Normalized Rank distributions of SNe in J-PLUS

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Master's degree final project

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NCRPVF.

Normaliced Cumulative
Rank Pixel Value Function
(NCR).

- NCR: A statistical pixel method.
- Correlates the spatial distribution of SNe with the host galaxy emission.
- NCR value of a SN tells the fraction of the host galaxy emission that originates in regions fainter than the pixel at the SN location.
- 0.1 means that the 10% of the flux of the galaxy came from fainter pixels, and 90% from brighter.

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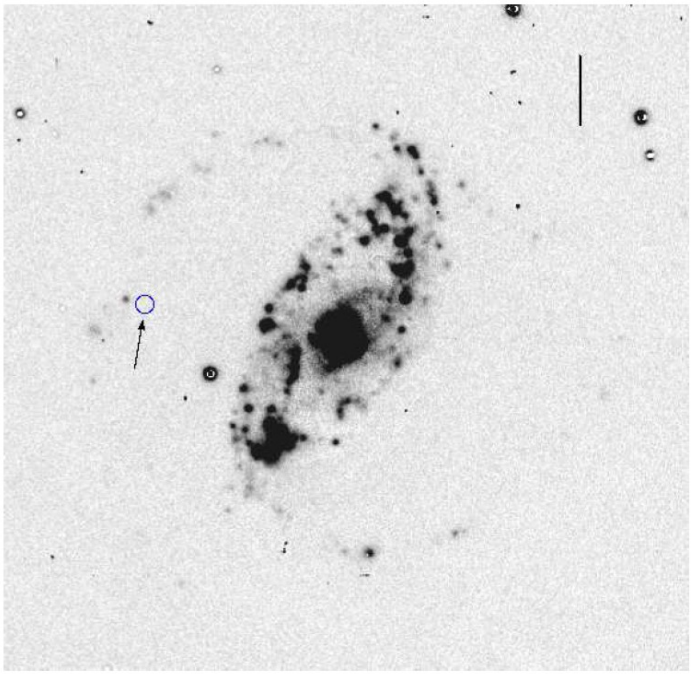

Figure 1. An example negative continuum subtracted Hα image from our data (image taken with the WFC on the INT); SN 2001ac (SN 'impostor') (position indicated by circle/arrow), within the host galaxy NGC 3504. The scale bar is 20″. The NCR value for this SN is 0.000.

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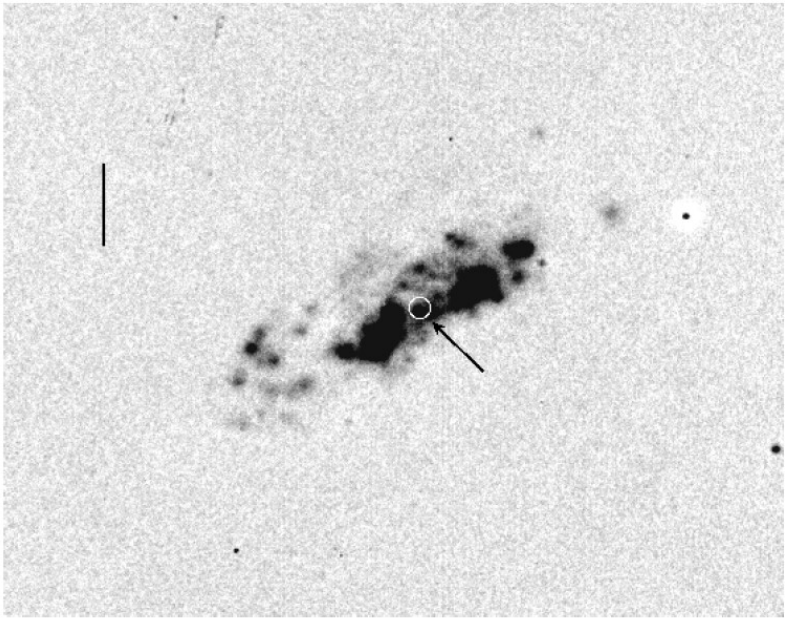

Figure 2. Another example negative continuum subtracted Hα image (WFC, INT); SN 2004bm (Ic) (position indicated by circle/arrow), within the host galaxy NGC 3437. The scale bar is 20″. The NCR value for this SN is 0.704.

Calculation of the NCR of a single SN.

1. Sort the pixel values (ascendant flux).

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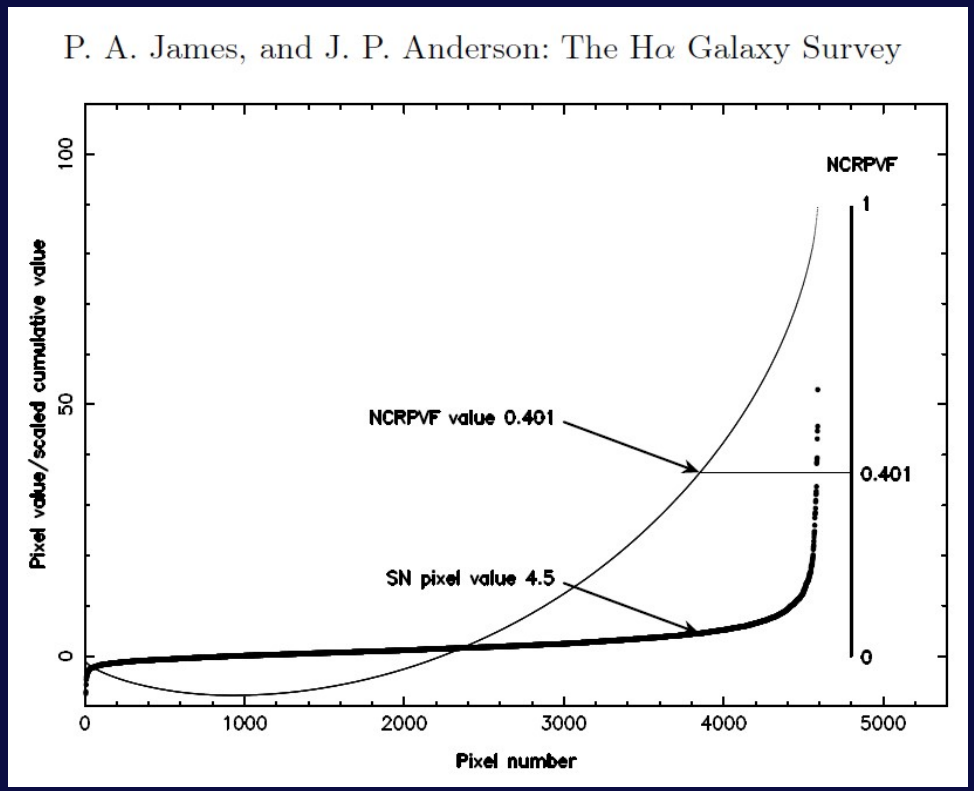

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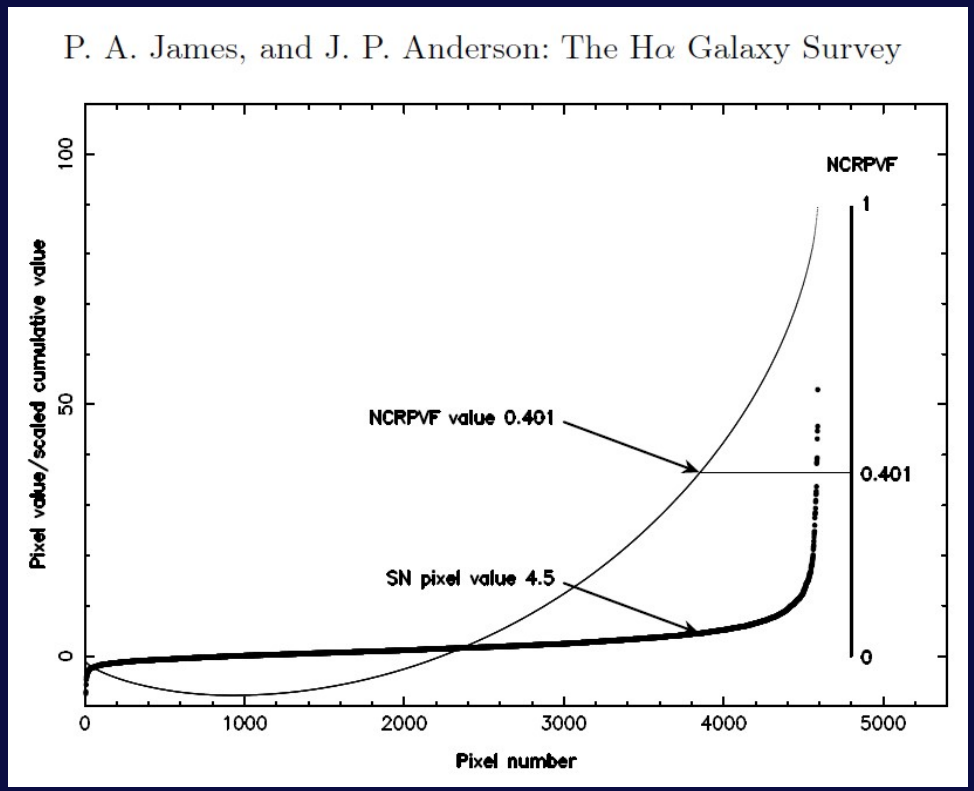

1. Sort the pixel values (ascendant flux).
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3. Search the pixel where our SN is.
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In other words...

$$NCR_n = \sum_{i=1}^{n} P_i \Big/ \sum_{j=1}^{m} P_j$$

2 A relevant plot.

Population that accurately traces the emission in which an analysis is presented.

↓

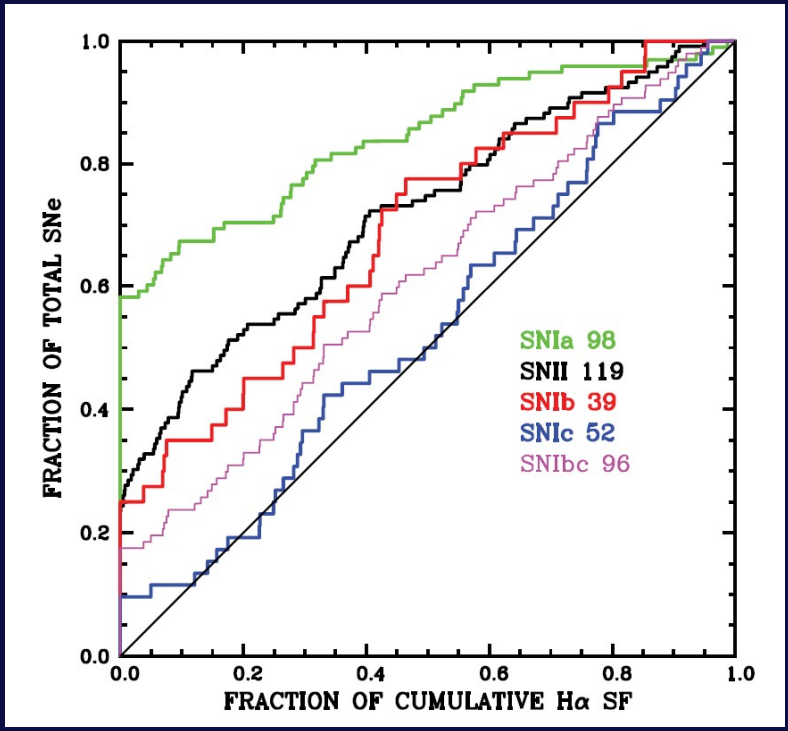
Flat distribution and a mean of 0.5 (diagonal in cumulative distributions)

Concentration of H-alpha emission (HII regions)

↓

Concentration of young massive stars. (~ < 15Myrs. < 15-20 M_sun)

Cumulative NCR distributions of the main SNe types



Statistical Studies of Supernova Environments
Joseph P. Anderson et al. (2015)

The distribution of Hα flux within galaxies traces ongoing SF.

If different SNe show differences in their association to the line emission....

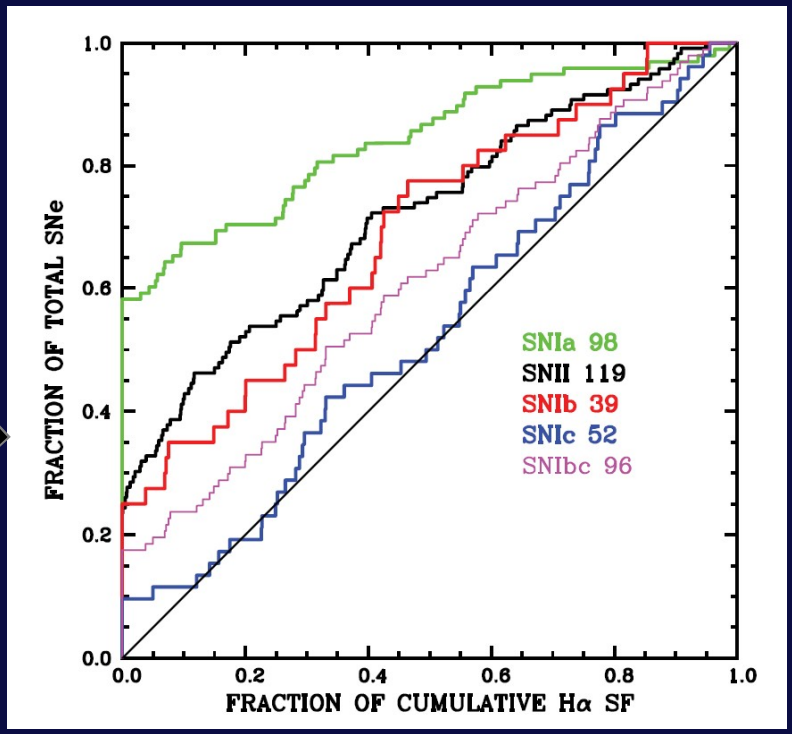
We are observing differences in the mean progenitor ages, and therefore masses of SN classes

Longer lifetime — **Shorter lifetime**

SNe Ia → SNe II → SNe Ib → SNe Ic

Lower mass — **Higher mass**

Cumulative NCR distributions of the main SNe types



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3

Current work.

What am I doing?

J-PLUS

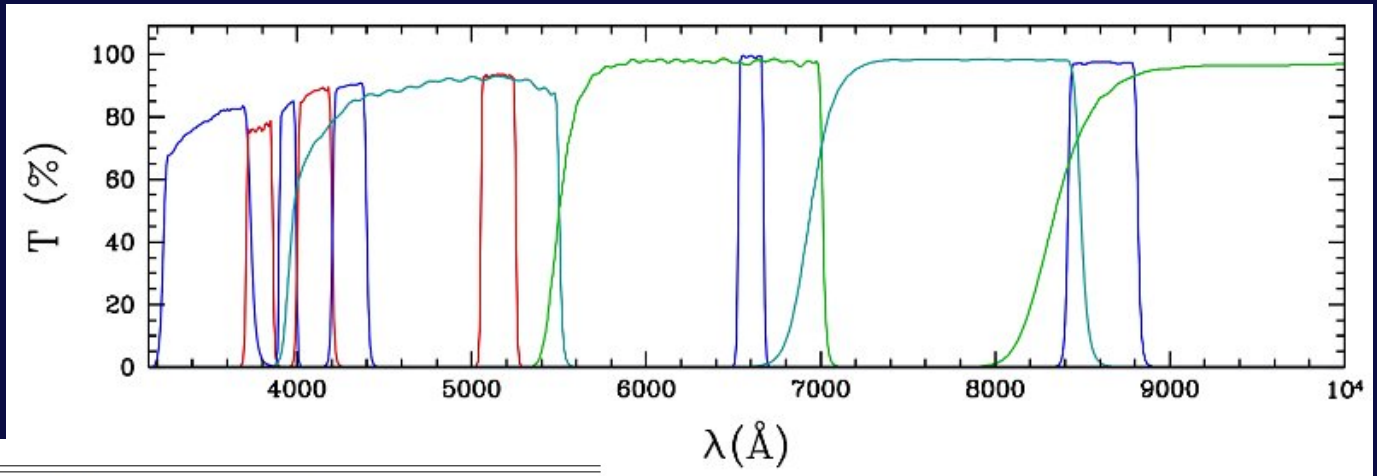
Javalambre Photometric Local Universe Survey

- Project to observe 8500 deg² of sky from Javalambre with 12 filters
- The project has been specially designed to carry out the photometric calibration of J-PAS.

OAJ - Observatorio Astrofísico de Javalambre (Teruel)

J-PLUS

Javalambre Photometric Local Universe Survey



Filter name	Central wavelength (nm)	FWHM (nm)	mag (AB) S/N=3	mag (AB) S/N=50	Comments
u'_J	348.5	50.8	23.00	19.69	In common with J-PAS
$F378$	378.5	16.8	21.58	18.01	[O II]; in common with J-PAS
$F395$	395.0	10.0	21.60	18.01	Ca H+K
$F410$	410.0	20.0	21.62	18.03	Hδ
$F430$	430.0	20.0	21.65	18.01	G-band
g'	480.3	140.9	23.23	19.92	SDSS
$F515$	515.0	20.0	21.67	18.01	Mg
r'	625.4	138.8	23.26	19.99	SDSS
$F660$	660.0	13.8	22.64	19.11	Hα+[N II]; in common with J-PAS
i'	766.8	153.5	22.31	18.88	SDSS
$F861$	861.0	40.0	21.48	18.01	Ca Triplet
z'	911.4	140.9	21.51	18.19	SDSS

And...

- H-alpha+[NII] continuous extracted (r)
- [OII] continuous extracted (u and g)
- Ca triplet continuous extracted (z)
- H-alpha continuous extracted (r)

So…how am I doing it?

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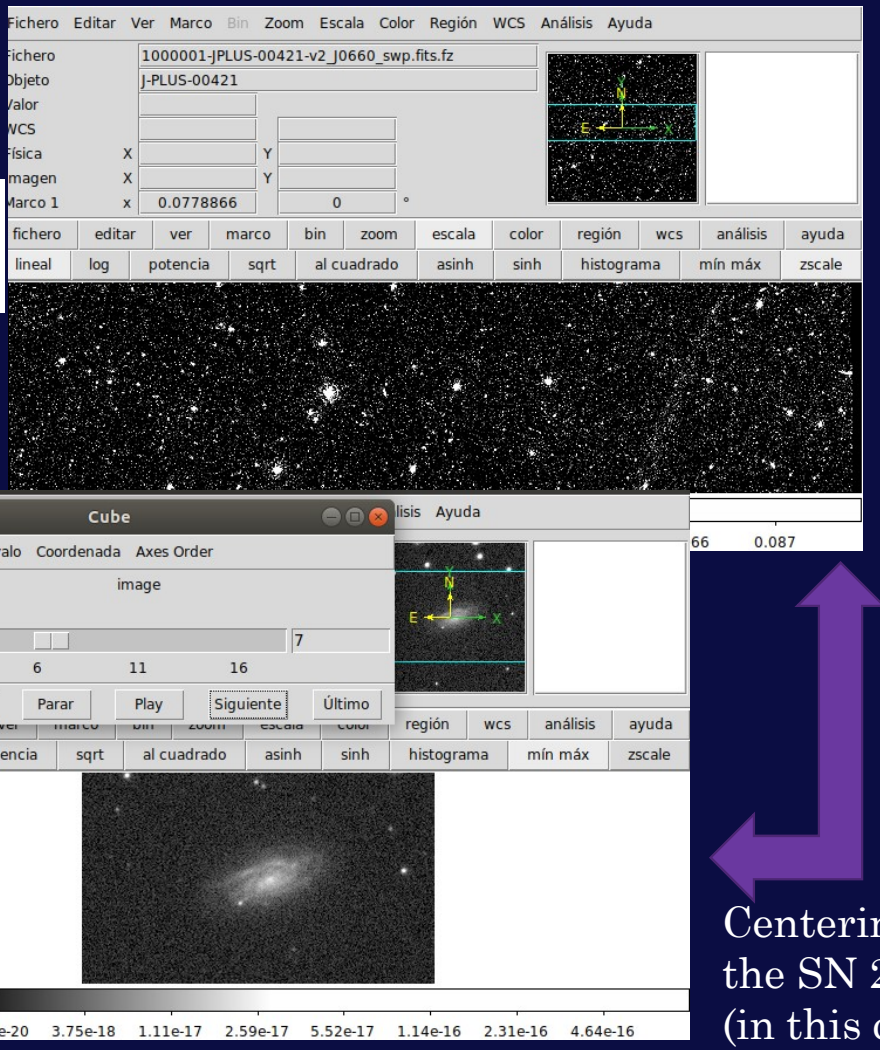
$$F_i(\lambda) = F_o(\lambda)10^{0.4A_\lambda} = F_o(\lambda)10^{0.4E(B-V)k'(\lambda)}$$

Step 1

Prepare the cube data:
cut the 12 images, calculate fluxes and Dust correction



Centering at the SN 2008az (in this case)

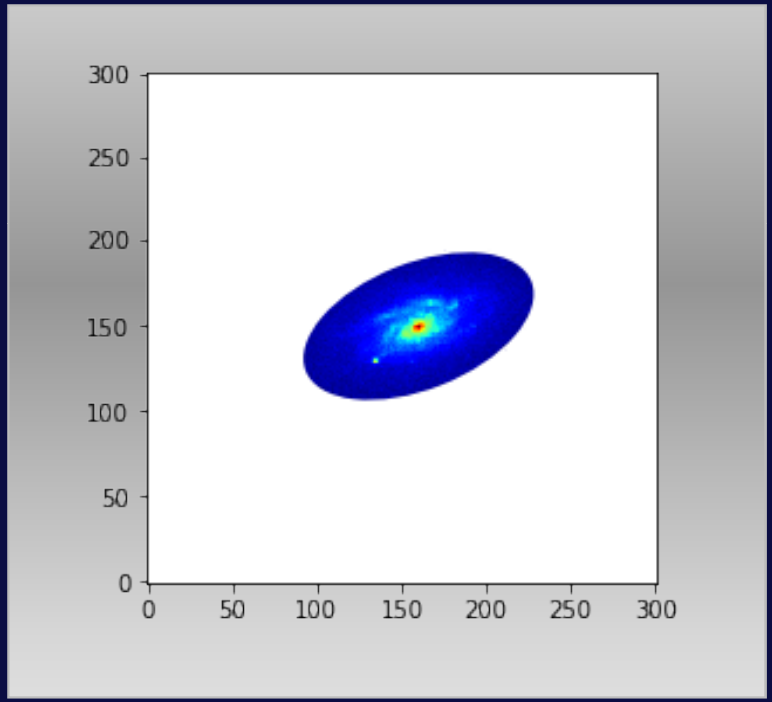
So...how am I doing it?

Step 2

Mask the data with a 2D gaussian fit

Step 1

Prepare the cube data: cut the 12 images, calculate fluxes and Dust correction



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Step 3

Search in StackOverflow why my code doesn't work

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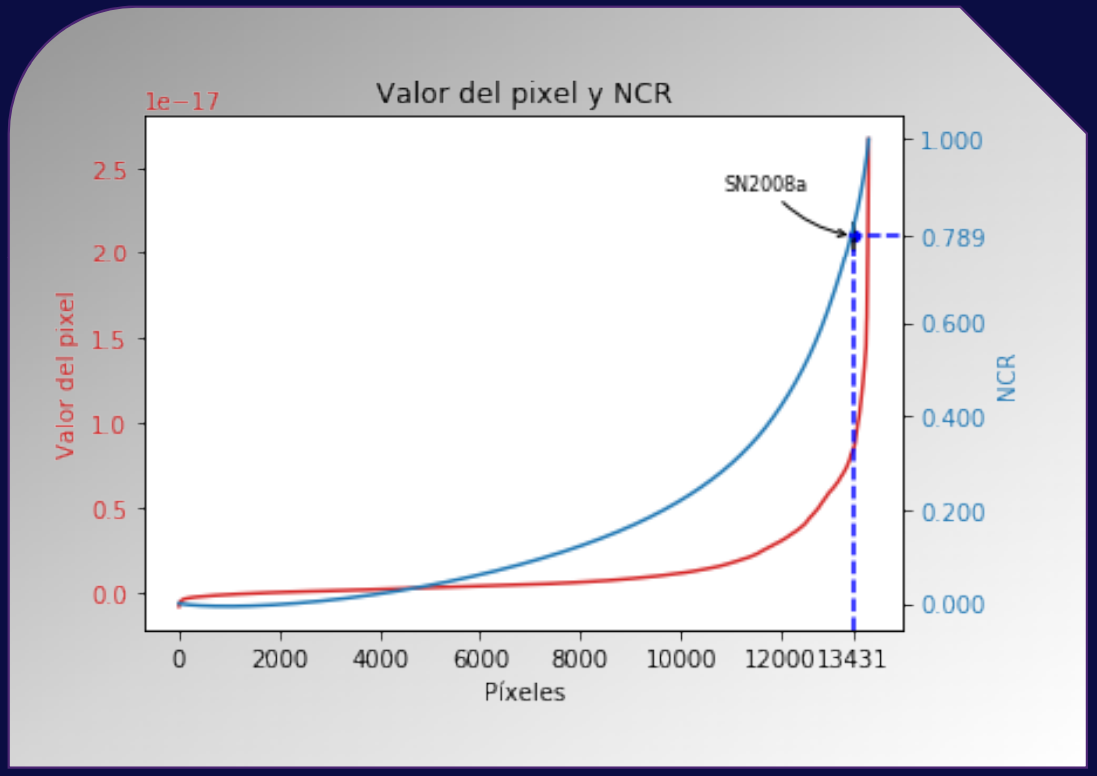
Step 4

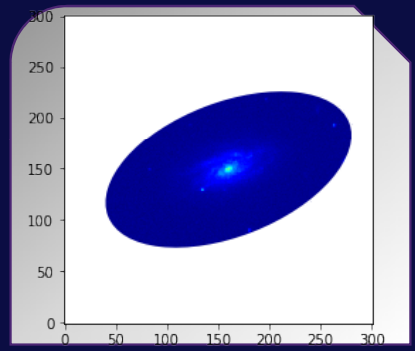
Calculate the NCR with the fitted data

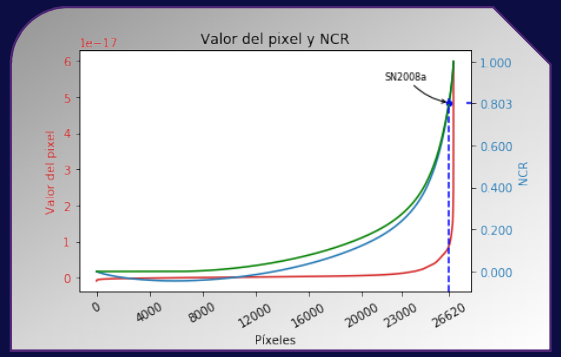
So...how am I doing it?

Step 4



And constracting the results
If I fit the data with different sigmas






astropy
python
So...how am I doing it?
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Step 2
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NCR
Step 4
Calculate the NCR with the fitted data
Step 5
Repeat steps 2-4 for all the bands

What's next?

Repeat all the process for all the dataset of J-PLUS that I have (+200 SNe).

Then, I will be able to the same relevant plot but for all the 16 bands and
get new correlations with the main SNne types and the emission of the host galaxies.

Thanks!

Any questions?