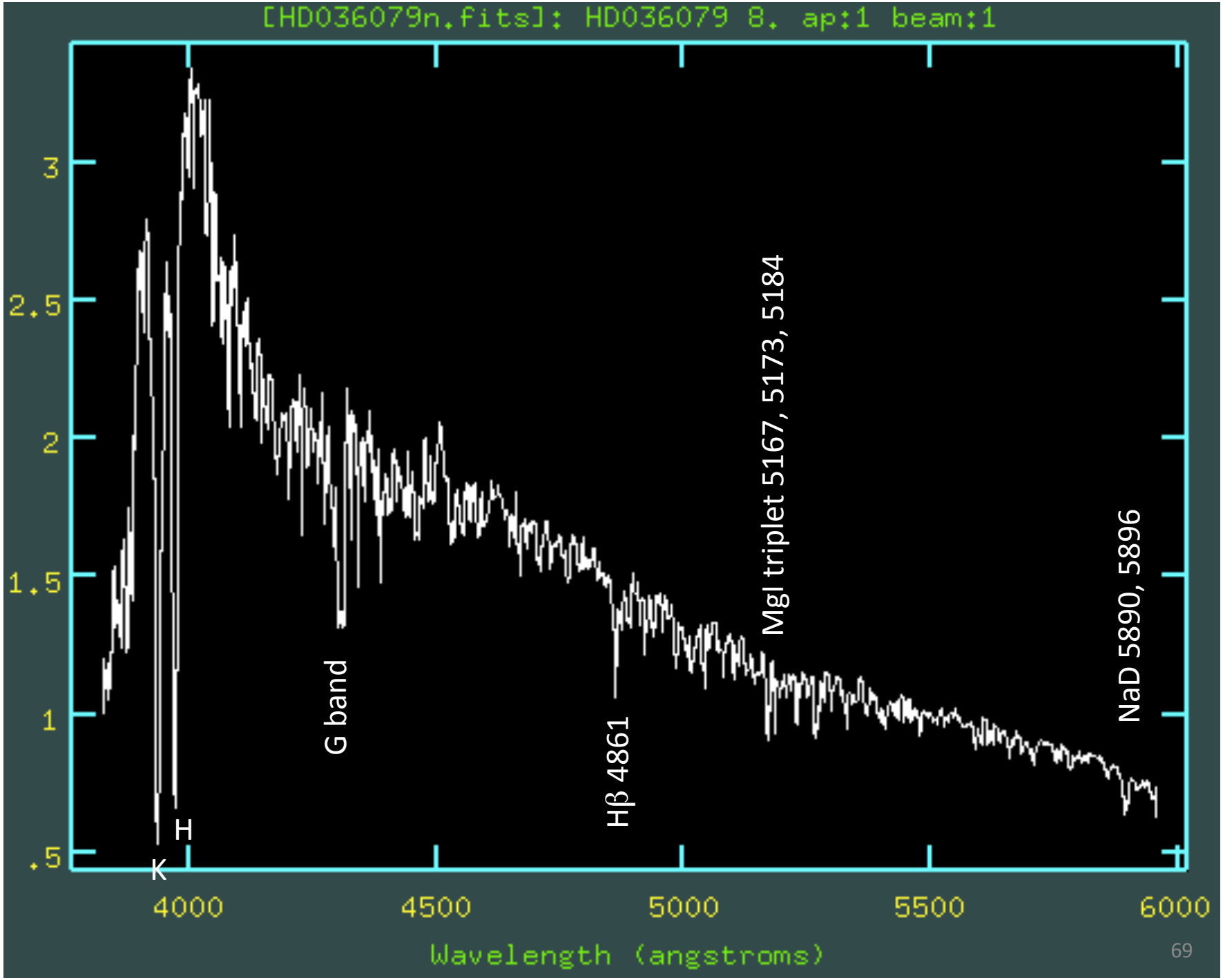
VERIFICAR

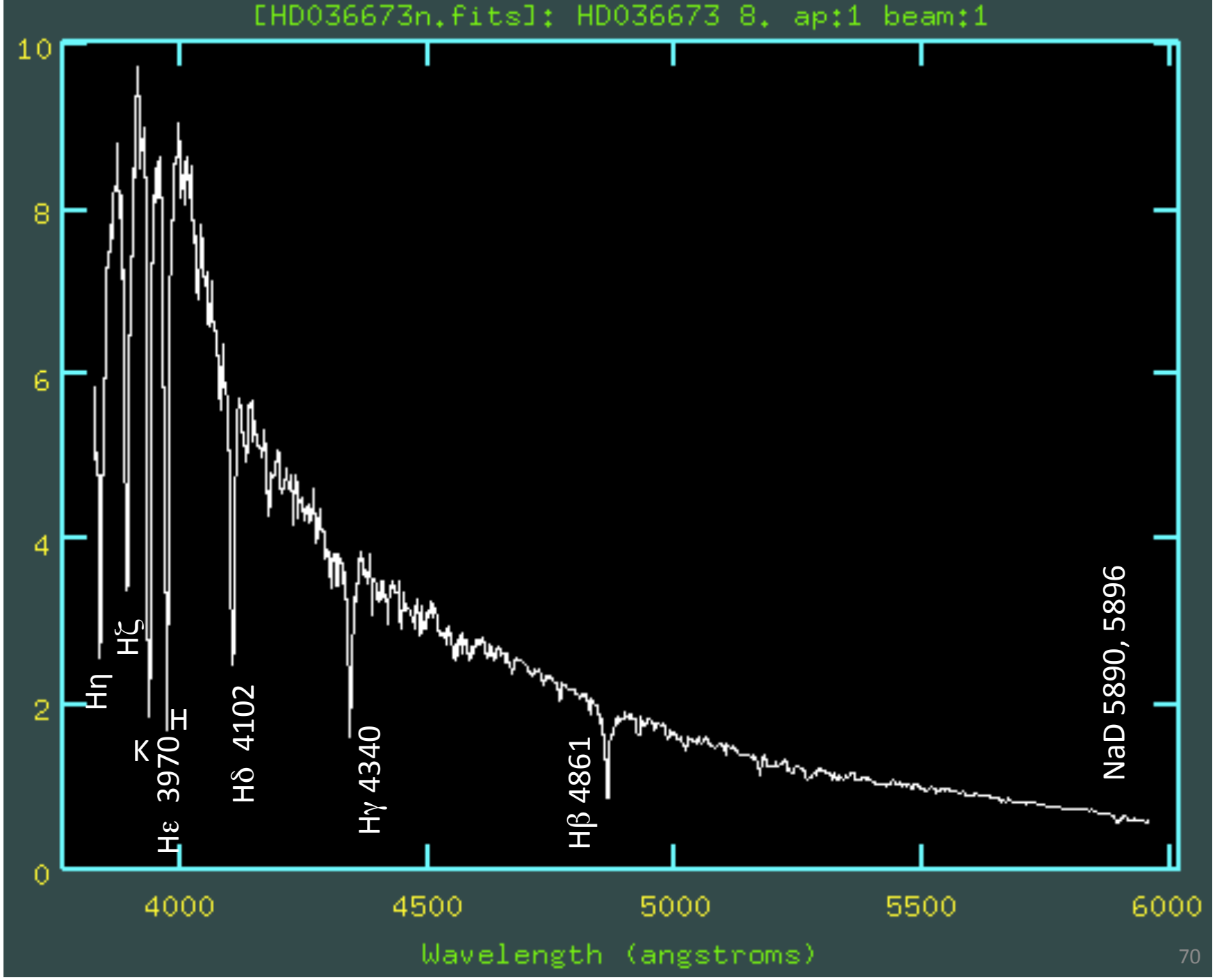
> !more listan

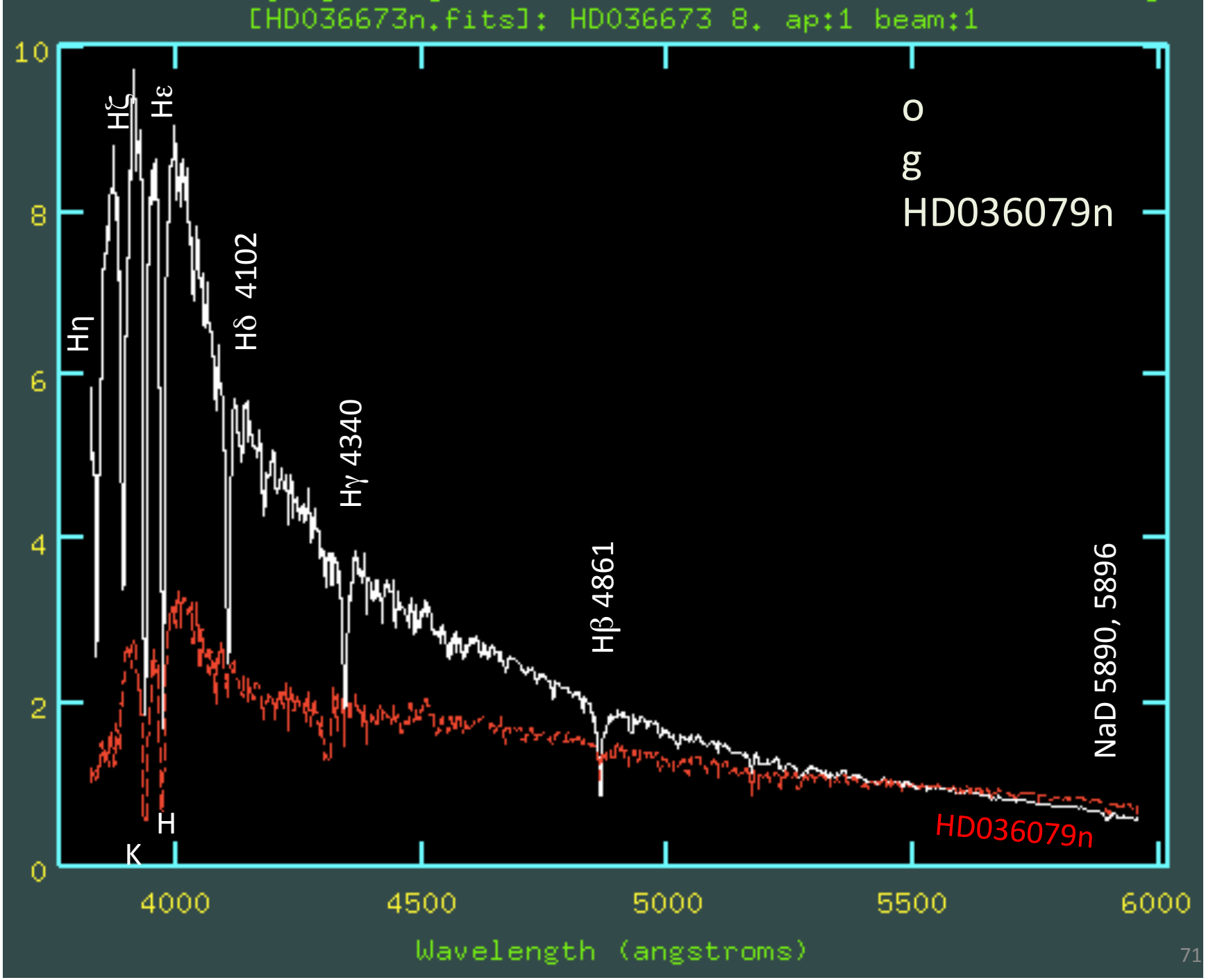
```
imarith HD036079d.fits /     33947. HD036079n.fits
imarith HD036673d.fits /     37505. HD036673n.fits
imarith HD045289d.fits /      6358. HD045289n.fits
```

> cl < listan

> splot HD*n.fits


[HD036079n.fits]: HD036079 8. ap:1 beam:1
3
2.5
2
1.5
1
.5
4000
4500
5000
5500
6000
Wavelength (angstroms)
K
H
G band
Hβ 4861
MgI triplet 5167, 5173, 5184
NaD 5890, 5896


[HD036673n.fits]: HD036673 8. ap:1 beam:1
10
8
6
4
2
0
4000
4500
5000
5500
6000
Wavelength (angstroms)
Hη
Hζ
K
Hε 3970
H
Hδ 4102
Hγ 4340
Hβ 4861
NaD 5890, 5896


[HD036673n.fits]: HD036673 8. ap:1 beam:1
10
8
6
4
2
0
4000
4500
5000
5500
6000
Wavelength (angstroms)
Hη
Hζ
Hε
K
H
Hδ 4102
Hγ 4340
Hβ 4861
NaD 5890, 5896
o
g
HD036079n
HD036079n

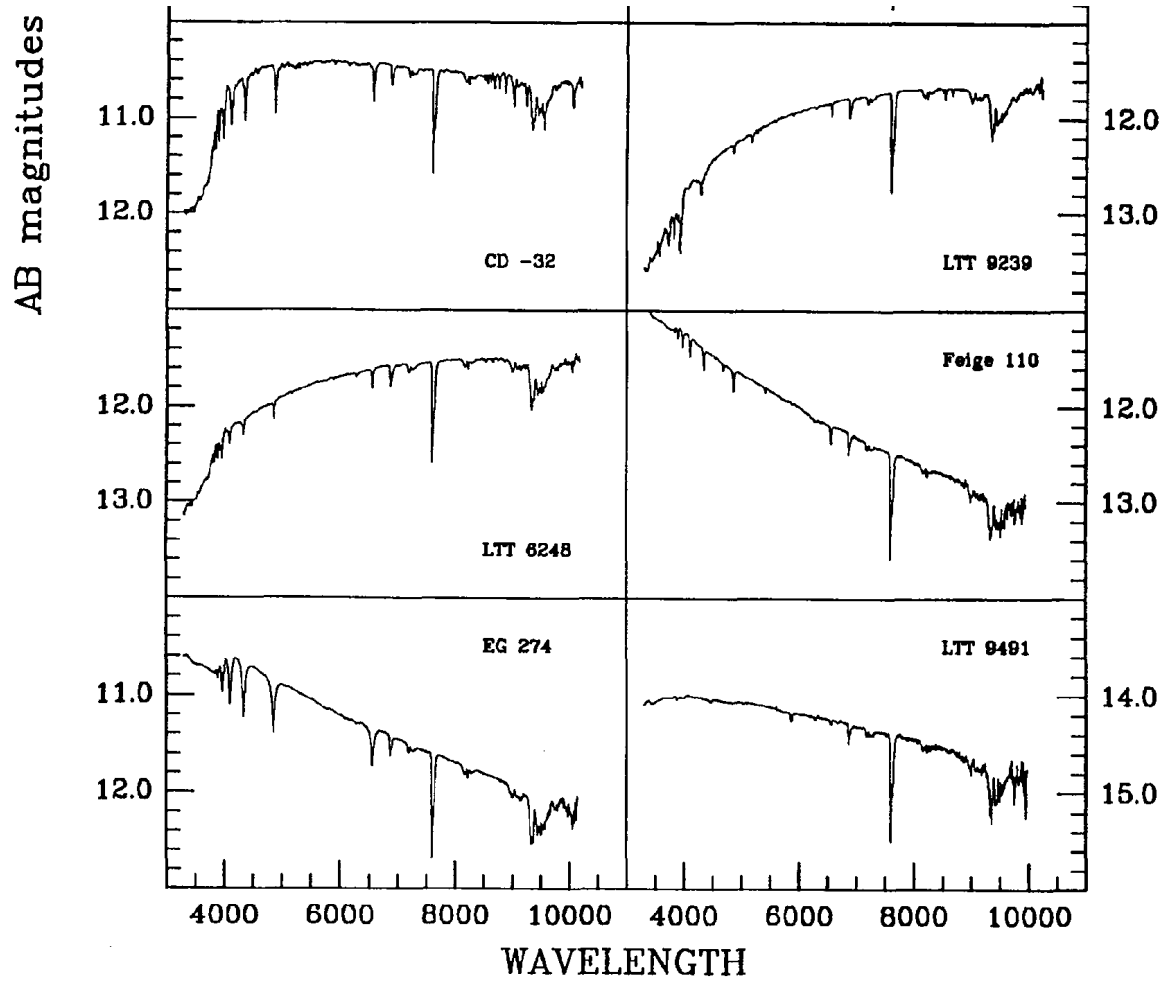
Absolute flux calibration

Publications of the Astronomical Society of the Pacific
106: 566–589, 1994 June

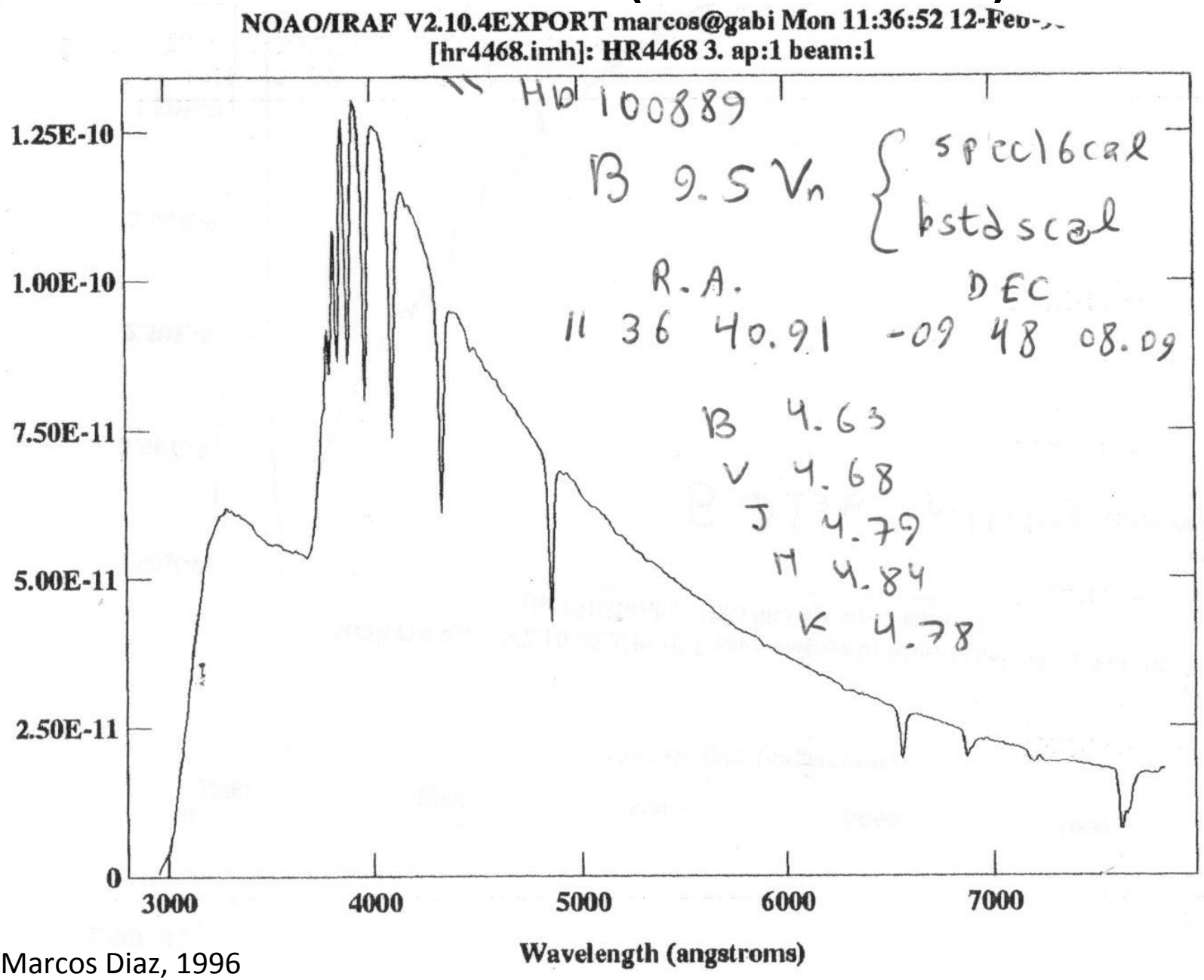
Southern Spectrophotometric Standards. II.

MARIO HAMUY, N. B. SUNTZEFF, S. R. HEATHCOTE, A. R. WALKER, P. GIGOUX, AND M. M. PHILLIPS

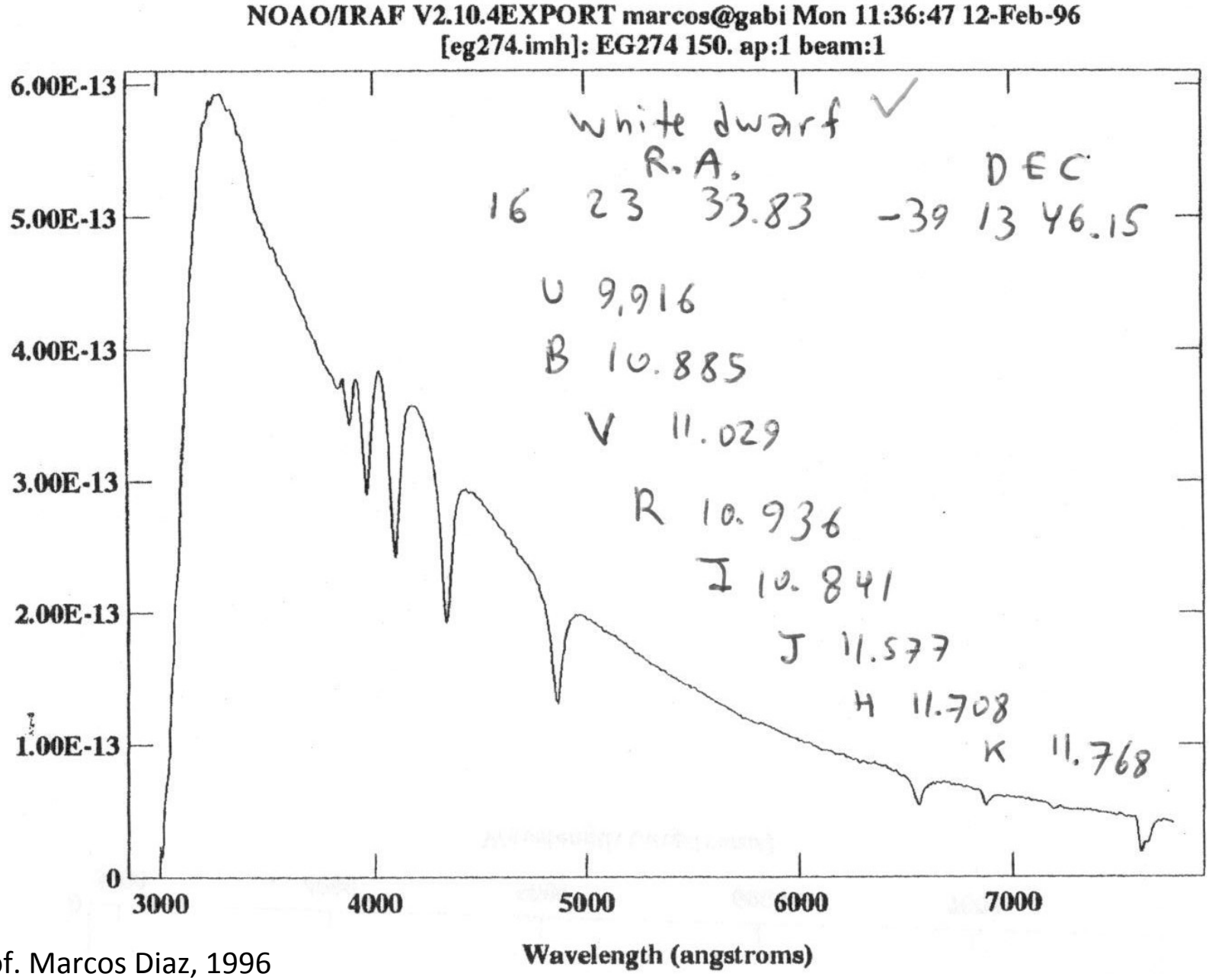
$$m_\nu \equiv -2.5 \log_{10}(f_\nu) - 48.590]$$



Flux standard HR4468 (HD 100889): B9.5Vn



Flux standard EG 274: white dwarf



The onedstds$ directory contains standard calibration data for extinction and sensitivity calibration

EXTINCTION TABLES (eg extinction = onedstds $ctioextinct.dat)

- ctioextinct.dat - CTIO extinction table for ONEDSPEC (in A)
- kpnoextinct.dat - KPNO extinction table for ONEDSPEC (in A)

FLUX STANDARD DIRECTORIES

(eg caldir = onedstds$bstdscal/):

- **blackbody** (blackbody flux distributions
- **bstdscal** (brighter KPNO standards)
- **ctionewcal** (Directory containing fluxes at 50A steps in the blue and red ranges
- **spec16cal** - Directory containing fluxes at 16A steps

Por exemplo

- **bstdscal** (brighter KPNO standards)

Standard stars in onedstds$bstdscal/

hr718 hr3454 hr3982 hr4468 hr4534 hr5191 hr5511 hr7001 hr7596 hr7950 hr8634 hr9087 hd15318 hd74280 hd100889 hd188350 hd198001 hd214923 hd224926

Notar que hd188350=hr7596 e hr4468=hd100889

Par ver todas as listas, dentro do IRAF (cl):

> cd onedstds

> ls

> cd bstdscal *(procedimento similar para ver outras listas)*

As listas completas estão disponíveis em:

http://star.pst.qub.ac.uk/~jrm/iraf/speclis

epar kpnoslit (salvar com CTRL-D)

*provavelmente podem usar **ctioslit**?*

```
                                  I R A F
                       Image Reduction and Analysis Facility
PACKAGE = imred
   TASK = kpnoslit

(extinct= onedstds$ctioextinct.dat) Extinction file
(caldir =  onedstds$spec50cal/) Standard star calibration directory
(observa=           observatory) Observatory of data
(interp =                poly5) Interpolation type

(databas=              database) Database
(verbose=                   yes) Verbose output?
(logfile=               logfile) Log file
(plotfil=                      ) Plot file

(nsum   =                     1) Aperture sum for 2D images
(records=                      ) Record number extensions
(version= KPNOSLIT V3: January 1992)
(mode   =                    ql)
($nargs =                     0)
```

ctioextinct.dat OK para o OPD

No Hemisfério Sul escolher ctionewcal ao invés de spec50cal. Para estrelas brilhantes temos outras opções (p.ex., bstdscal). Procurar as padrões em onedstds

Figure 19: The package parameters for **kpnoslit**, modified to specify the ctio atmospheric extinction table. Note the final "/" on the subdirectory for **caldir**.

(absolute) flux calibration

Precisamos de observar estrelas padrões de calibração em fluxo (e.g. Hamuy et al. 1994, PASP 106, 566)

standard (noao.onedspec) p/todas as padrões

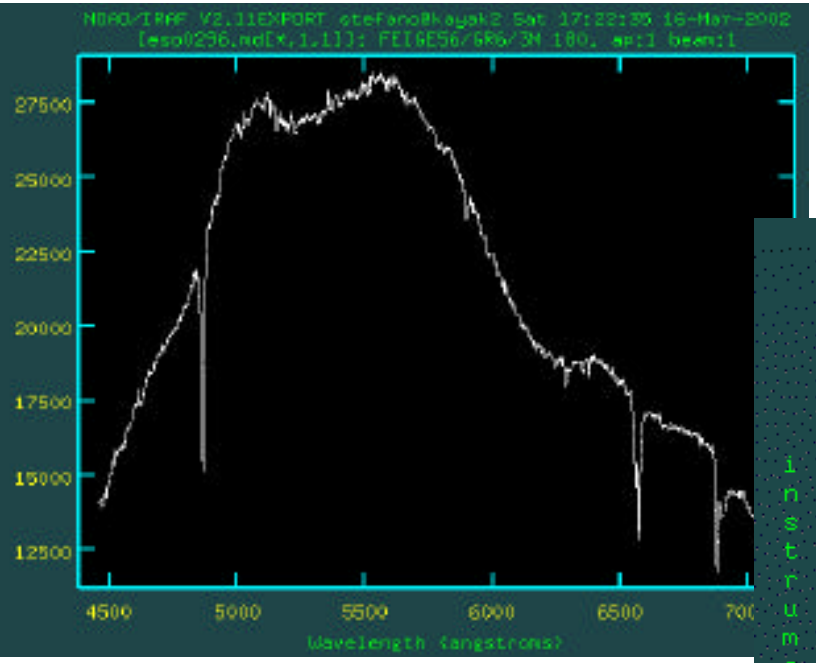
sensfunc (noao.onedspec) (do output de standard)

calibrate (noao.twodspec.longslit) aplica sensfunc

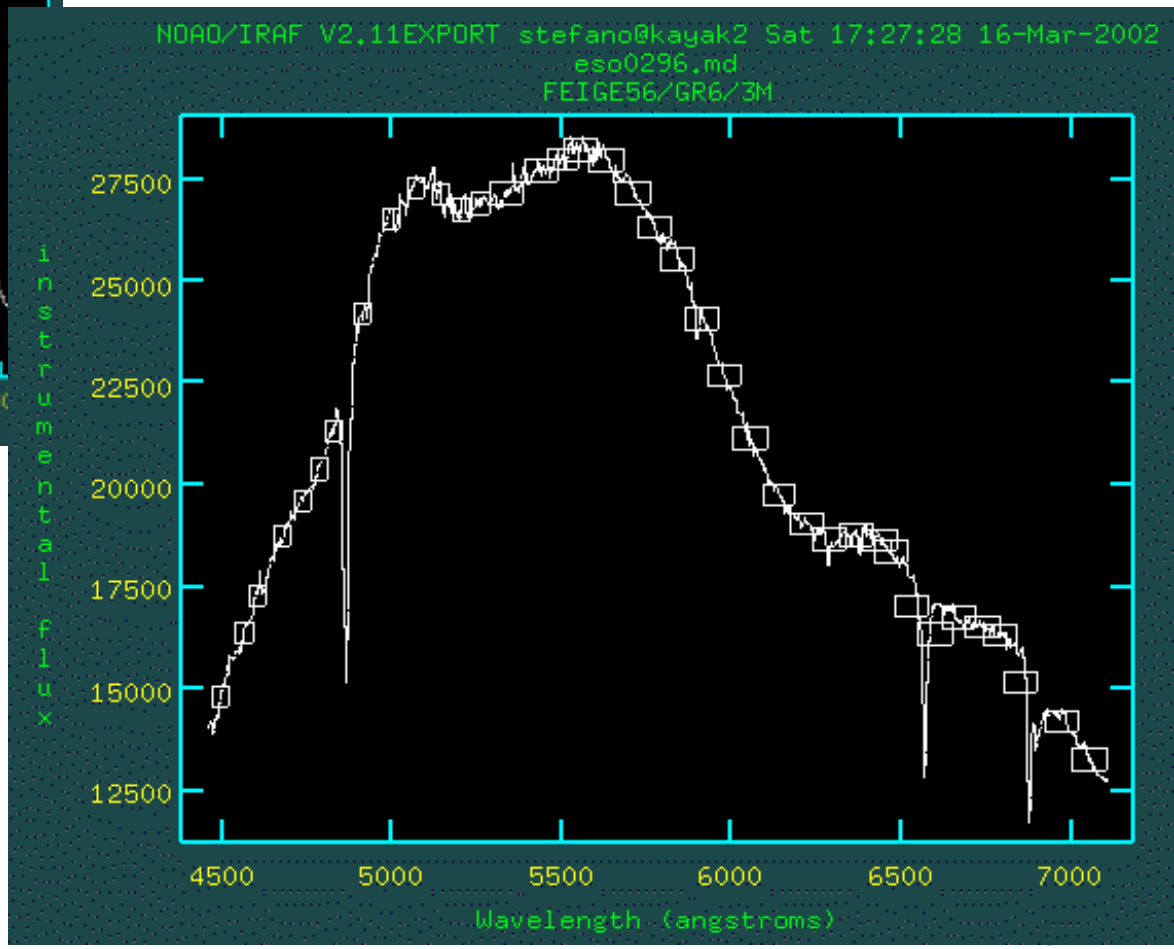
Detalhes em pp 29-35 do manual de reducoes do IRAF

http://www.astro.iag.usp.br/~jorge/aga5802/spect_iraf_reducao.pdf

Extraer o espectro da padrão



Selecionar apenas regiões do continuo (ou seja, excluir linhas)



Ajustar polinomio de transformação de contagens para fluxo (erg cm^{-2} s^{-1} $Å^{-1}$)