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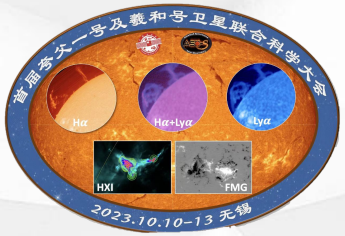
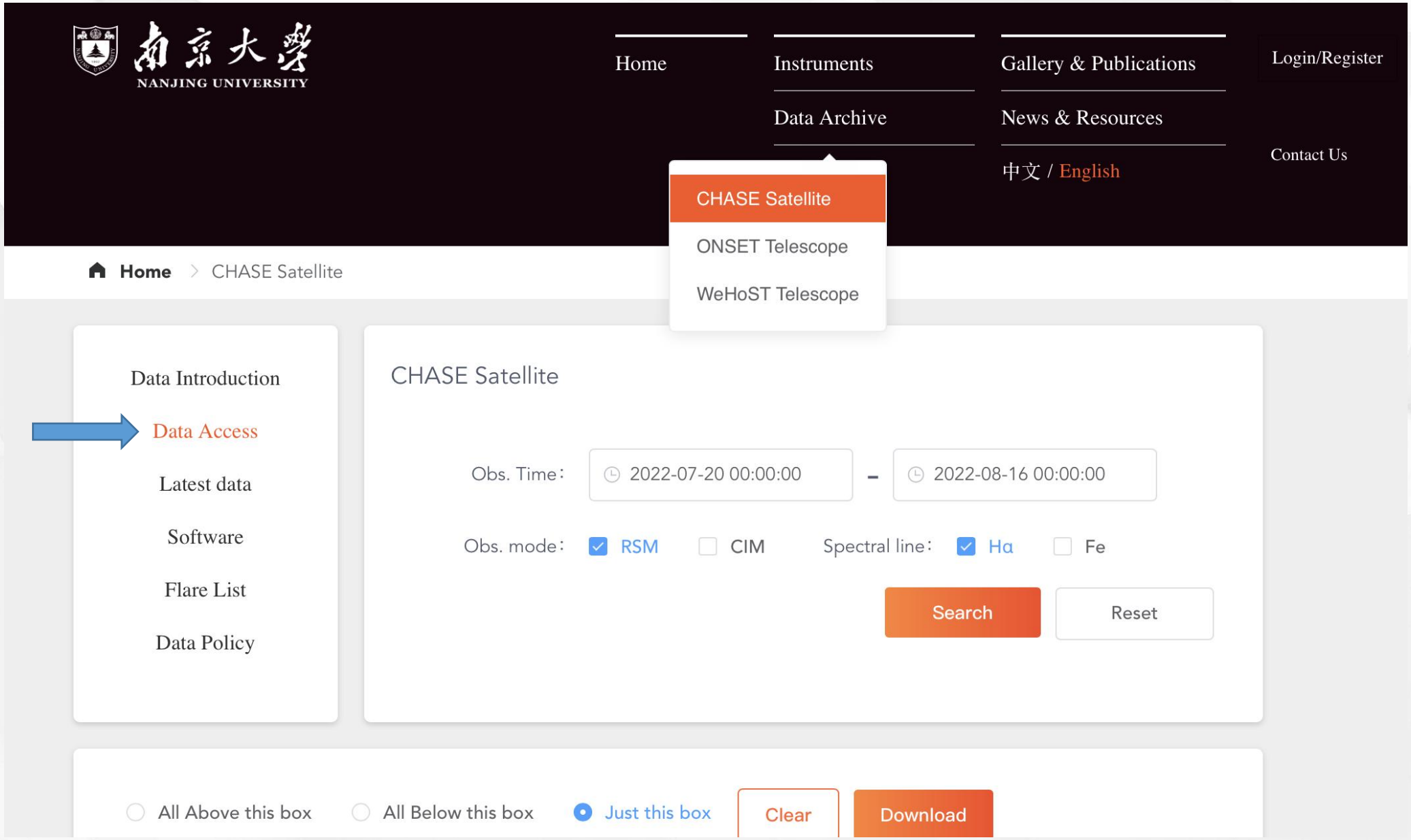



# CHASE Lev1 Data Processing Demonstration
## --IDL

Ye Qiu

2023.10.13

# Getting the Lev1 Data: https://ssdc.nju.edu.cn/



# Getting Lev1 Data: https://ssdc.nju.edu.cn/

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- Data Introduction
- Data Access
- Latest data
- Software
- Flare List
- Data Policy

Data Policy

**The list keeps only flares > C5.0 class.**

| Date | Start | End | Class | Location (NOAA AR) | CHASE Obs. time | IRIS Obs. | ASO-S/HXI Obs. |
|---|---|---|---|---|---|---|---|
| 2023-09-30 | 03:57 | 04:34 | C7.2 | N15E73 | 03:31-03:59 | N | Y(04:06-04:14) |
| | 11:51 | 12:06 | C9.6 | S15W68 ( 3445 ) | 11:25-11:53 | N | Y(11:56) |
| | 14:35 | 15:01 | C5.1 | S20E41 ( 3450 ) | 14:35-15:03 | N | Y(14:41) |
| | 15:57 | 16:14 | C6.3 | N11E65 ( 3451 ) | 16:10-16:38 | N | N |
| | 16:16 | 16:52 | M1.2 | N11E66 ( 3451 ) | 16:10-16:38 | N | N |
| | 21:18 | 21:39 | C6.2 | N11E64 ( 3451 ) | 20:54-21:23 | N | N |
| 2023-09-29 | 18:11 | 18:43 | C7.6 | N18E87 | 18:01-18:30 | N | Y(18:19-18:23) |
| | 19:58 | 20:22 | C5.0 | N15E79 | 19:36-20:05 | N | Y(20:05) |
| 2023-09-28 | 08:58 | 09:11 | M1.3 | S19E66 ( 3450 ) | 08:49-09:17 | N | Y(09:05-09:10; 09:07) |

All Above this box | All Below this box | Just this box | Clear | Download

# Reading Data

*Decompress (compression ratio is 3.45) :*

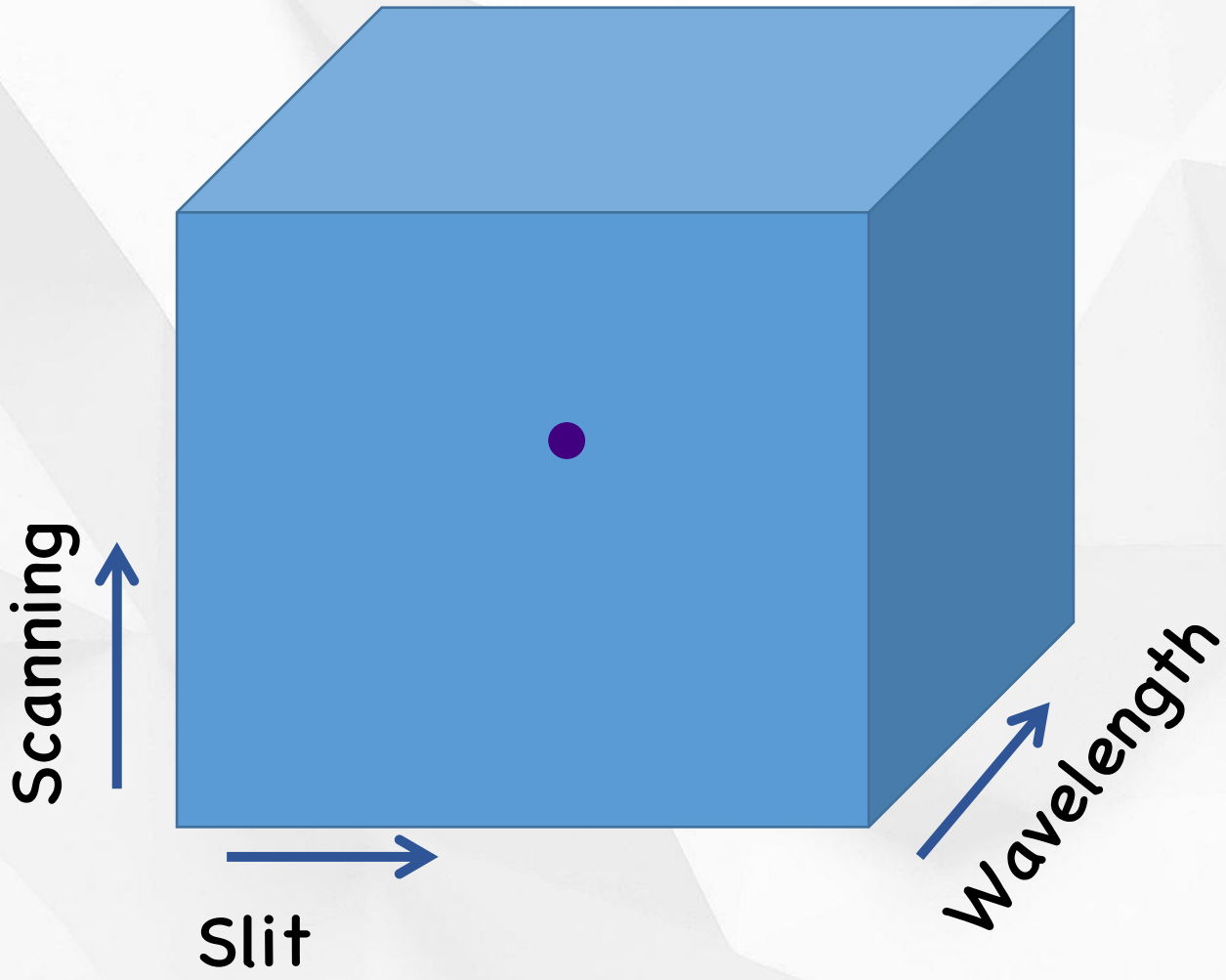
```
ff = 'RSM20230326T044900_0009_HA.fits'
mreadfits_tilecomp,ff,index,fnames_uncomp=fnames, $
  /only_uncompress, outdir='./CHASE_IDL'
```

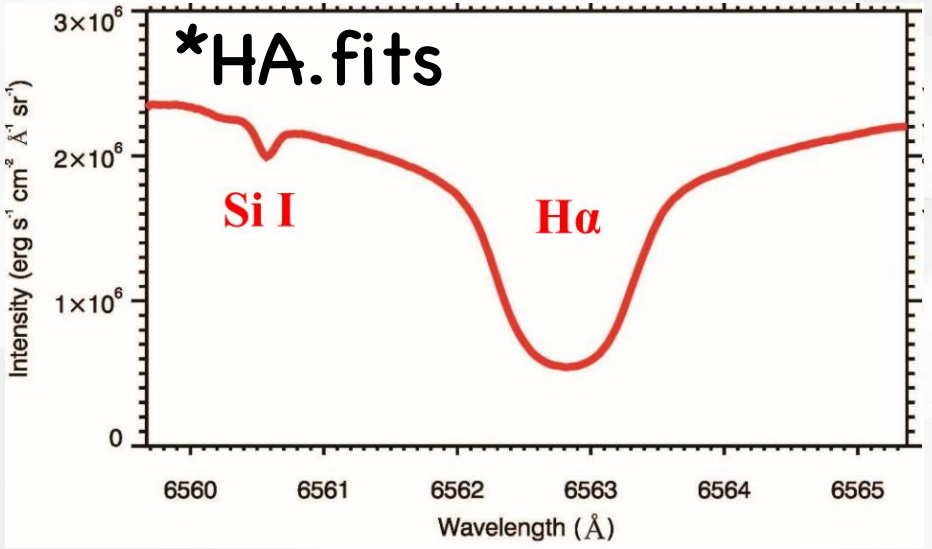
*Read:*

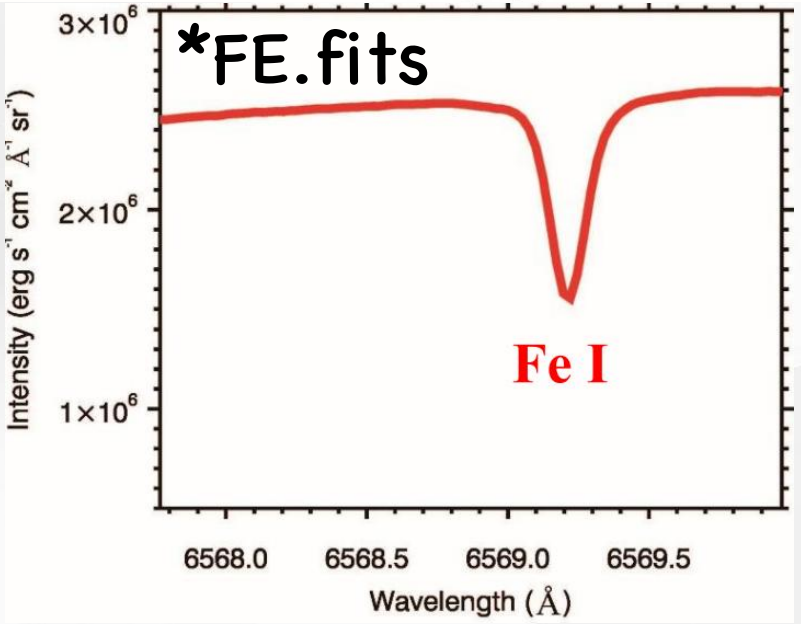
```
mreadfits,fnames,header,data
fits_read,fnames,data,header
```

*Delete the decompressed file:*

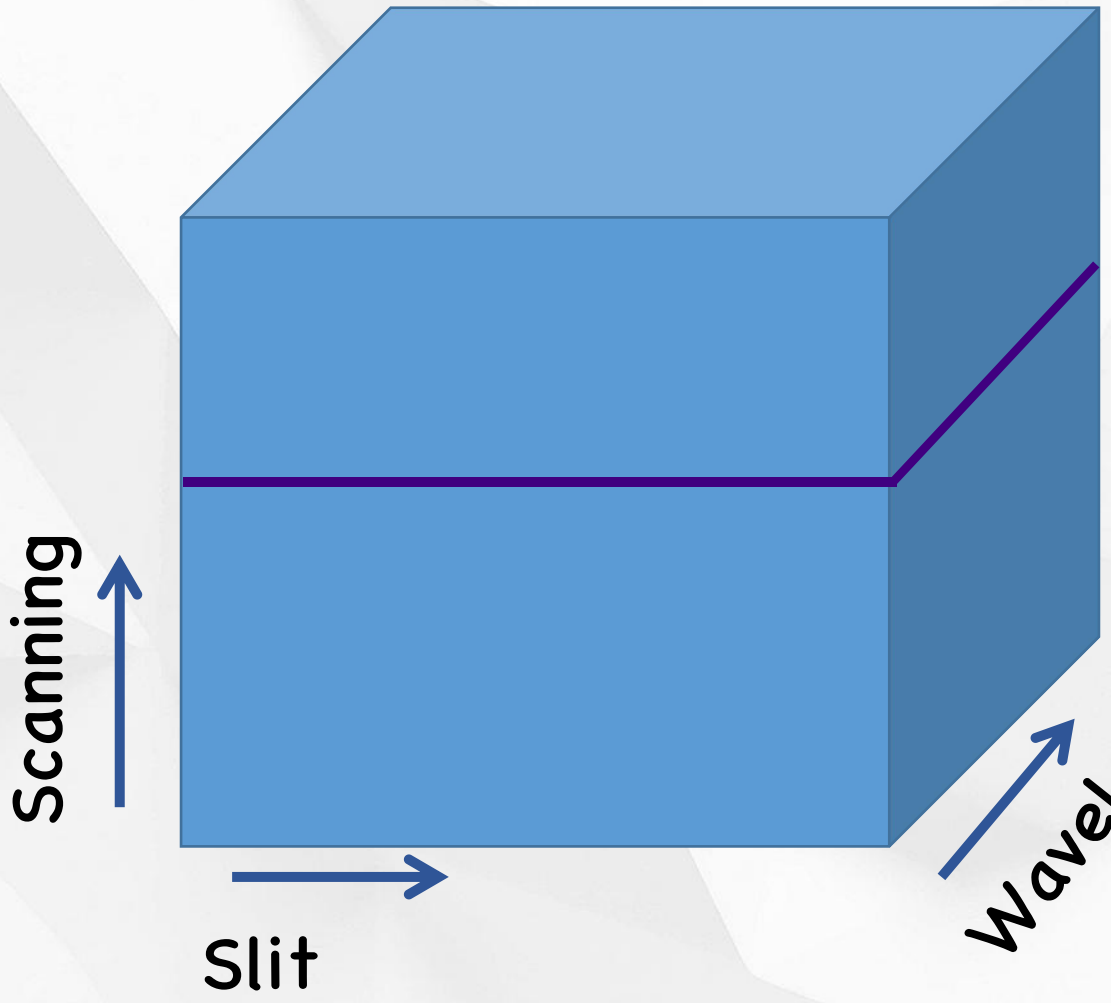
```
file_delete,fnames
```

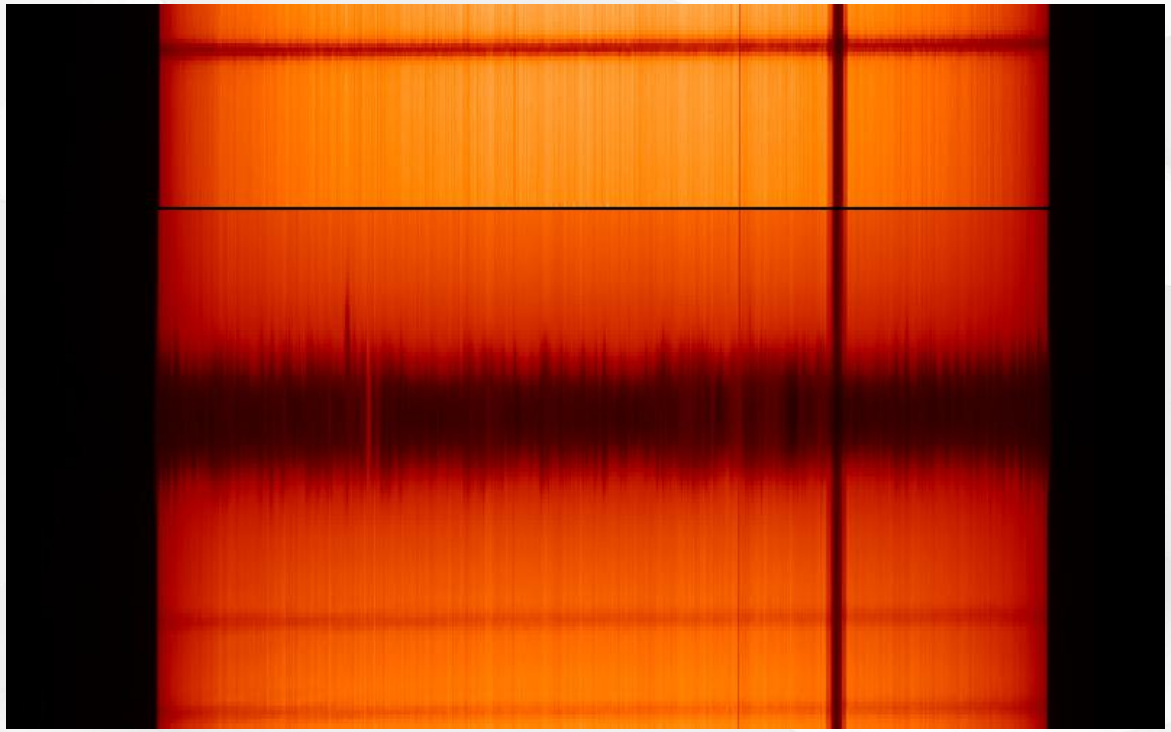


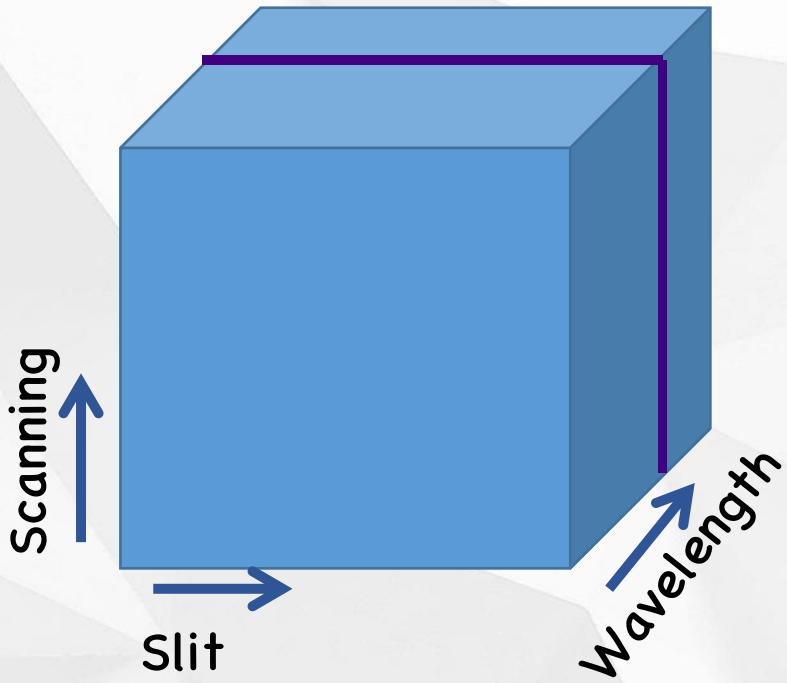



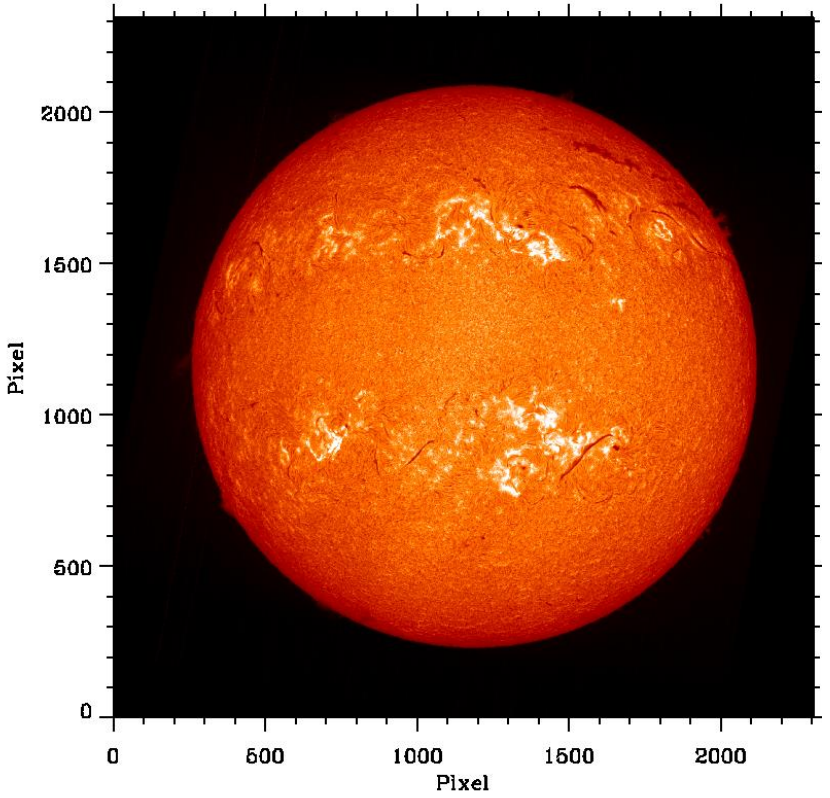

```
spectrum = reform(data[1000,893,*])
```

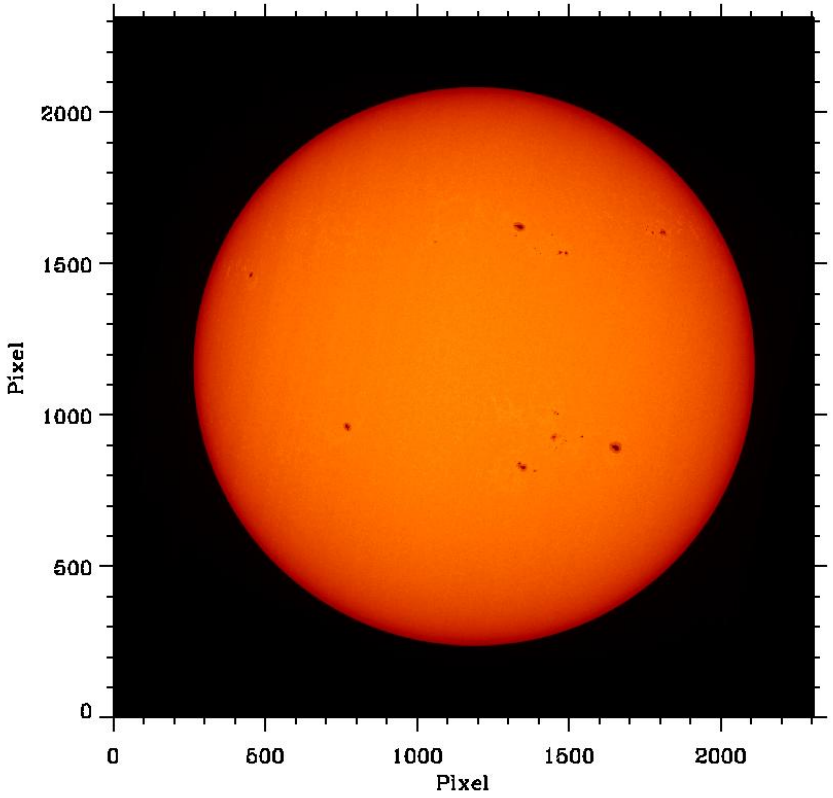


```
spectrum = reform(data[*,893,*])
```

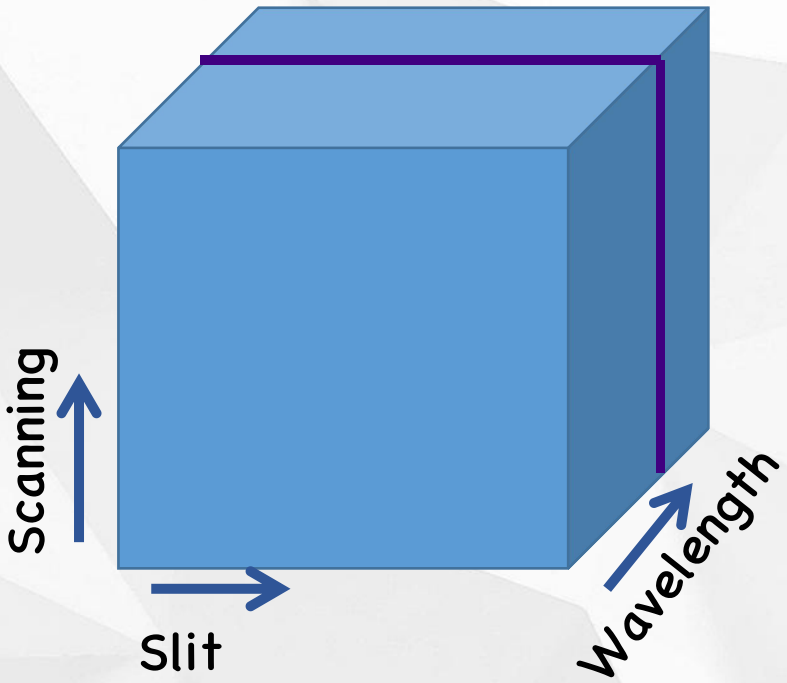


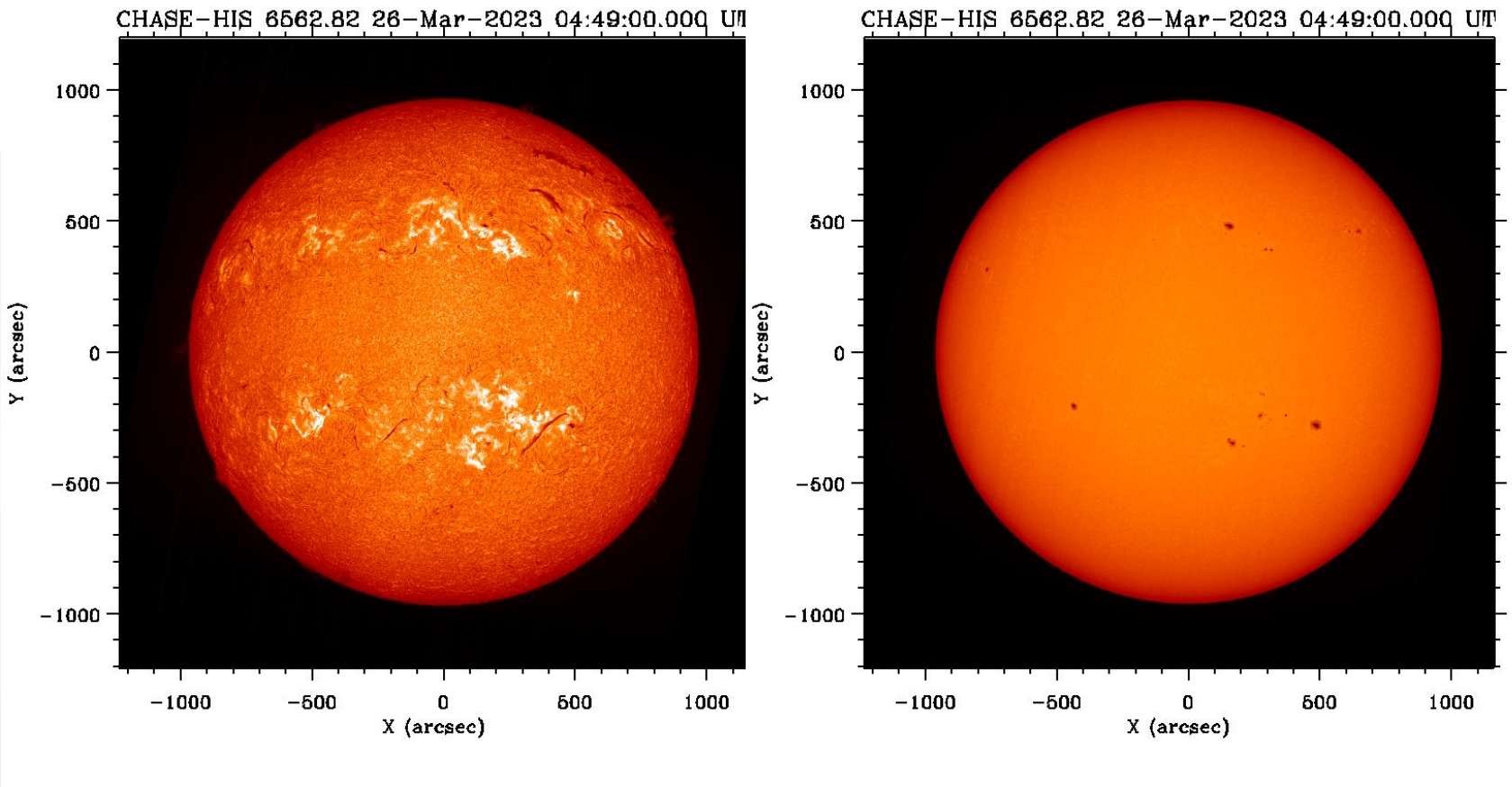




spectrum = reform(data[*,*,67])

spectrum = reform(data[*,*,30])




For mreadfits

```
img = reform(data[*,*,67])
index2map,header[0],img,map
```

```
img = reform(data[*,*,30])
index2map,header[0],img,map
```

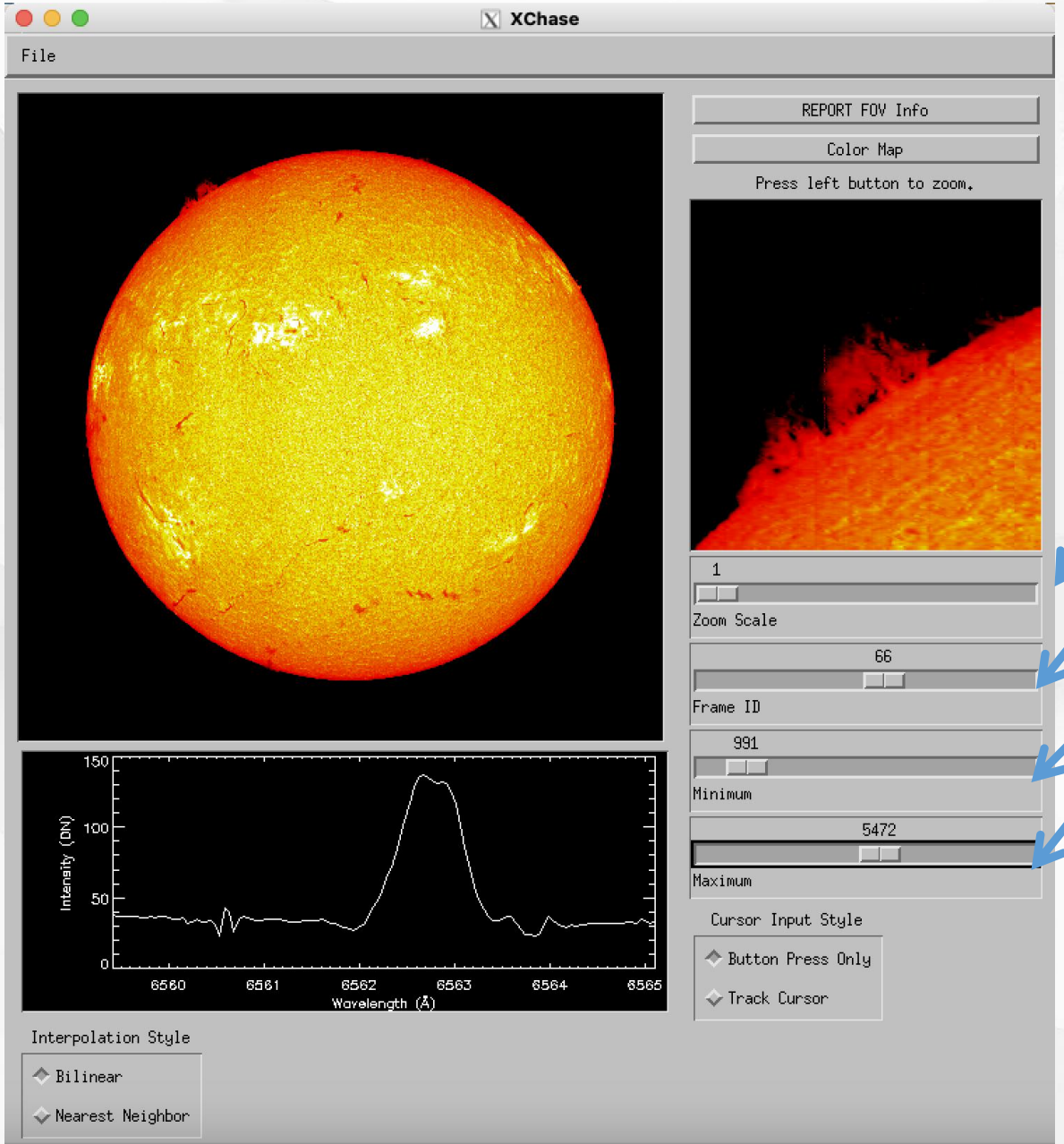
or:

For fits_read

```
index2map,header,img,map
```

```
index2map,header,img,map
```

# XCHASE




zooming in factor

wavelength point

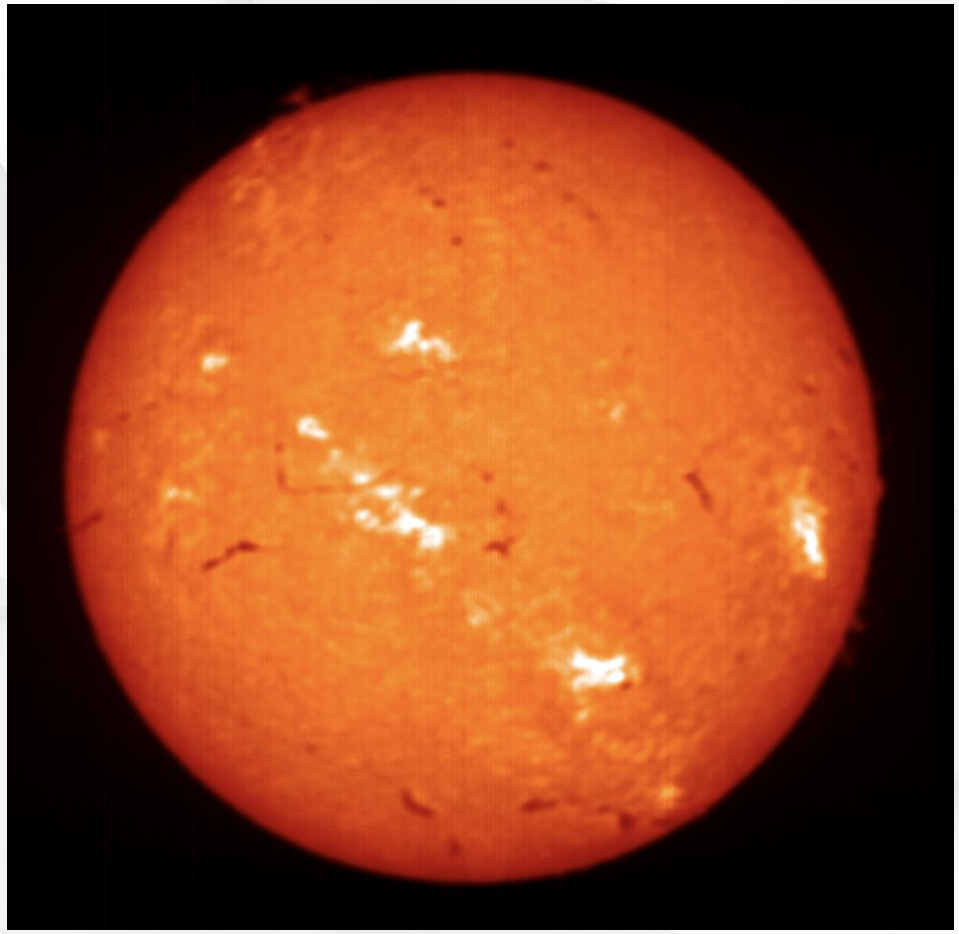
image contrast

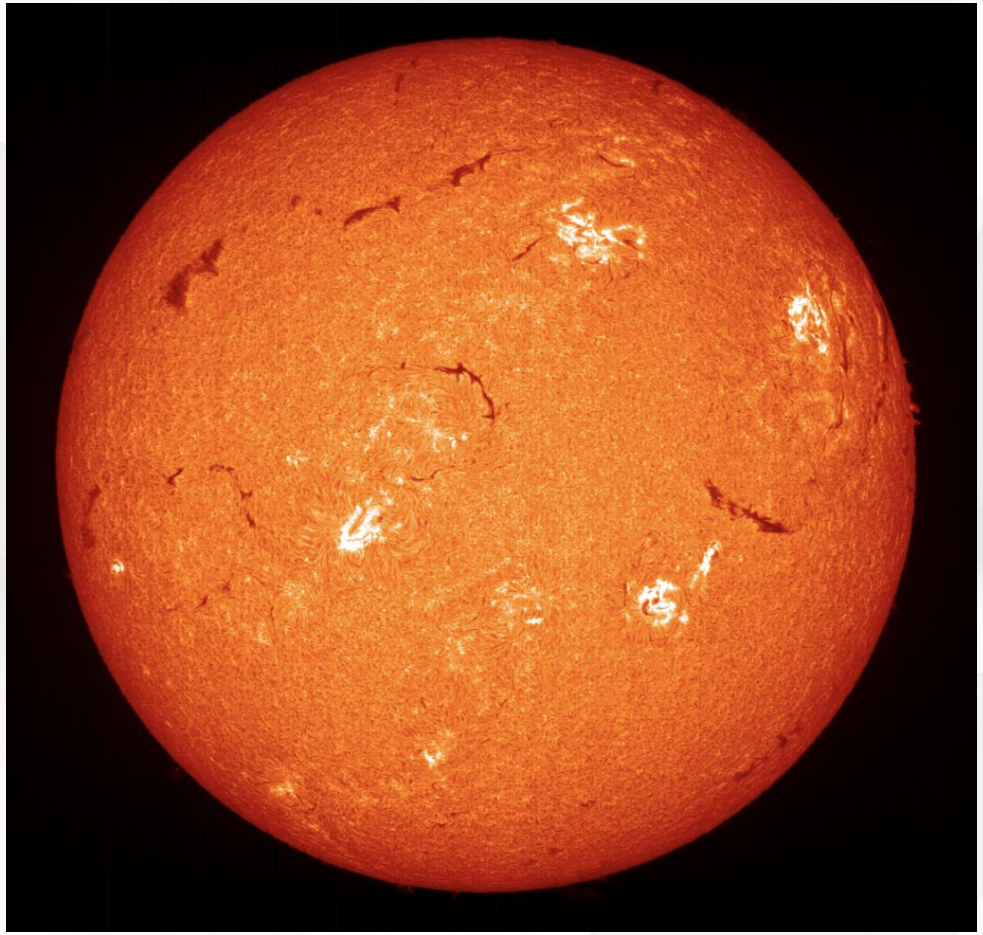
XCHASE V1.01

Windows MAC Linux

https://ssdc.nju.edu.cn/NdchaseSatellite

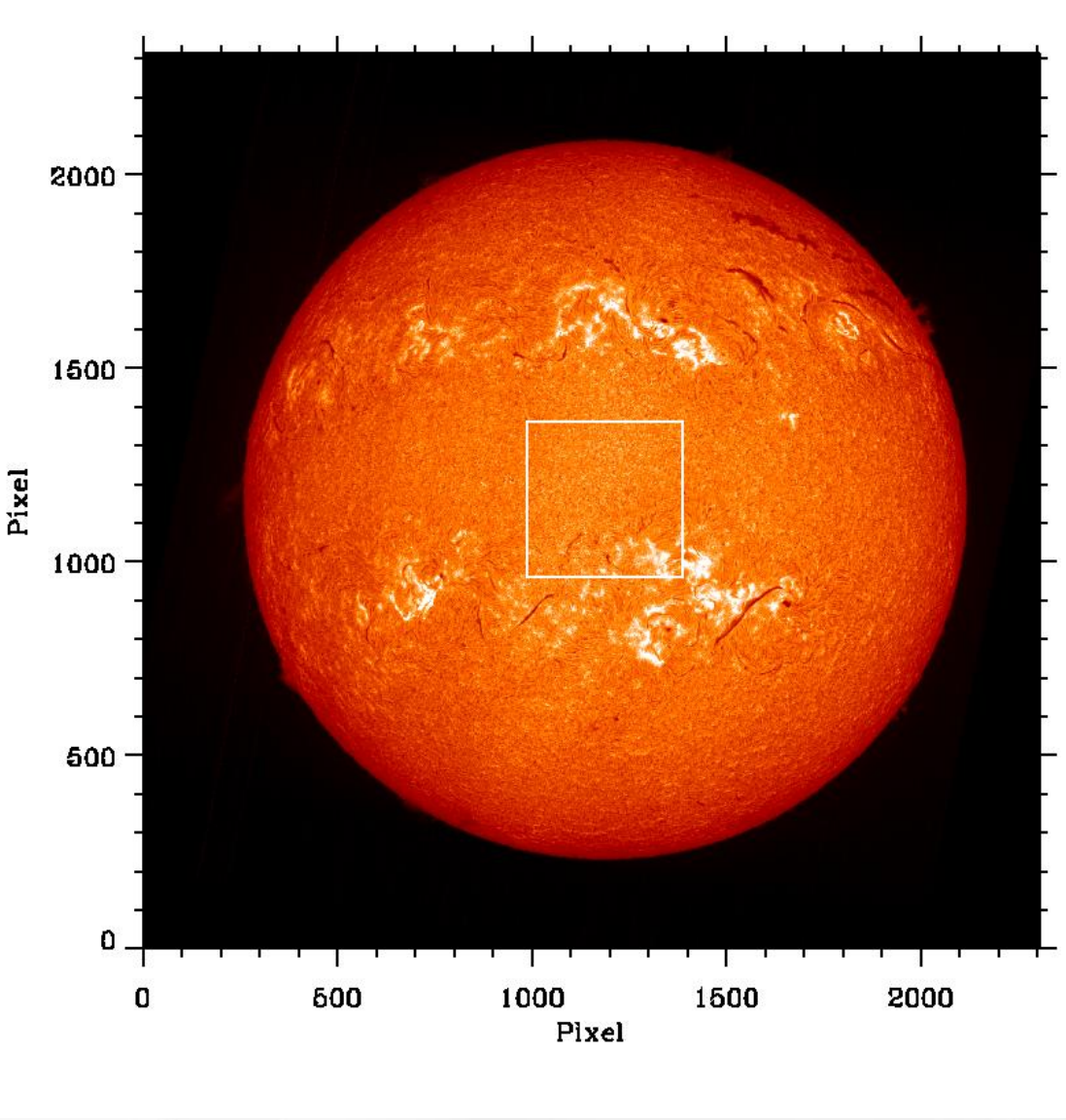
# Focal Length Optimization

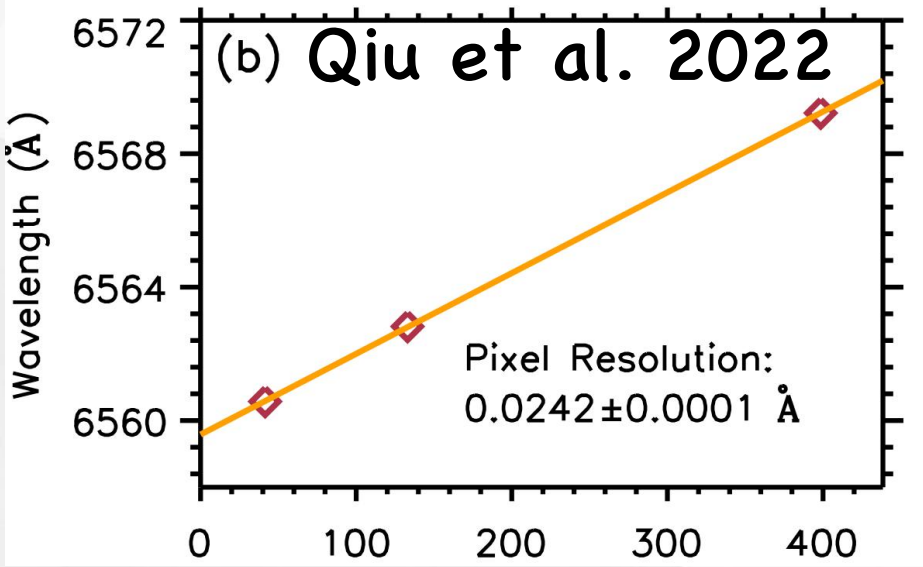




before ⟵ 2022-08-04 ⟶ after

# Eliminating Instrumental Velocity



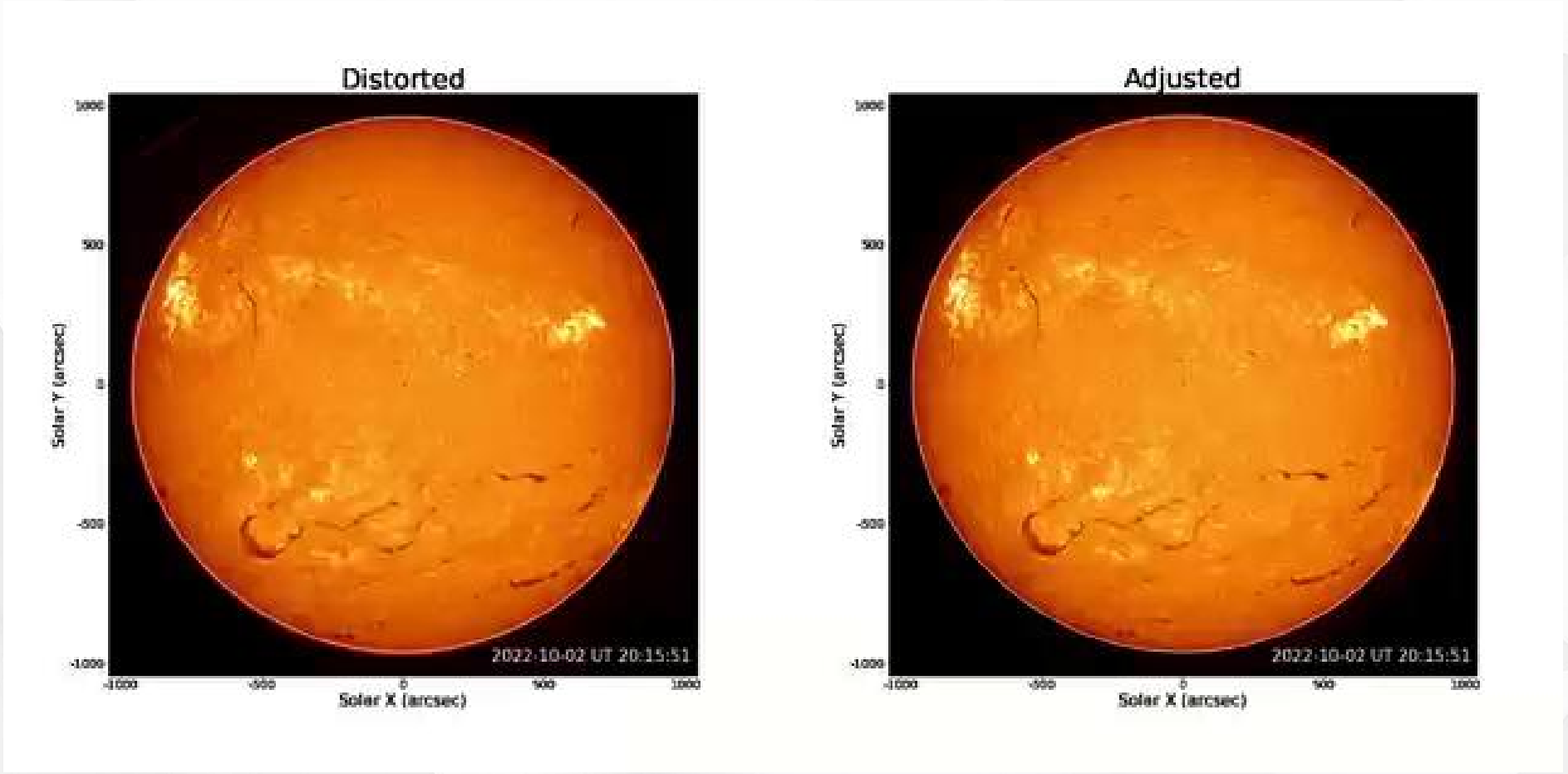

2022-10-11

**Note:**

1.there might be residual speed;

2.can't eliminate the bias caused by the scanning .

# Eliminating Distortion

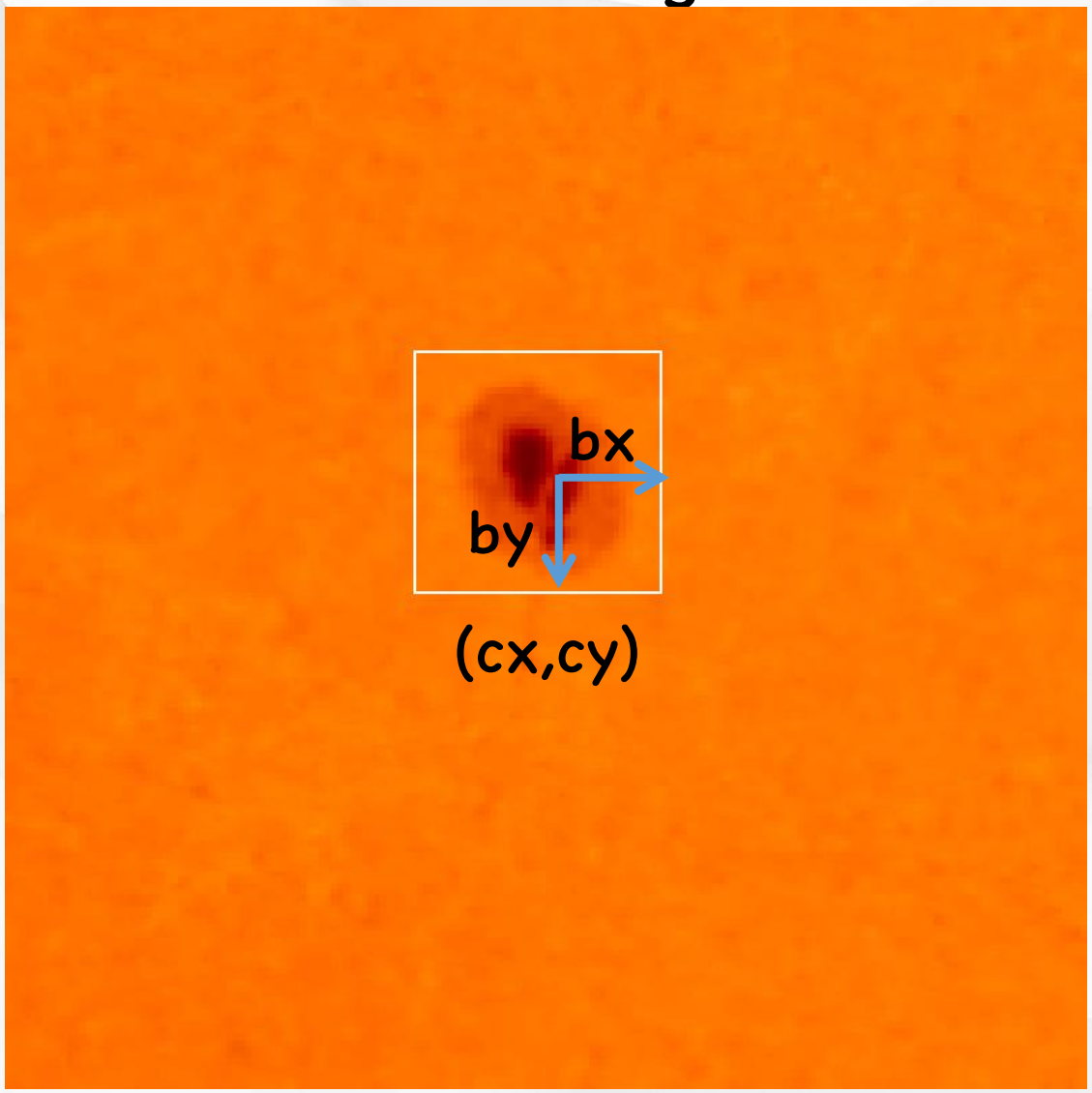



before ⟵ 2023-07-18 ⟶ after

For recalibration or any scientific requests, please contact us

lic@nju.edu.cn; lizhen@nju.edu.cn; qiuyeah@163.com;sh_rao@163.com

For data before distortion elimination, xyoff.pro can be used for alignment.




reference image

s = xyoff(img0,img,bx,by,cx,cy)

aligned image

s[0] = The x offset.
s[1] = The y offset.
s[2] = max value of the correlation
s[3] = cross correlation at 0 shift
s[4] = maximum of the real part of absolute value of cross correlation

# For data after distortion elimination

get_map_xp.pro
get_map_yp.pro
interpol.pro

```
pro map_subregion
;;;;;input;;;;;;
xran = [300,900]
yran = [-500,0]    ;in arcsec

path_read = '/data/chase/Chase/Lev1/higher_level/2023/1/14/'
path_sav  = '/data/home/yqiu/chase/space/science/2023/1/14/jpg/'
file_mkdir,path_sav
path      = '/data/home/yqiu/chase/space/science/2023/1/14/'

ff = file_search(path_read,'*HA.fits*',count=num)
mreadfits,ff[0],header0,data
mreadfits_tilecomp,ff[0],header,fnames_uncomp=fnames,/only_uncompress,$
  outdir='/data/home/yqiu/chase/space/uncomp'
mreadfits,fnames,header0,data
file_delete,fnames
index2map,header0[0],float(reform(data[*,*,67])),map
save,map,filename=path_sav+file_basename(ff[0],'.fits.gz')+'_map.sav'
xx0 = get_map_xp(map,/oned)
yy0 = get_map_yp(map,/oned)
if n_elements(xran) eq 0 && n_elements(yran) eq 0 then begin
  wdef,1,900,900
  plot_map,map,color=0
  xran = fltarr(2)
  yran = fltarr(2)
  for i=0,1 do begin
    cursor,a,b,/down
    xran[i]=a
    yran[i]=b
  endfor
endif
sz = size(data)
indx = round(minmax(interpol(findgen(sz[1]),xx0,xran)))
indy = round(minmax(interpol(findgen(sz[2]),yy0,yran)))
data_cube = fltarr(indx[1]-indx[0]+1,indy[1]-indy[0]+1,sz[3],num)
data_cube[*,*,*,0] = data[indx[0]:indx[1],indy[0]:indy[1],*]
date = header0[0].date_obs
```

input helioprojective coordinate

manually select the region

```
wdef,1,800,800
plot_image,reform(data_cube[*,*,67,0]),color=0,min=0,max=mean(data_cube[*,*,67,0])*2
xyouts,20,30,date[0],color=255,charsize=2,charthick=2
write_jpeg,path_sav+'img'+string(0,format='(i02)')+'.jpg',tvrd(true=1),quality=100,true=1
for i=1, num-1 do begin
;for i=7,7 do begin
  mreadfits,ff[i],index,data
  mreadfits_tilecomp,ff[i],header,fnames_uncomp=fnames,/only_uncompress,$
    outdir='/data/home/yqiu/chase/space/uncomp'
  mreadfits,fnames,header,data
  file_delete,fnames
  index2map,header[0],reform(data[*,*,67]),map
  xx = get_map_xp(map,/oned)
  yy = get_map_yp(map,/oned)
  sz = size(data)
  ix = round(minmax(interpol(findgen(sz[1]),xx,xran)))
  iy = round(minmax(interpol(findgen(sz[2]),yy,yran)))
  data_cube[*,*,*,i] = data[ix[0]:ix[0]+indx[1]-indx[0],iy[0]:iy[0]+indy[1]-indy[0],*]
  date = [date,header[0].date_obs]
  plot_image,reform(data_cube[*,*,67,i]),color=0 ,min=0,max=mean(data_cube[*,*,67,i])*2
  xyouts,20,30,date[i],color=255,charsize=2,charthick=2
  write_jpeg,path_sav+'img'+string(i,format='(i02)')+'.jpg',tvrd(true=1),quality=100,true=1
endfor
header = header0
save,data_cube,date,xran,yran,header,filename=path_sav+'datacube.sav'
fjpg = file_search(path_sav,'img*.jpg')
create_gif_animation,fjpg,path+'aligned.gif',30
print,'xrange is', xran
print,'yrange is', yran
```

same size

# Moment Analysis

## Moment 0: integrated intensity

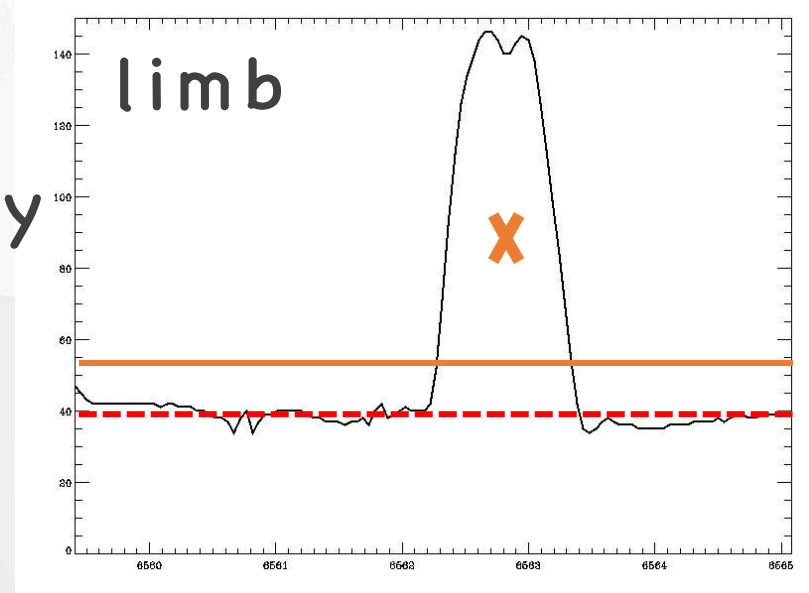
$$I_t = \sum (I_i - I_c)$$

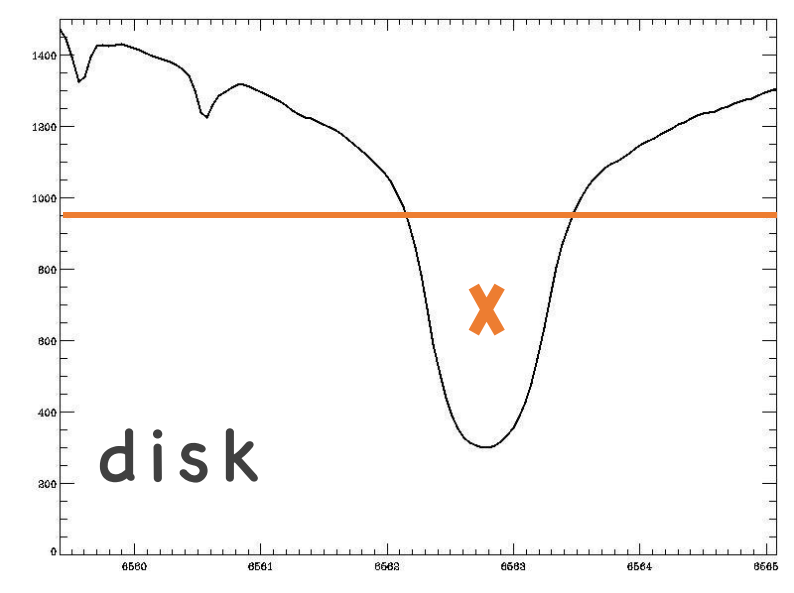
## Moment 1: Doppler velocity

$$v_d = \frac{\sum v_i (I_i - I_c)}{\Sigma (I_i - I_c)}$$

## Moment 2: spectral width

$$w = \sqrt{\frac{\sum (v_i - v_d)^2 (I_i - I_c)}{\Sigma (I_i - I_c)}}$$



```
function wave_centroid2,wavelengthIn,spectrumIn,thresholdIn,spec_thres=spec_thres, $
    delta_spec_thres=delta_spec_thres,contrastp=contrastp,error=error

error  = 0
x_wave = wavelengthIn
y_spec = spectrumIn
back_intensity=(y_spec[0]+y_spec[-1])/2.

if mean(y_spec) lt back_intensity then y_spec = 2*back_intensity-y_spec    ;if absorpted,
spec_max   = max(y_spec)
if n_elements(spec_thres) then begin
   spec_threshold = spec_thres
endif else begin
  if n_elements(delta_spec_thres) then begin
    spec_threshold = abs(delta_spec_thres-back_intensity)+back_intensity
  endif else begin
    if 1-n_elements(thresholdIn) then  thresholdIn= 0.15
    spec_threshold = back_intensity+thresholdIn*abs(back_intensity)
    if keyword_set(contrastp) then spec_threshold = back_intensity+ $
                                   thresholdIn*(spec_max-back_intensity)
  endelse
endelse

if (spec_threshold ge spec_max) then begin
  print,'The threshold is too big!'
  spec_threshold =back_intensity+thresholdIn*(spec_max-back_intensity)
  error = 1
endif
s_q = where(y_spec ge spec_threshold)
spectrum_eff   = y_spec[s_q]-spec_threshold
wavelength_eff = x_wave[s_q]
centroid       = total(spectrum_eff*wavelength_eff)/total(spectrum_eff)

return,centroid

end
```

If it is an absorption line, flip the spectral line

Giving the intensity threshold

Giving the intensity difference

Giving the multiple of intensity difference relative to background intensity

Giving the contrast profile

If the intensity threshold is too big

calculating the spectral gravity center

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# Welcome to download CHASE data https://ssdc.nju.edu.cn/