

SN 1987A with JWST: An ETC workbook

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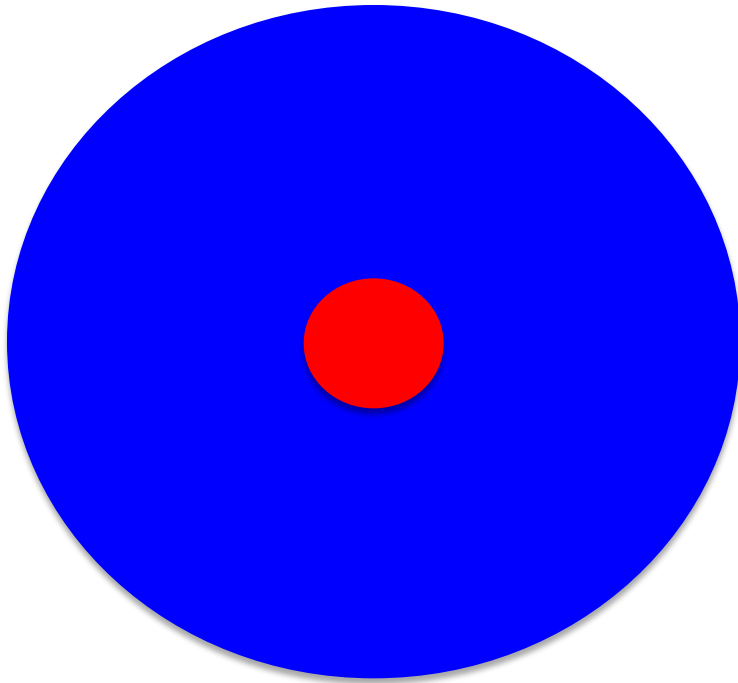
JWST Proposal Planning Workshop, 15-17 May 2017

- Creating an extended source using:
 - Composite extended shapes & simple spectra
 - Extended shapes with uploaded spectrum
- Specifying the flux & normalisation for extended sources (including caveats!)
- Sample SNR calculations for:
 - MIRI Imaging
 - MIRI Medium-resolution Spectroscopy (MRS)
 - NIRSpec Integral Field Spectroscopy (IFS)
- Features:
 - Implementing dither patterns
 - Nodding in- or off-scene with MIRI MRS
 - Batch expansions

- SN1987A consists of a bright ring, enclosing the dust ejecta from the SNa. One challenge is to detect the ejecta without saturating the ring.
 - Ring diameter ~ 1.1 arcsec, with thickness ~ 0.2 arcsec
 - Total emitting area ~ 1.3 arcsec².
 - With a MIRI pixel scale of 0.11 arcsec/px $\rightarrow \sim 107$ pixels
 - Ejecta occupy approx. 4 pixels, i.e. just-resolved.
- Flux normalisation for surface brightness units is not supported in current public version of the ETC – have to provide the integrated flux and ensure that # of pixels results in right surface brightness
- Have defined the source SED in 2 different ways:
 - Blackbody sources with temperatures 100K (ejecta) and 400K (ring), normalised to 0.1 mJy and 80 mJy @ 10 μ m, respectively
 - Single disk with uploaded integrated mid-IR spectrum from Spitzer

Defining the Source

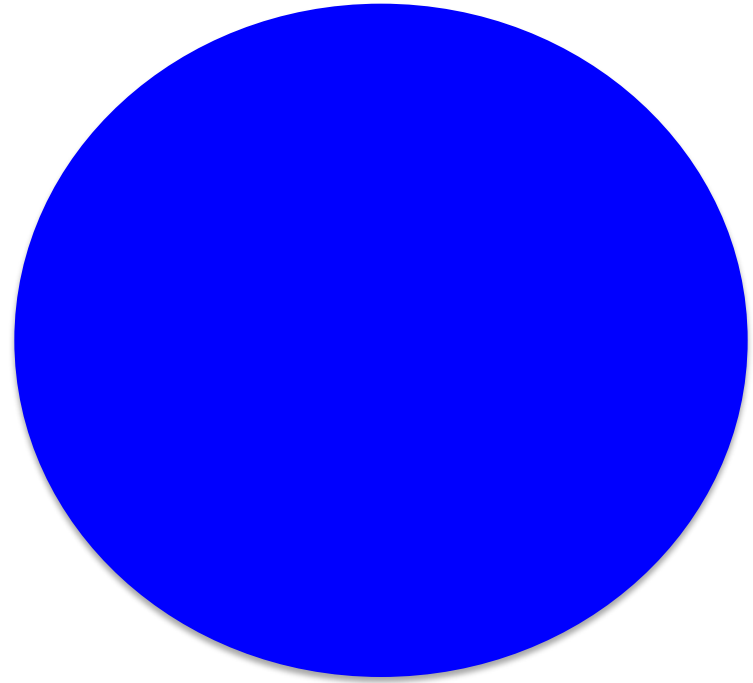
Method 1 (not to scale)



Ring
BB 525K
80 mJy @ 10 μ m

Ejecta
BB 90 K
0.1 mJy @ 10 μ m

Method 2



Uniform source
User uploaded Spitzer spectrum

Select a Source

ID	Plot	Name	Scenes	# Calcs	
6	<input checked="" type="checkbox"/>	SN1987A Spitzer s 5		3	
7	<input type="checkbox"/>	ejecta only	6	1	
8	<input type="checkbox"/>	ring only	6	1	

New

Delete

Source Editor

ID Continuum Renorm Lines Shape Offset

Spectral Energy Distribution

Uploaded File

sn1987a_spitzer_kendrew

Select

Flat Continuum

fnu

No Continuum

Redshift

0

Extinction

Law

Milky Way R_V=3.

Ext. Magnitude

0

Ext. Bandpass

J

Source selected: 6

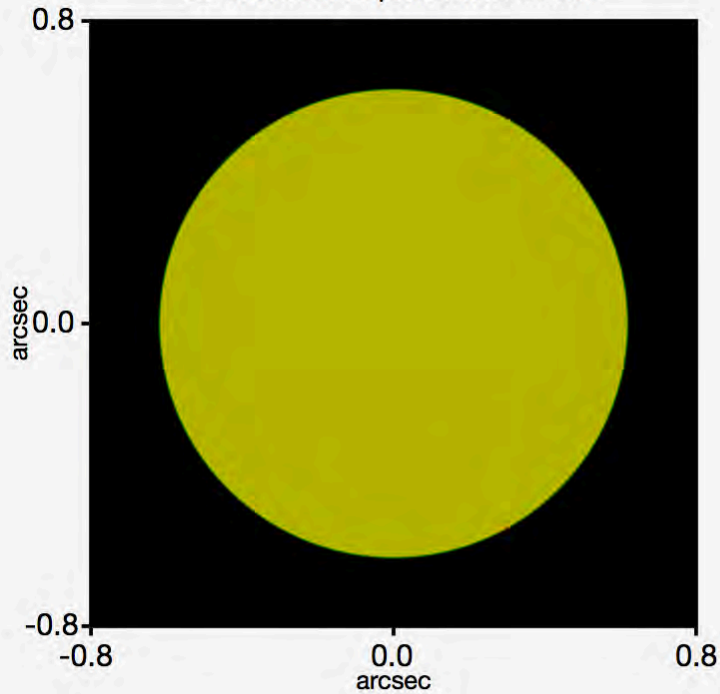
Reset

Save

Scene plot, Spitzer spectrum

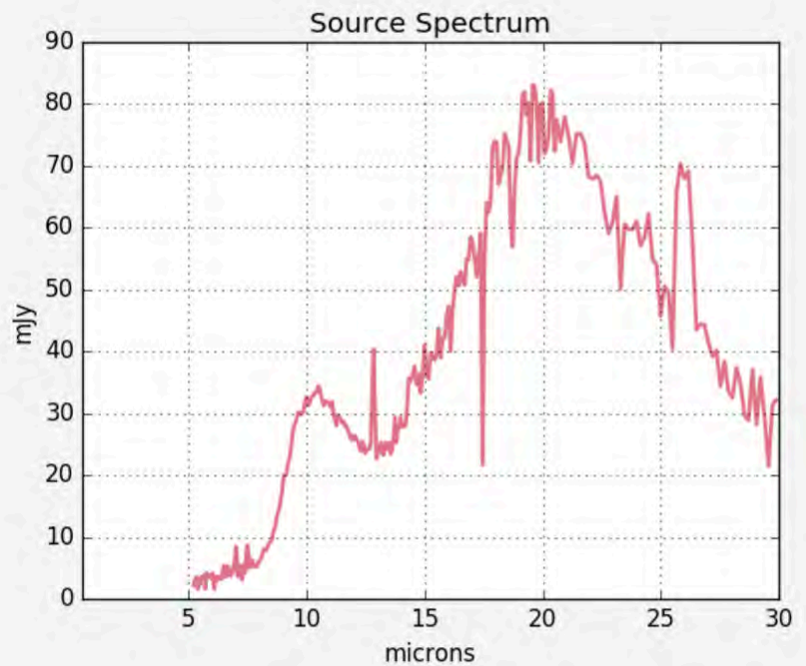
Scene Sketch

5: SN1987A Spitzer IRS scene



Show source outlines

Source Spectrum Plots



[Spectra Plot](#)

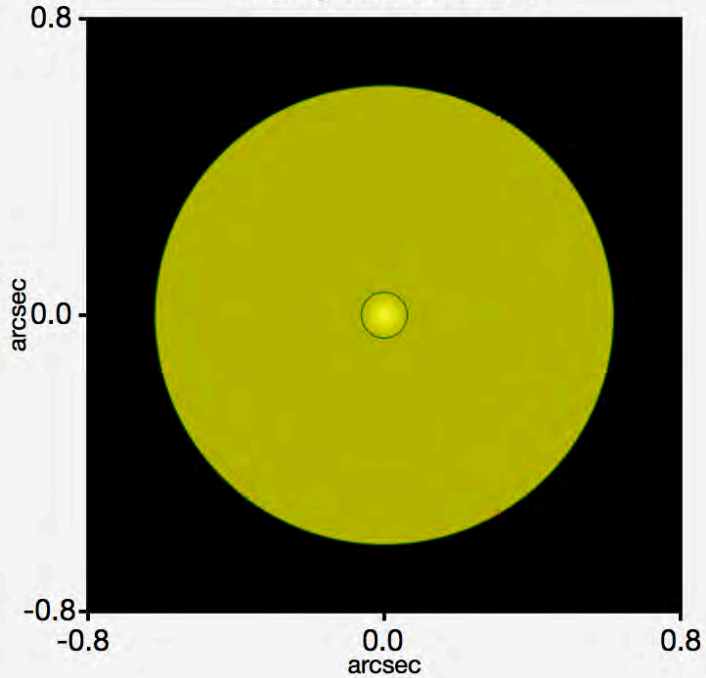
Bounds/Scale:

Note no NIR coverage.....

Scene plot, simplified source

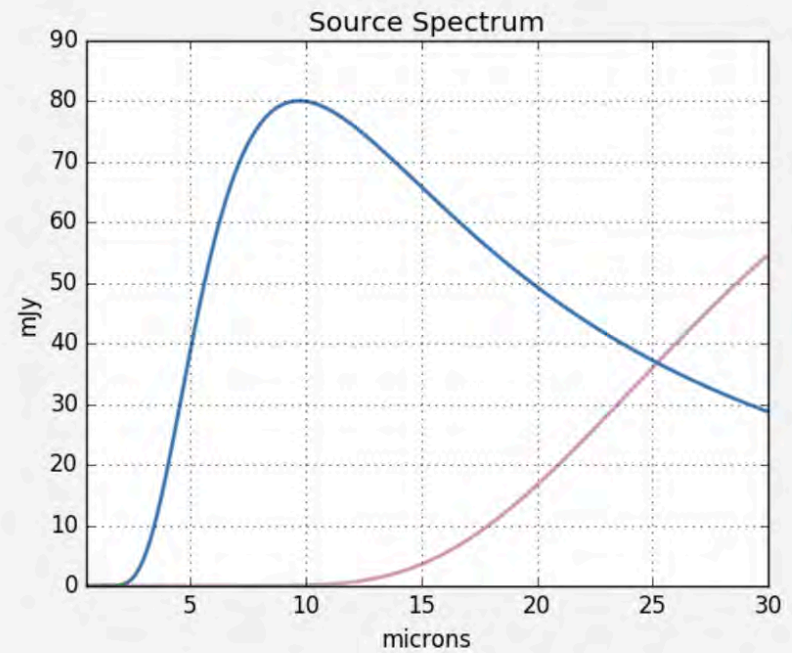
Scene Sketch

6: Simplified SN scene



Show source outlines

Source Spectrum Plots



[Spectra Plot](#)

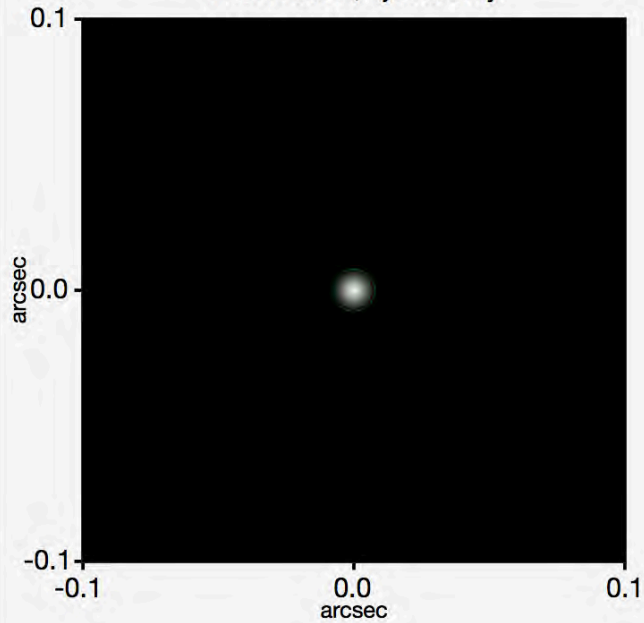
Bounds/Scale:

Scene plot, simplified, ejecta only

Exposure Time Calculator Edit ▾ Expand ▾

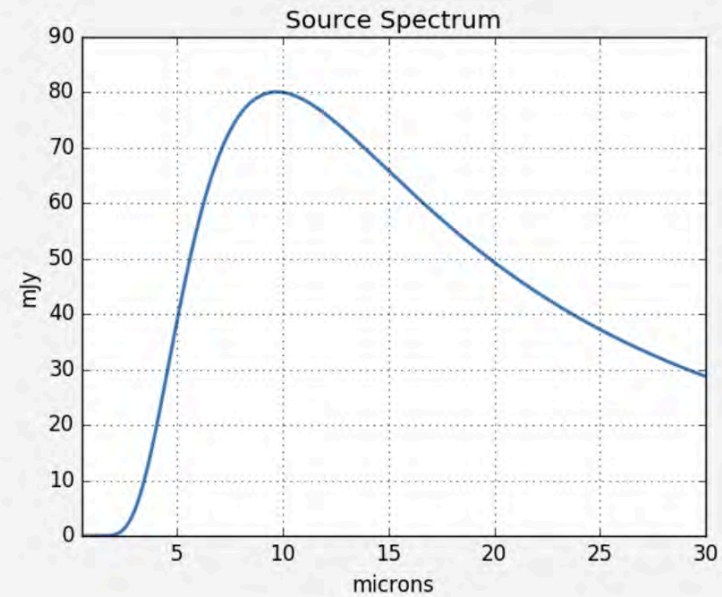
Scene Sketch

7: SN1987A, ejecta only



Show source outlines

Source Spectrum Plots



Spectra Plot

Bounds/Scale:

X:

Y:

- MIRI Imaging (F560W), Spitzer spectrum
- MIRI Imaging (F1000W), simplified SED & extracted off-centre in the ring
- MIRI Imaging (F2550W), ejecta only
- MIRI MRS, Spitzer spectrum: Ch3-Short for the [NeII] line @ 12.8 μm
- MIRI MRS, Spitzer spectrum: Ch4-Med for the [NeV] line @ 24.3 μm
- NIRSpec IFS, Simplified scene: G235M/F170LP (1.66-3.17 μm @ R~1000)
- NIRSpec IFS, Ejecta only: G395M/F290LP (2.87-5.87 μm @ R~1000)

MIRI Imaging: batch expansion (int)

