Supergalactic Winds Scenario

Massive starburst evolve and via stellar winds and supernova explosion leave their parent galaxy (creating a channel) and through their products out of the galaxies.

Some may even destroy their home galaxy (in the case of BCDs)

Talisman used

to enrich the intergalactic medium (IGM metallicity is 10-30% solar).

to understand the low metallicity in BCDs

to understand the BCDs (lack of galaxy behind)

Superwinds Demographics (Heckman, 2001)

Several indicators of minor axis outflows.

An excess of ionized gas along the minor axis(from Halpha images)

Emision-line profiles broader along the minor axis

Emision-line ratios which are more shock-like along the galaxy minA.

Isolated galaxies , spirals, irregulars and BCDs

Supervientos Galácticos



Nuclear Starburts Hydrodinamics (Supergalactic Winds- SGWs)

GTT+CMT, Ap.J., 478, 1997; MNRAS, 293, 1998.
Also...ApJ. Letters, 490, 1997; ApJ, 123 (2002)

Nuclear starburts Regions ($E=10^{40}$ -10^{44} ergs/s)

2D MODELS

*Massive nuclear stellar burst in Kpc THICK discs (Tomisaka & Ikeuchi, 1988)

*Extension to...THIN galactic discs surrounded by a low-density halo (Suckkov etal., 1994)

OBSERVABLES (INTERPRETACION)

**large scale Xrays remnants.....thermalized stellar ejecta in the reverse shock*

**superwind...free expanding stellar wind*

**Optical remnants (the debris of the shell)*

Radiative phase before "break-out". swept-up ISM

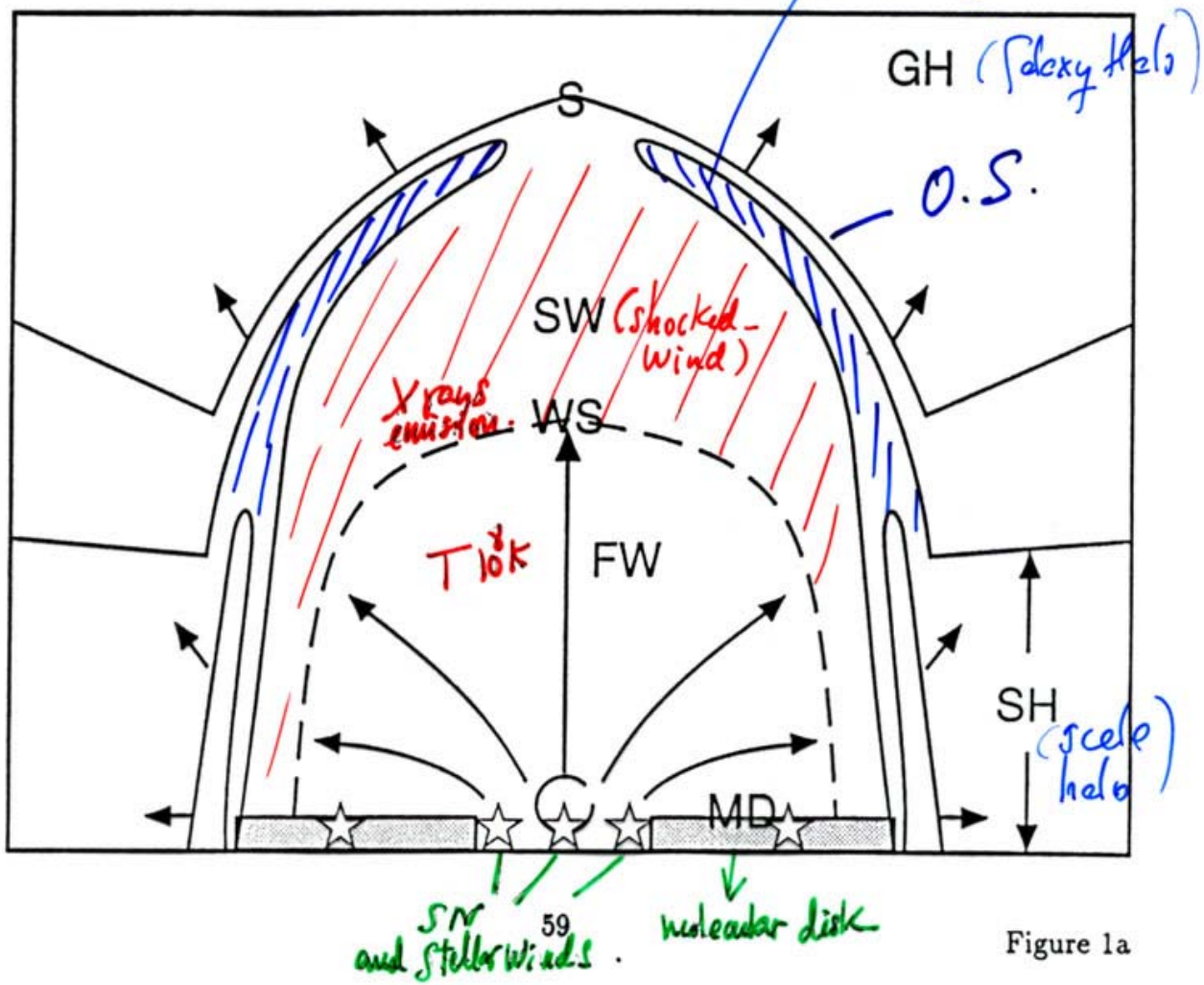


Figure 1a

Tomisaka & Ikeuchi (1988)

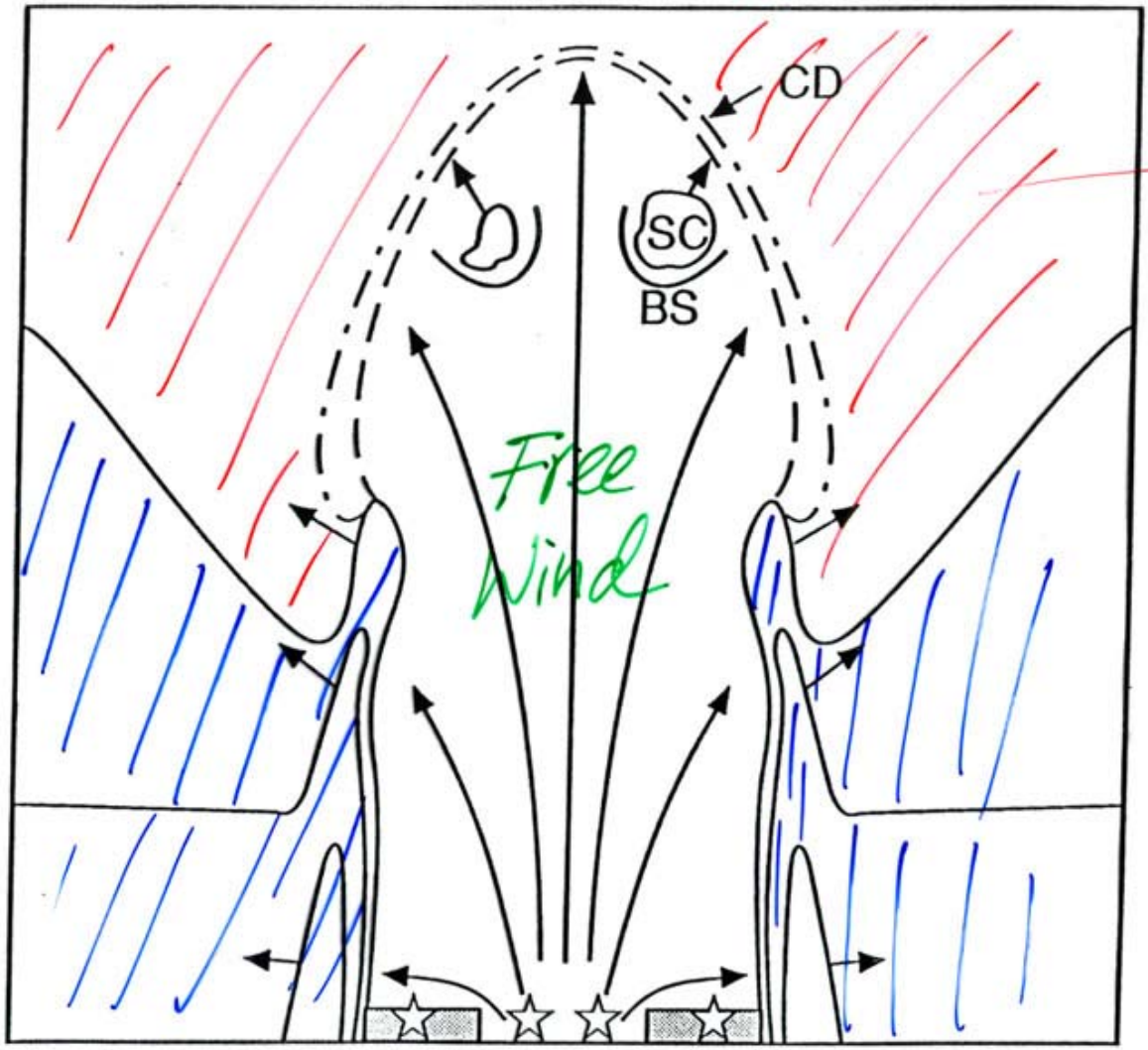
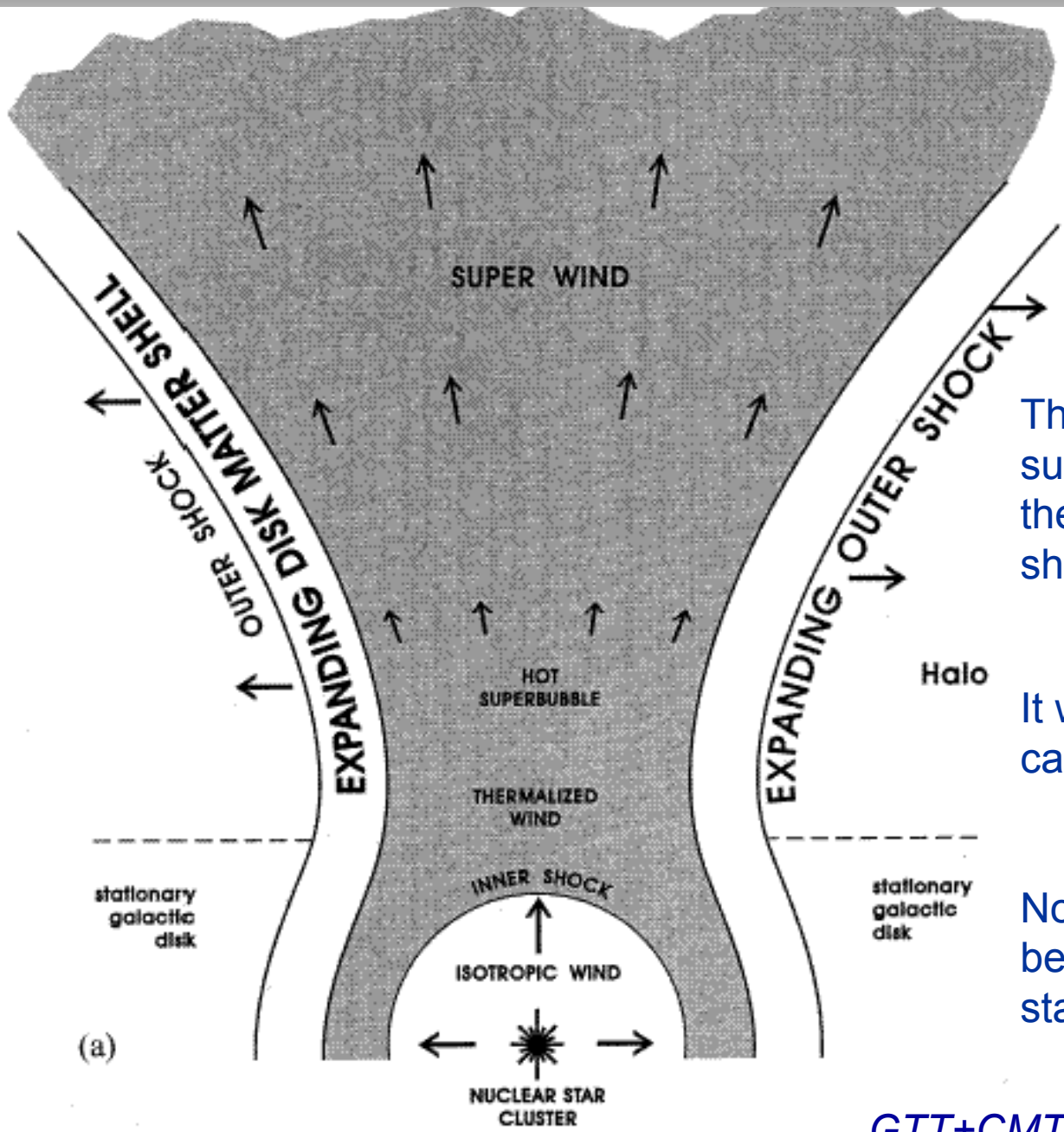


Figure 1b

After Break-out



The large pressure in the hot superbbuble...would open the cones...moreover the shell is too hot.

It woud lead to a giant cavity...not a narrow waist.

No causal relationship between the disk and the starburst....

GTT+CMT, ApJ,1997,MNRAS, 1998

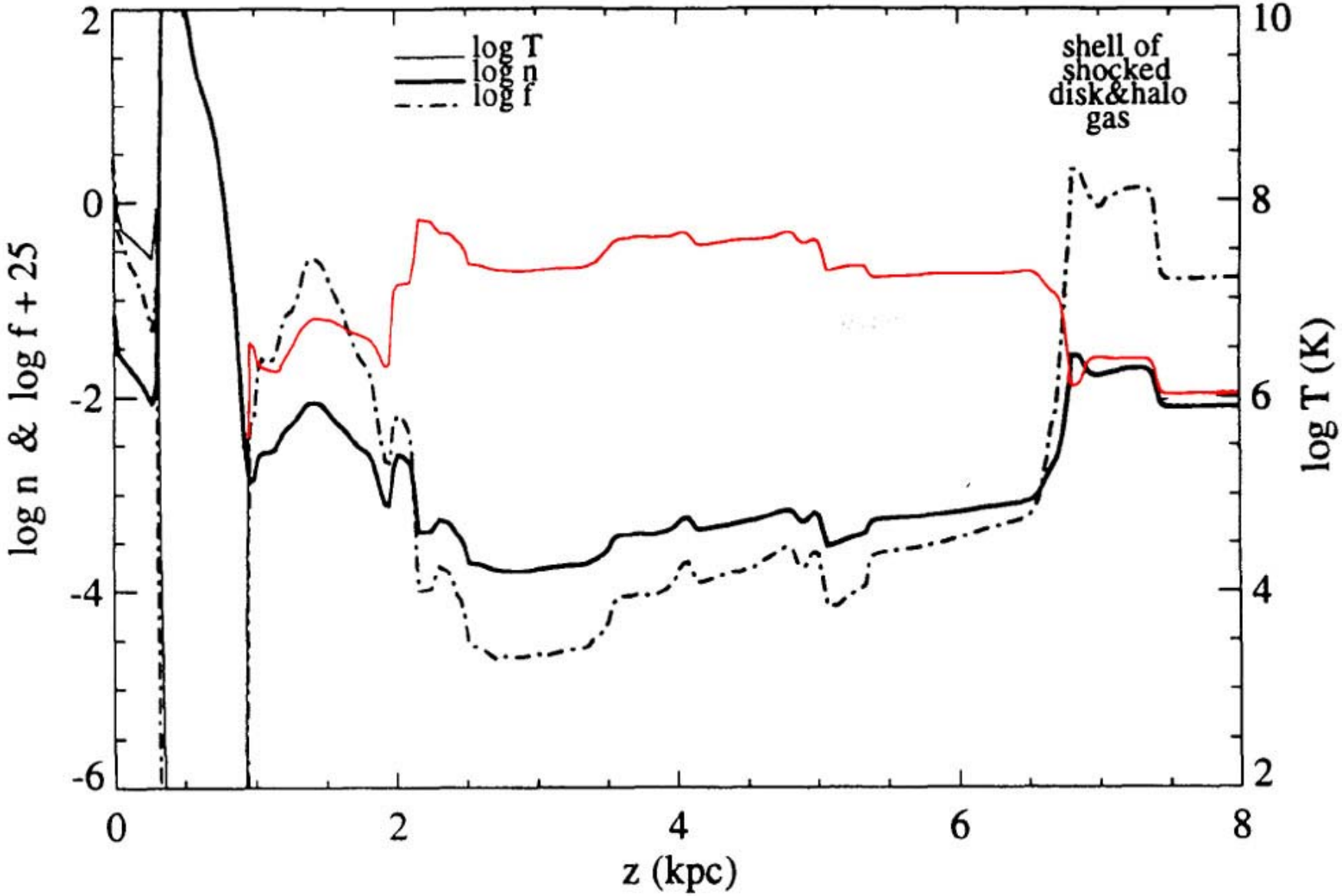
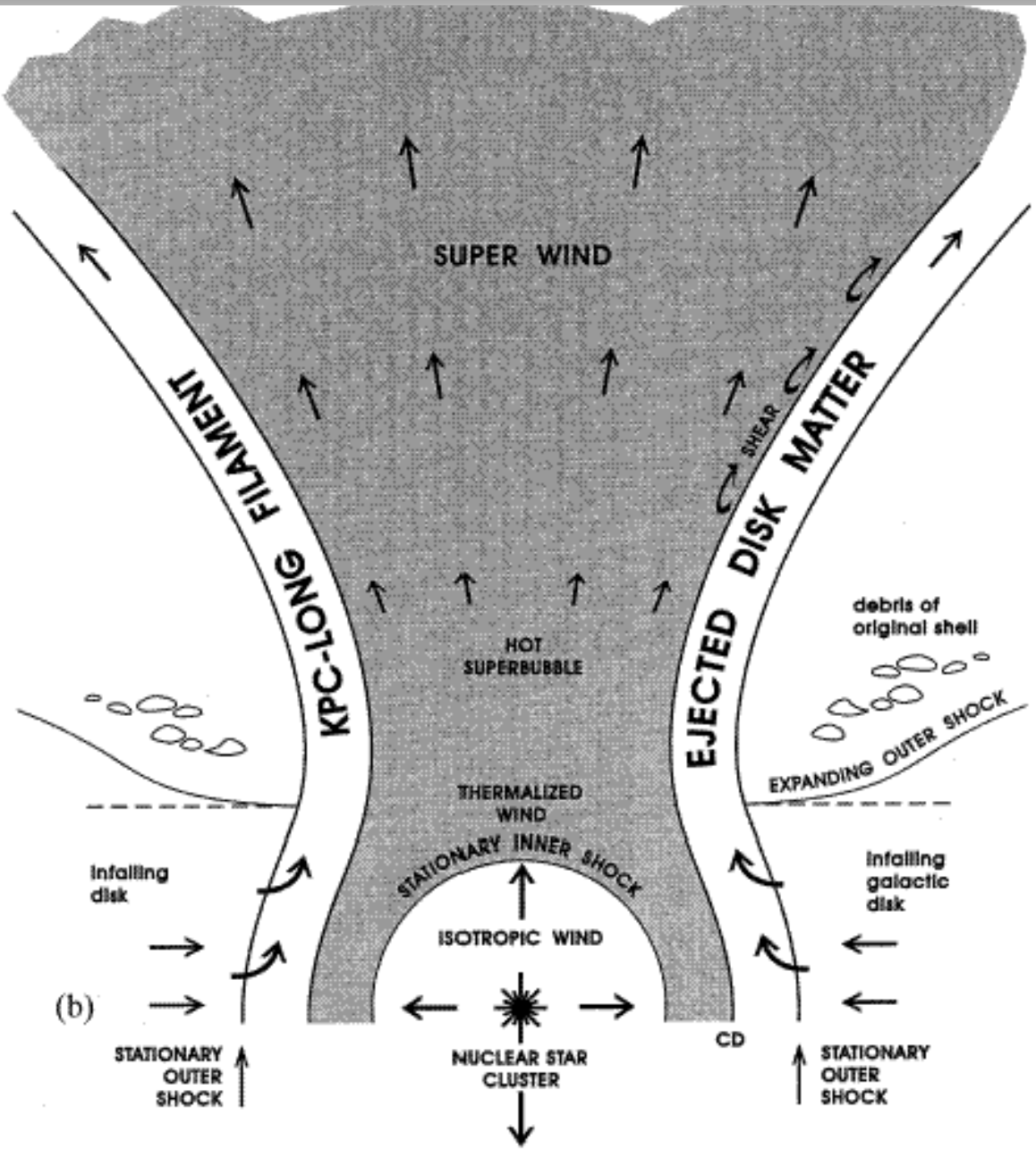
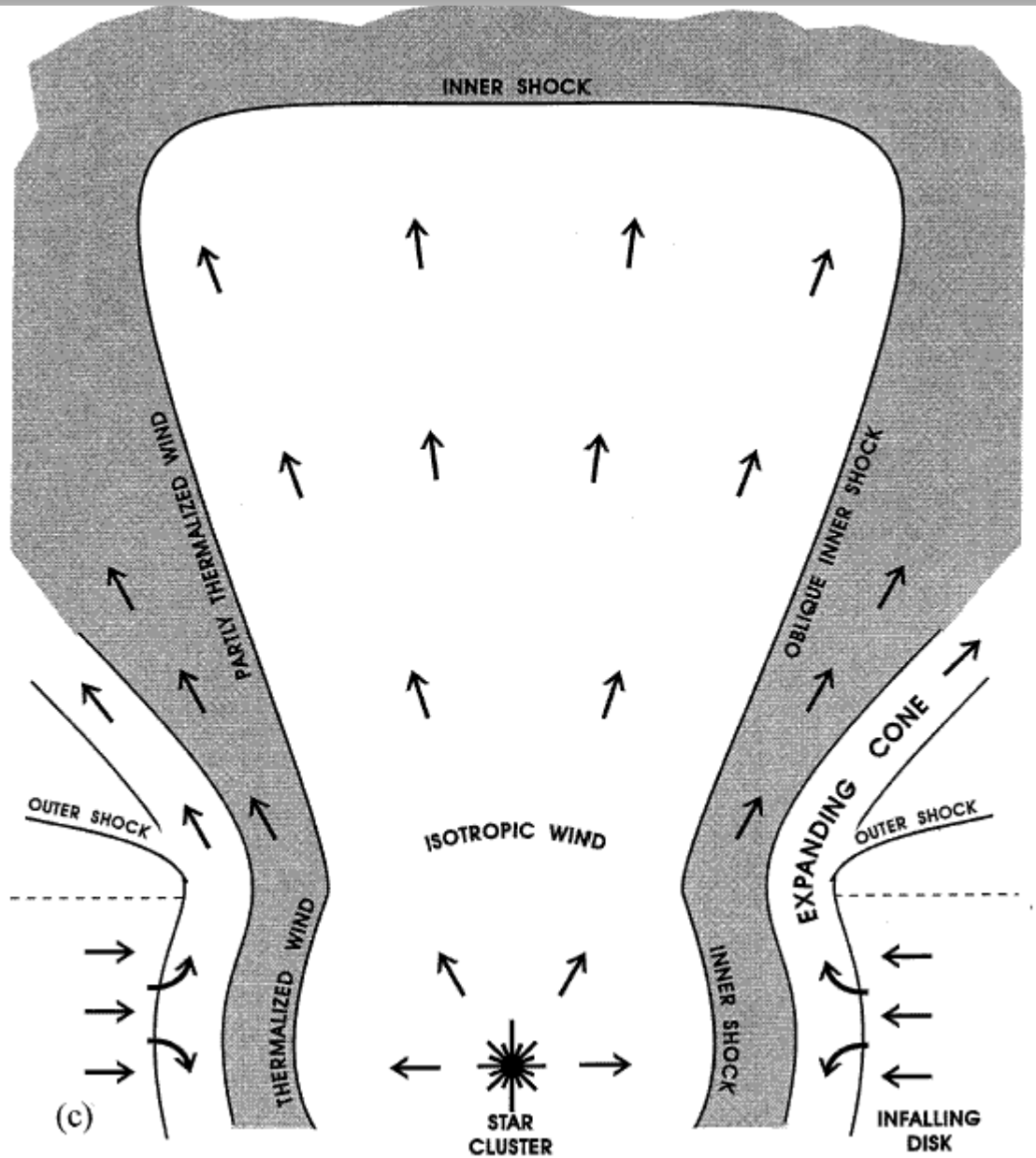


FIG. 11.—Same as in Fig. 5 but at 16.6 Myr / Suchkov et al. 1994 (ApJ 430)



GTT+CMT, ApJ,1997,MNRAS, 1998



$$\rho \approx R^{-2}$$

$$T \approx R^{-4/3}$$

$$P \approx R^{-10/3}$$

Free expanding wind (Chevalier & Clegg, 1995)

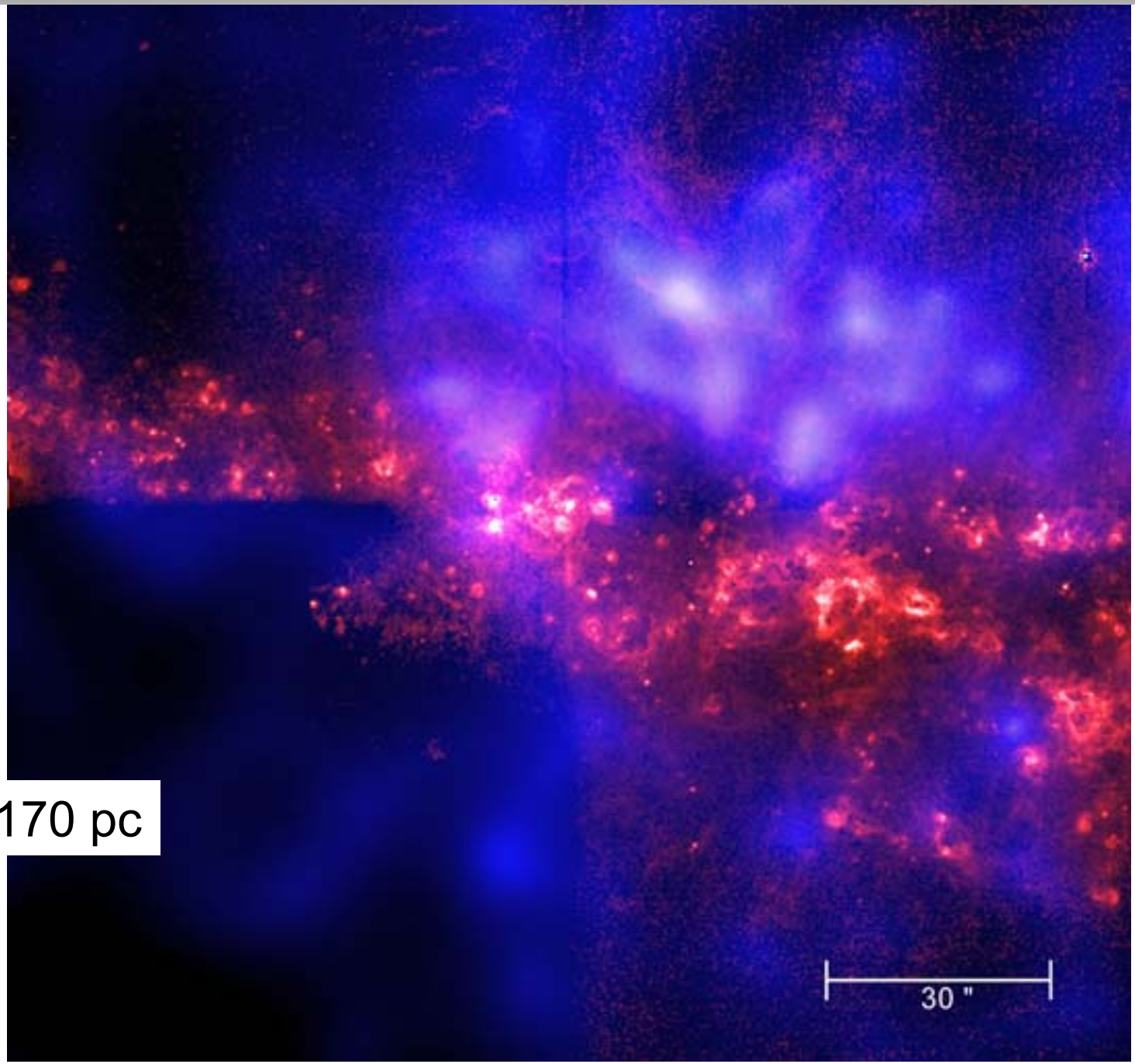
GTT+CMT, ApJ,1997,MNRAS, 1998

Chandra X-Ray Image of M82





Estallidos I. Madrid, 27-29 january 2003; C. Muñoz-Tuñón & V. Melo



30”=1170 pc

TAURUSII

- Fabry-Perot imaging spectrograph (R=10000-40000 for the 125 microns-500microns etalons).
- Was at the WHT (4.2m) at the ORM (unavailable since july 1999).
- TAUCAL for phase calibration.
- MATADOR for data annalysis

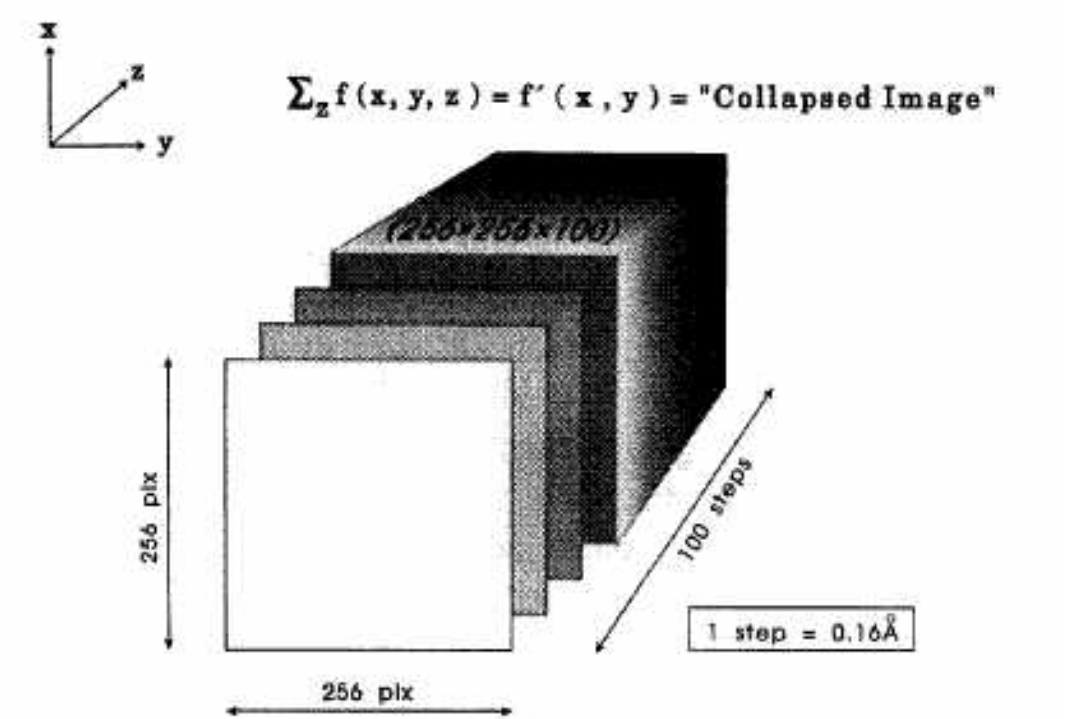
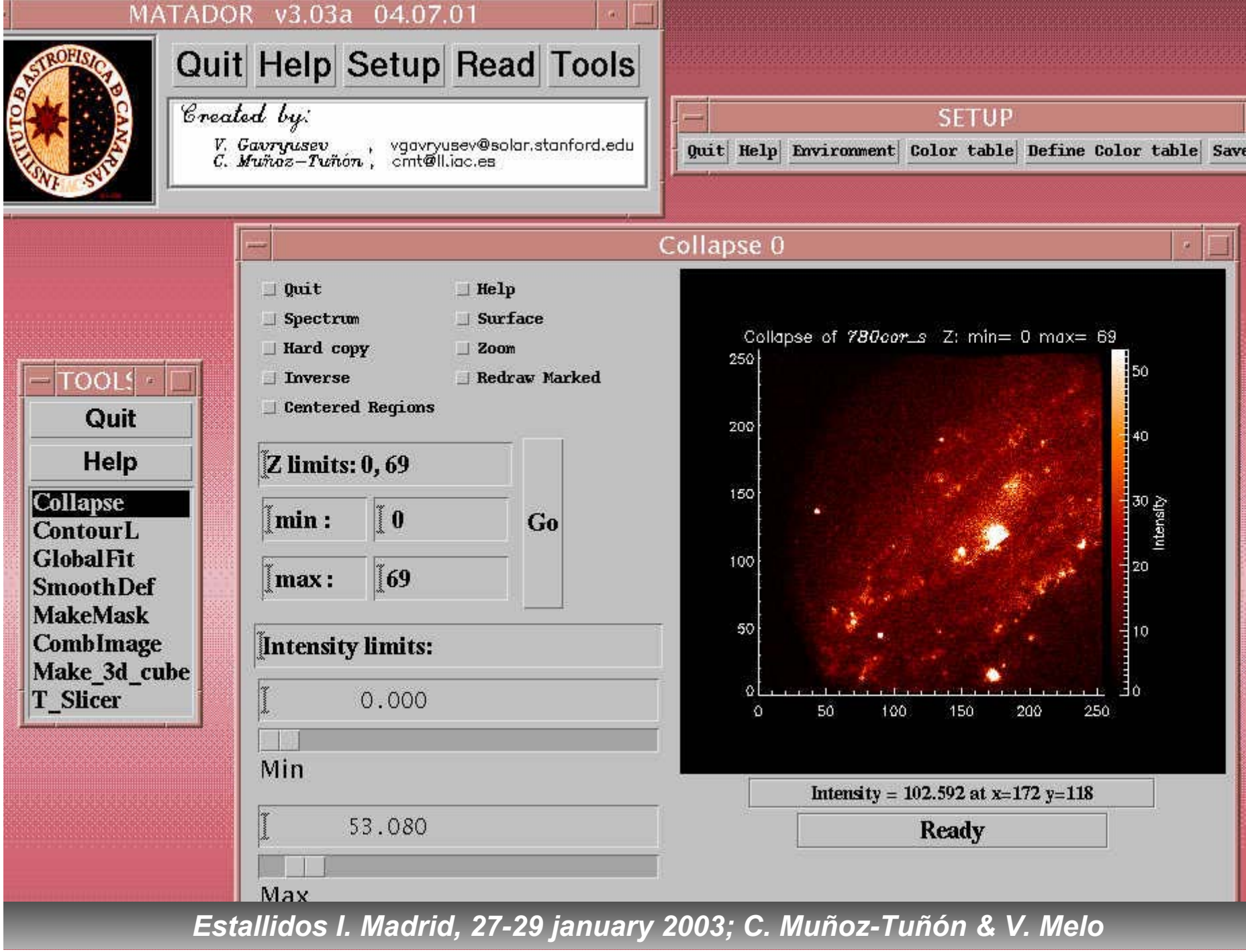
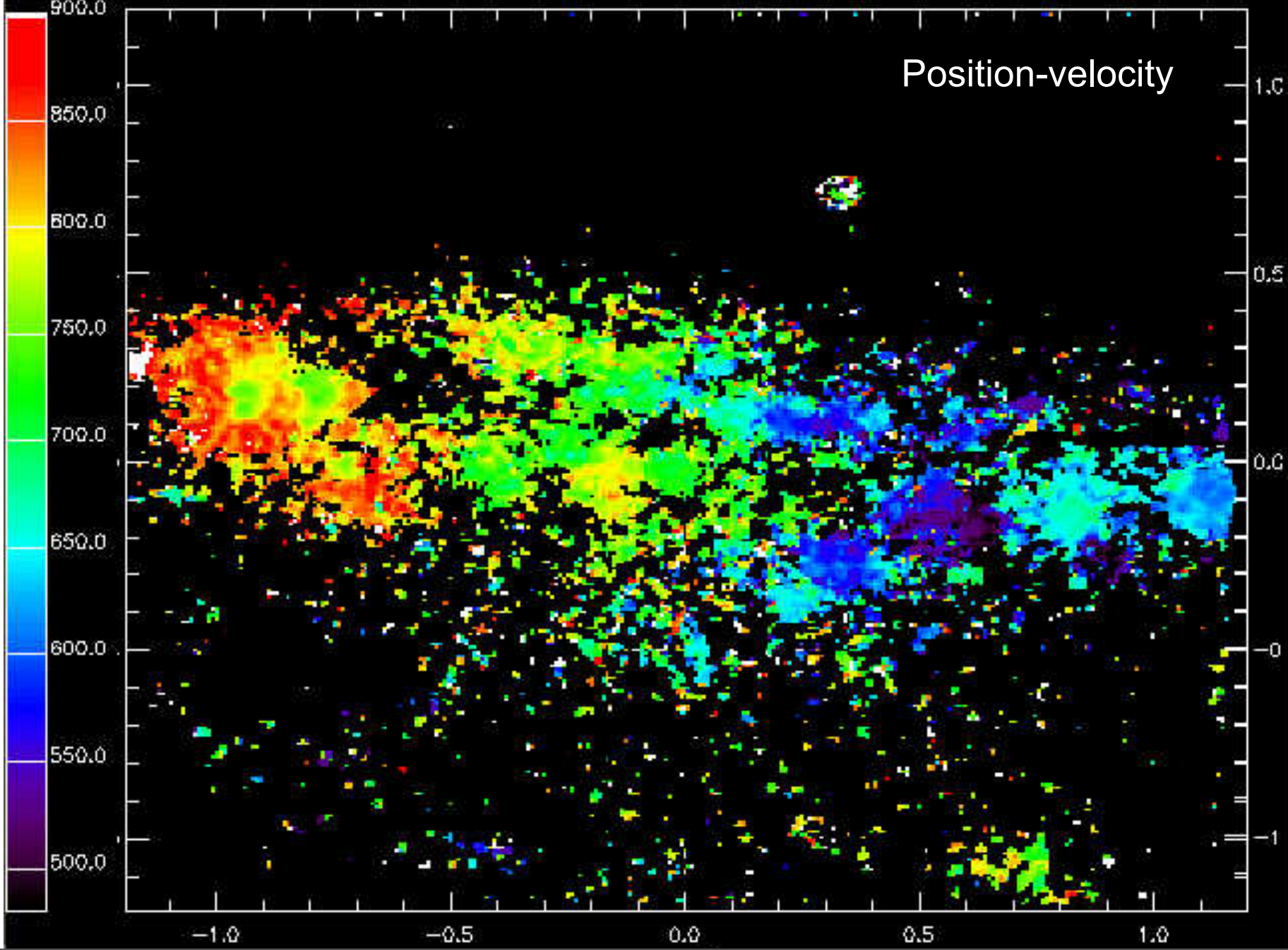
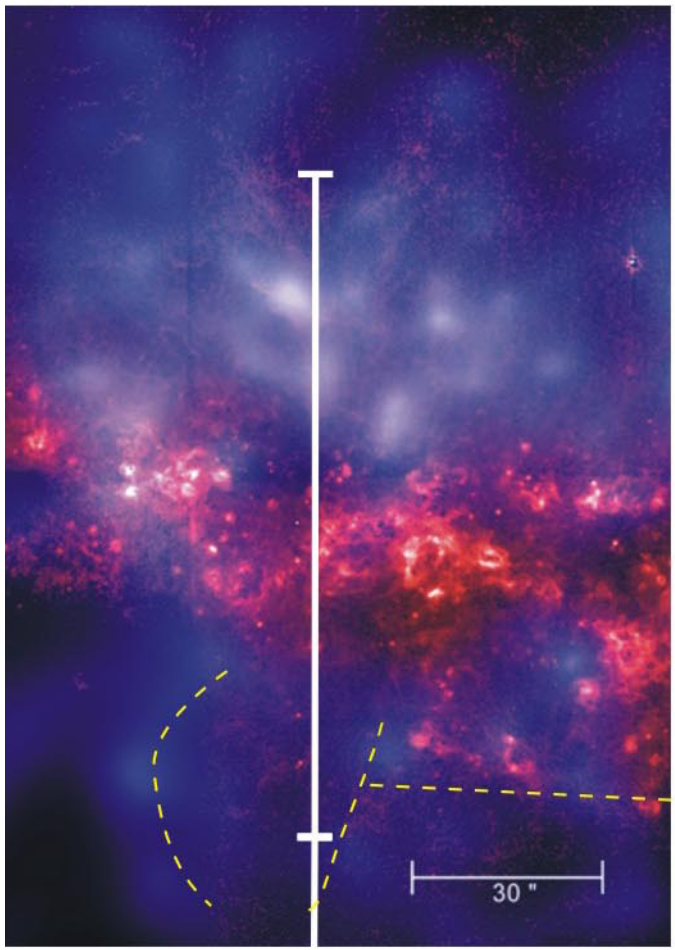


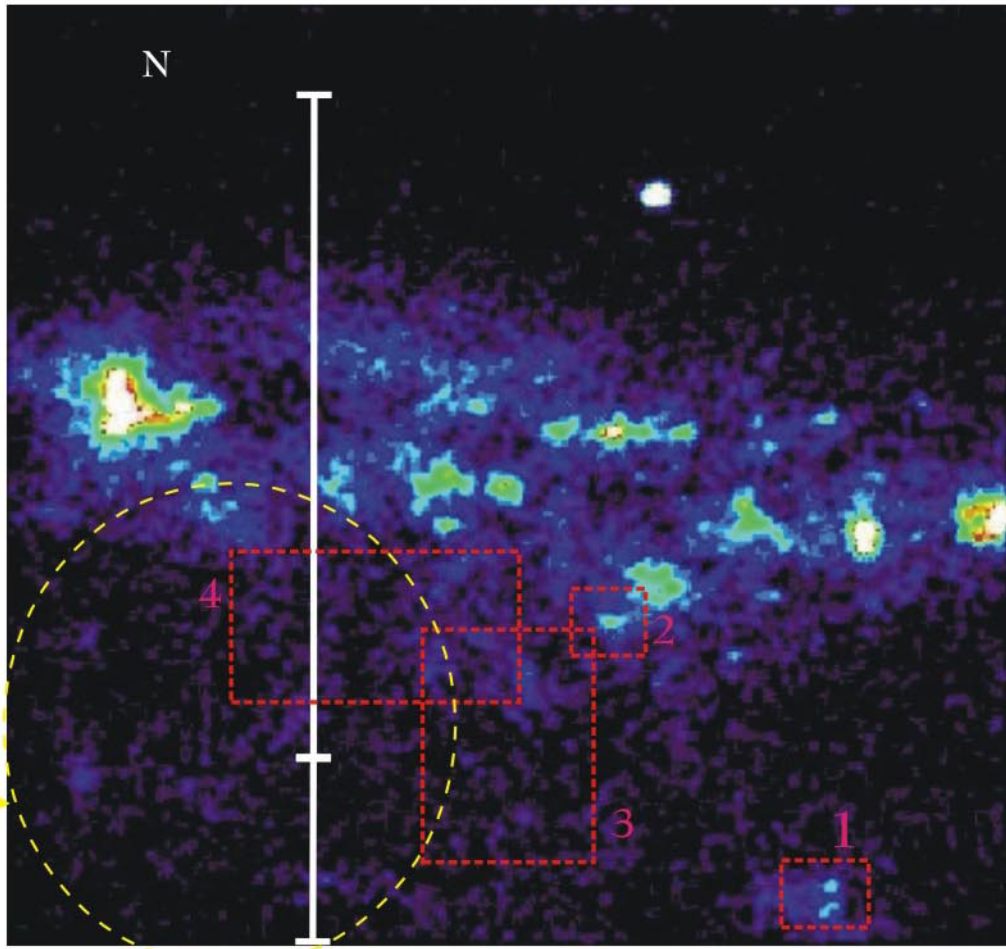
FIG. 1. Sketch of phase-corrected TAURUS II output file.

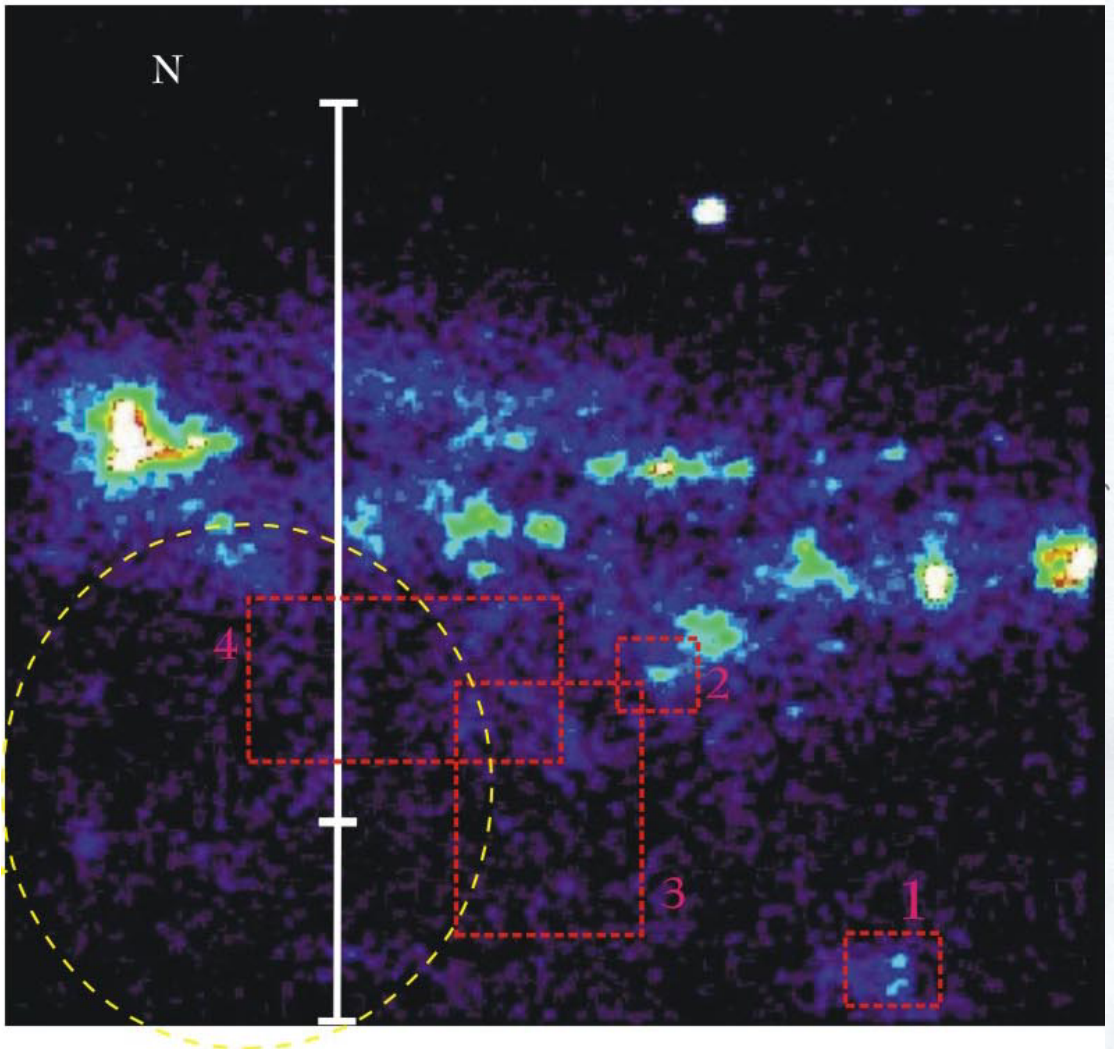

MATADOR v3.03a 04.07.01
Quit Help Setup Read Tools
Created by:
V. Gavryusev , vgavryusev@solar.stanford.edu
C. Muñoz-Tuñón , cmt@ll.iac.es
SETUP
Quit Help Environment Color table Define Color table Save
Collapse 0
Quit
Help
Spectrum
Surface
Hard copy
Zoom
Inverse
Redraw Marked
Centered Regions
Z limits: 0, 69
min : 0
max : 69
Go
Intensity limits:
0.000
Min
53.080
Max
TOOLS
Quit
Help
Collapse
ContourL
GlobalFit
SmoothDef
MakeMask
CombImage
Make_3d_cube
T_Slicer
Collapse of 780cor_s Z: min= 0 max= 69
Intensity
Intensity = 102.592 at x=172 y=118
Ready
Estallidos I. Madrid, 27-29 january 2003; C. Muñoz-Tuñón & V. Melo

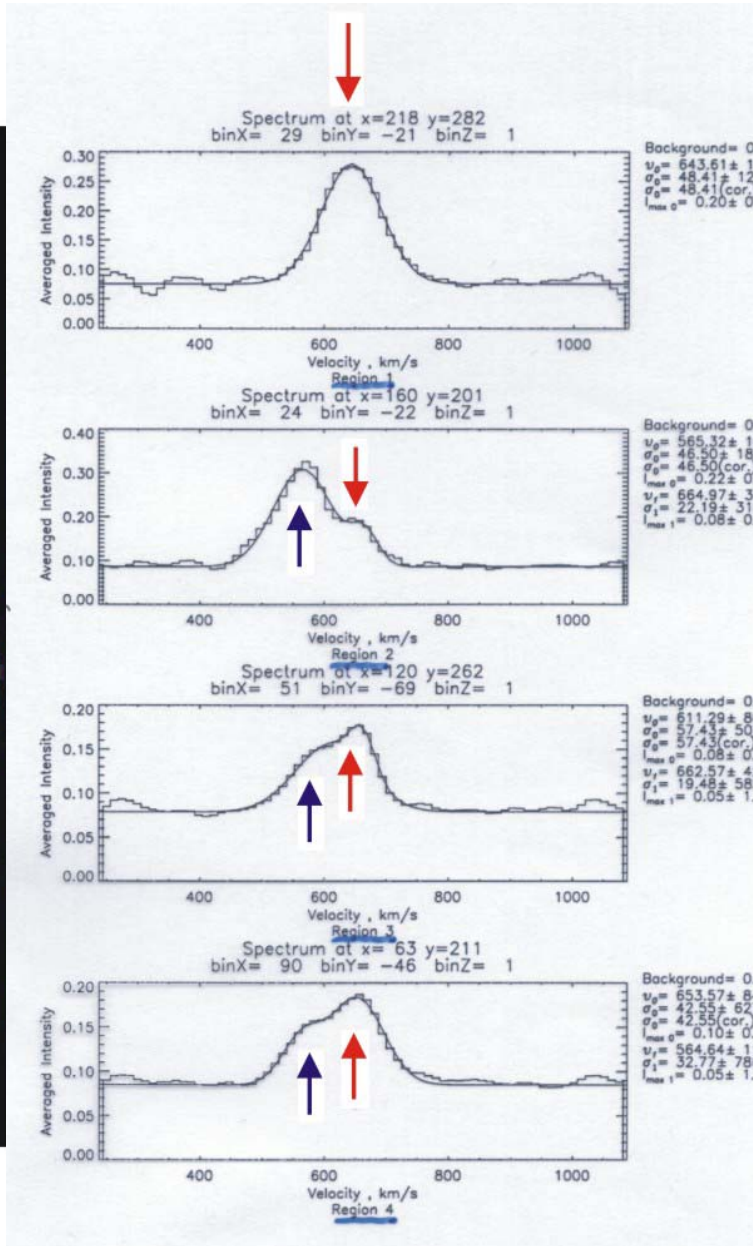


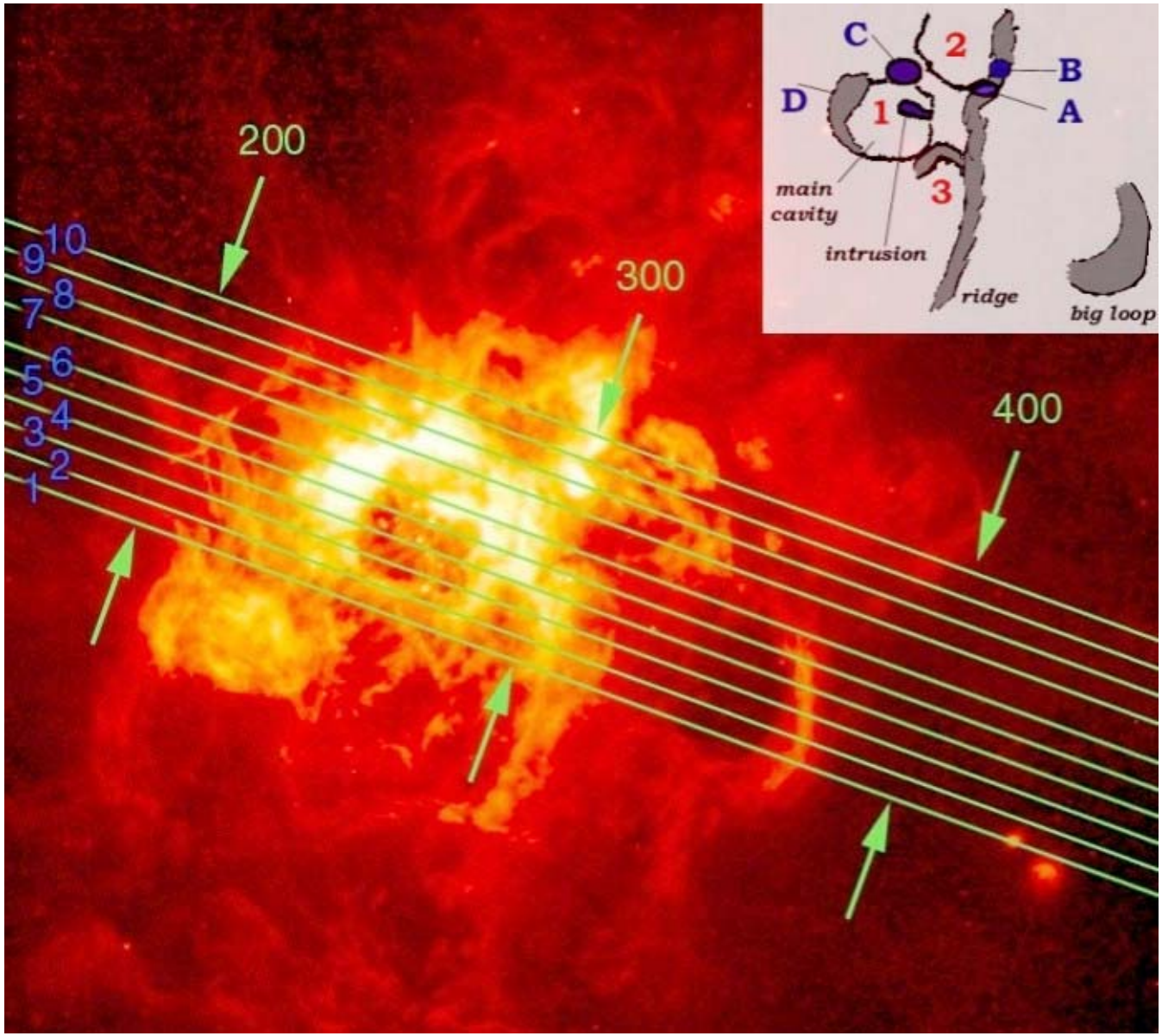
Estallidos I. Madrid, 27-29 january 2003; C. Muñoz-Tuñón & V. Melo

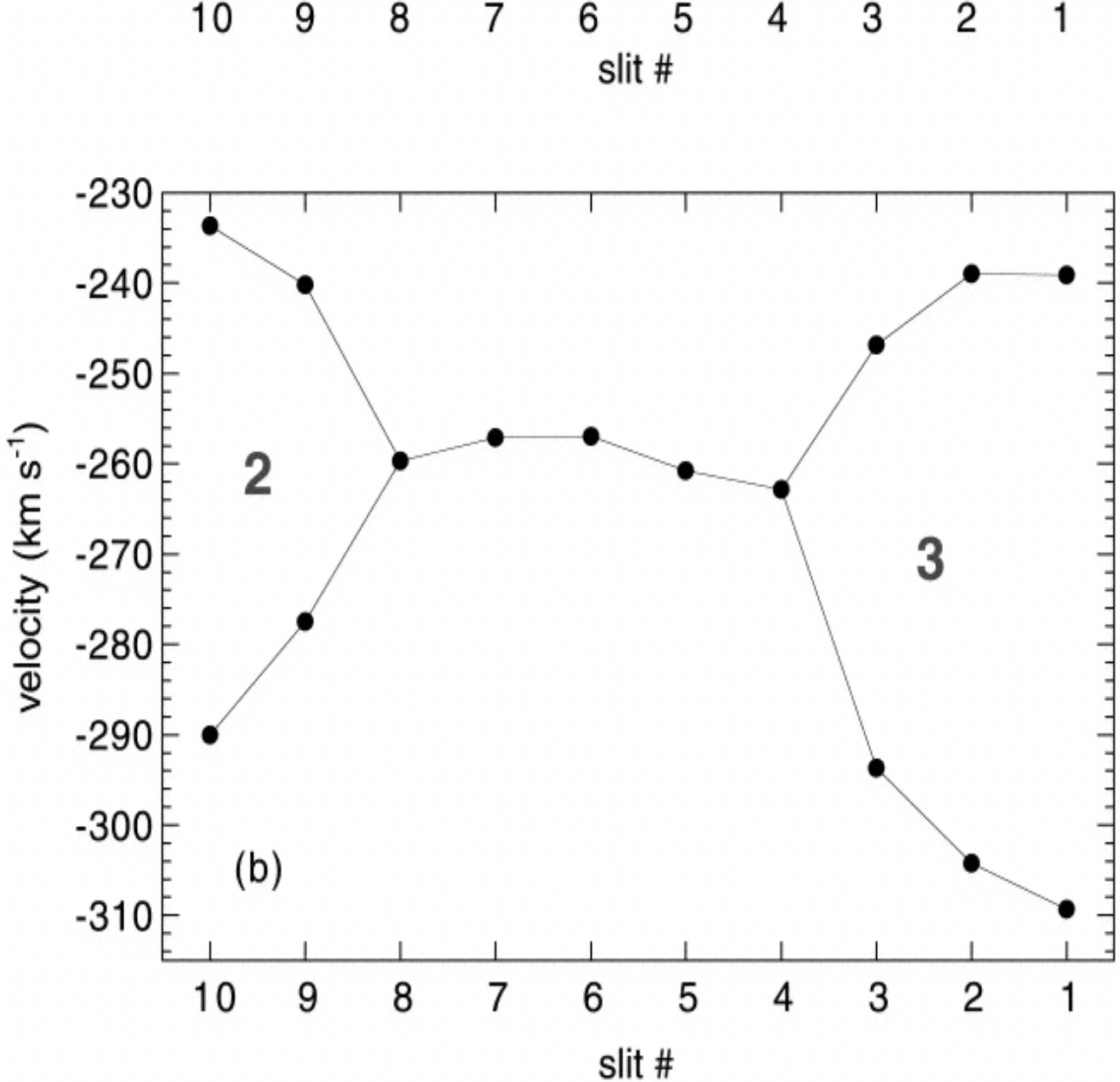

30 "

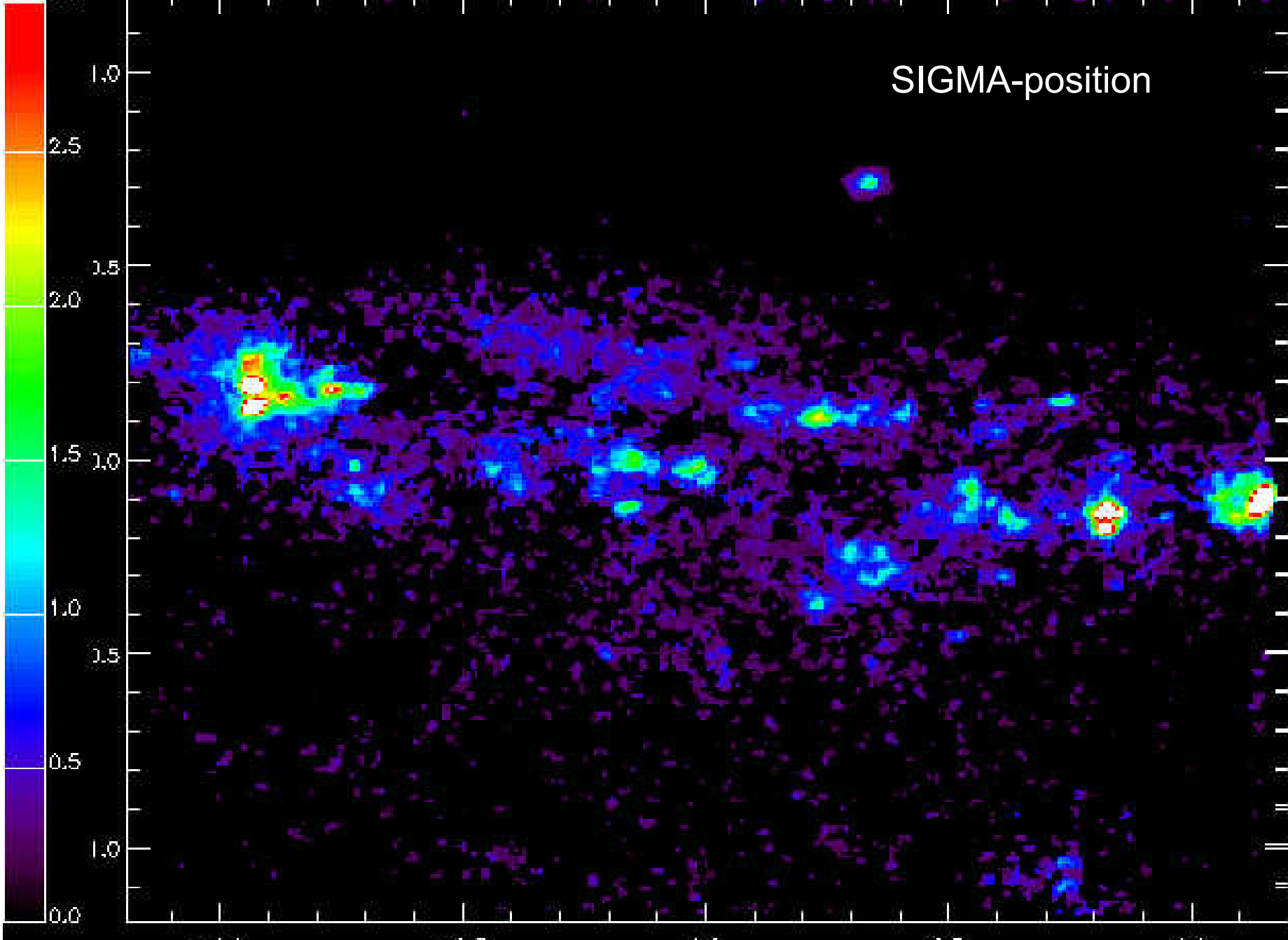

N
4
2
3
1


N
4
2
3
1

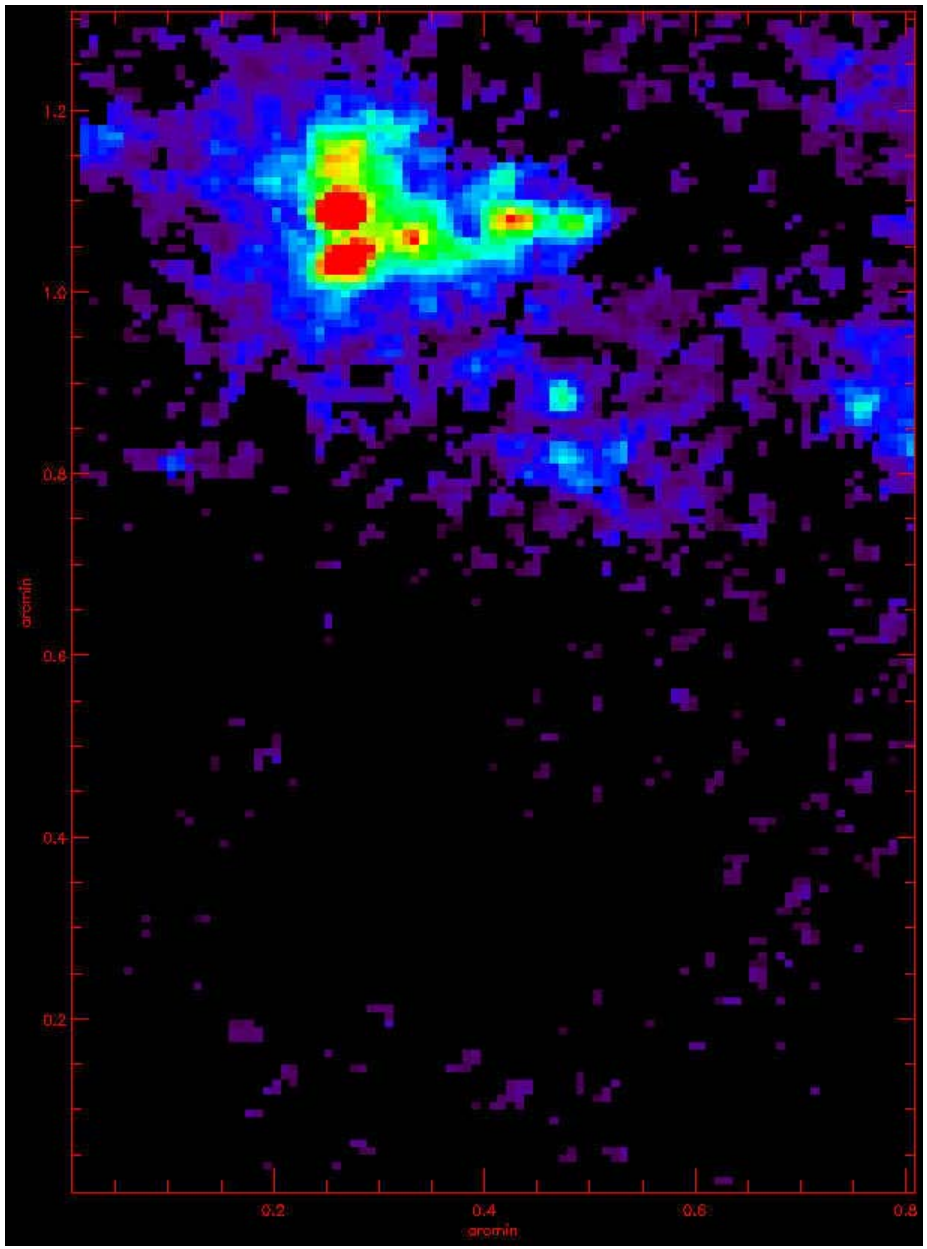

Spectrum at x=218 y=282
binX= 29 binY= -21 binZ= 1
Averaged Intensity
Velocity , km/s
Region 1
Spectrum at x=160 y=201
binX= 24 binY= -22 binZ= 1
Averaged Intensity
Velocity , km/s
Region 2
Spectrum at x=120 y=262
binX= 51 binY= -69 binZ= 1
Averaged Intensity
Velocity , km/s
Region 3
Spectrum at x= 63 y=211
binX= 90 binY= -46 binZ= 1
Averaged Intensity
Velocity , km/s
Region 4

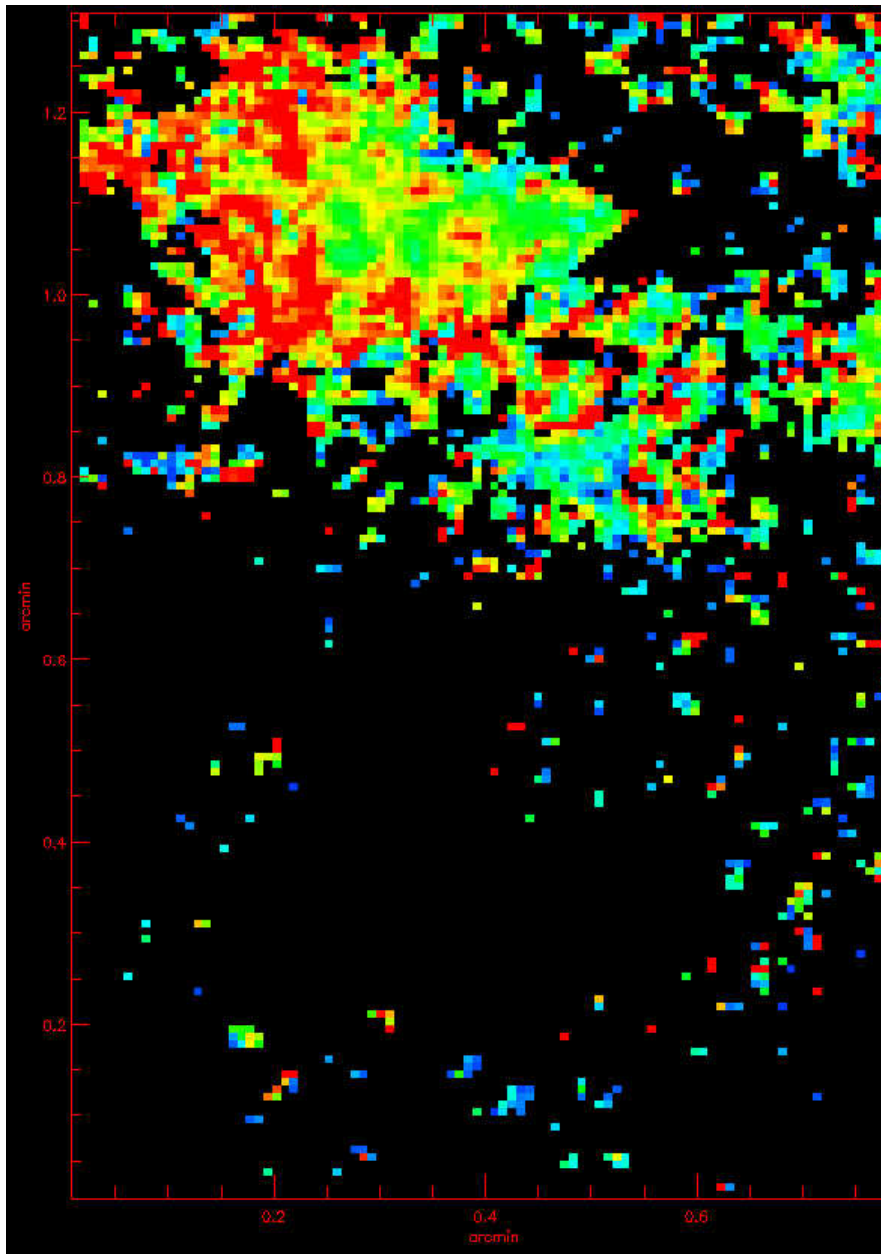

200
300
400
1
2
3
4
5
6
7
8
9
10
C
2
B
D
1
A
main
cavity
3
intrusion
ridge
big loop


10 9 8 7 6 5 4 3 2 1
slit #
-230
-240
-250
-260
-270
-280
-290
-300
-310
velocity (km s^{-1})
2
3
(b)
10 9 8 7 6 5 4 3 2 1
slit #



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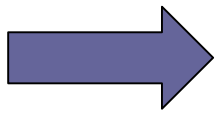


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- *We have the knots classified...select the brightest ones in the central zone S20+21 (#20 and #21 from Smith etal., 2001)...*
- *We measure R=1210 pc and v=85 km/s from the datacube.*

$$V_S(t) = 100\left(\frac{E}{n}\right)^{\frac{1}{5}} t^{-\frac{2}{5}}$$

$$R_S(t) = 1.6\left(\frac{E}{n}\right)^{\frac{1}{5}} t^{\frac{3}{5}}$$

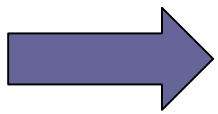


$E_{wind} = 7.02 \times 10^{40}$ erg/s

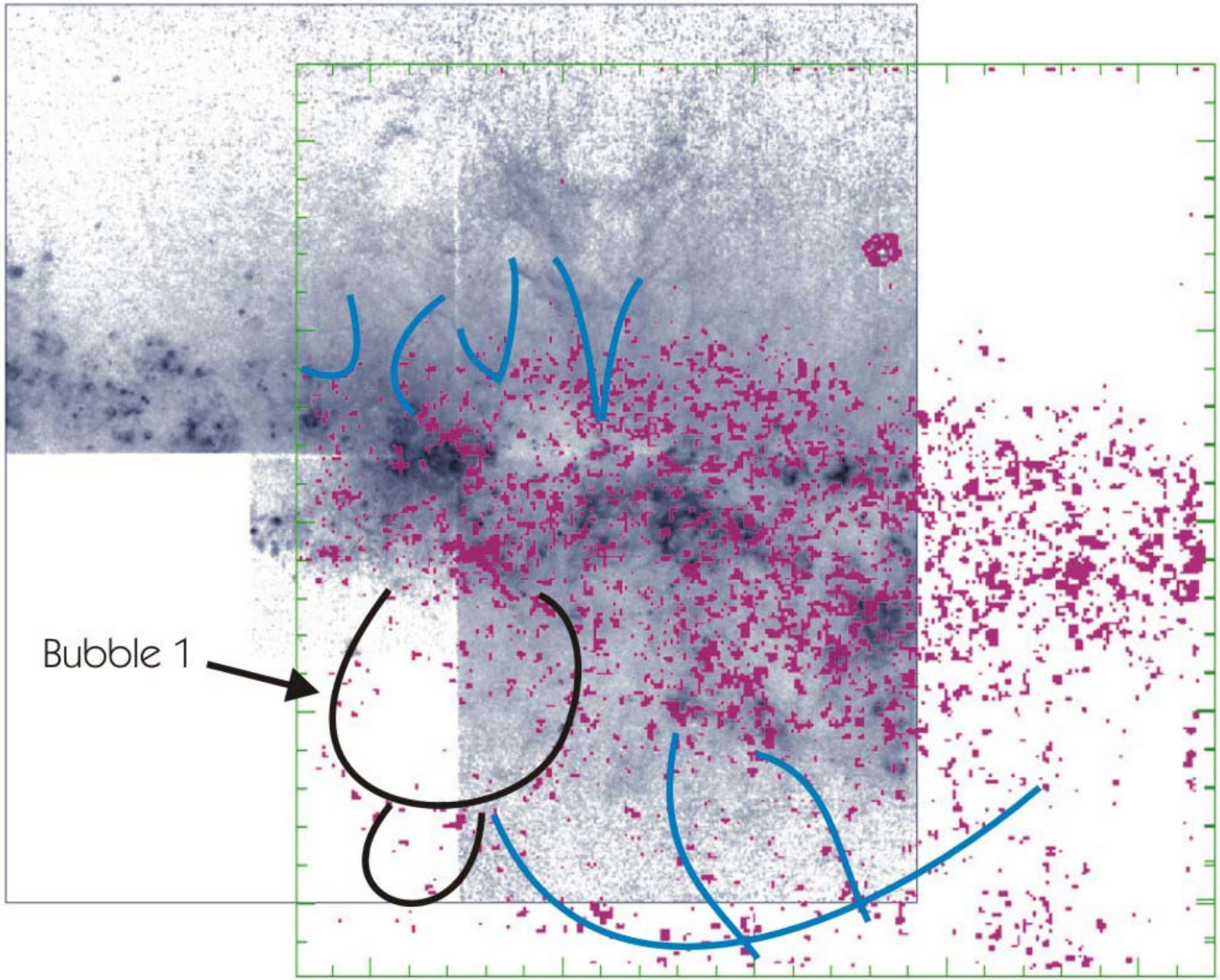
EW

H_α luminosity

models



$E_{wind} = 6.11 \times 10^{40}$ erg/s


Bubble 1

“M82 the last SGW in the nearby universe???”

Casiana Muñoz-Tuñón & Veronica Melo

Not all cases (starburts) will undergo a SGW

Starburst luminosity

The underlying Galaxy

The starburts “pigeon hole”

The environment (interactions)

Gas inflows (triggering) vs “espontaneous” star formation.



Ingredients???

Important implications (star formation at low z):

IGM enrichment (e.g. IZW18, “the case” all metals gone??)

Star formation feedback

DIG FEBEL, The aparence of Galaxies.

Parameters used in models (z greater than 1)

Looking for more cases...at low z

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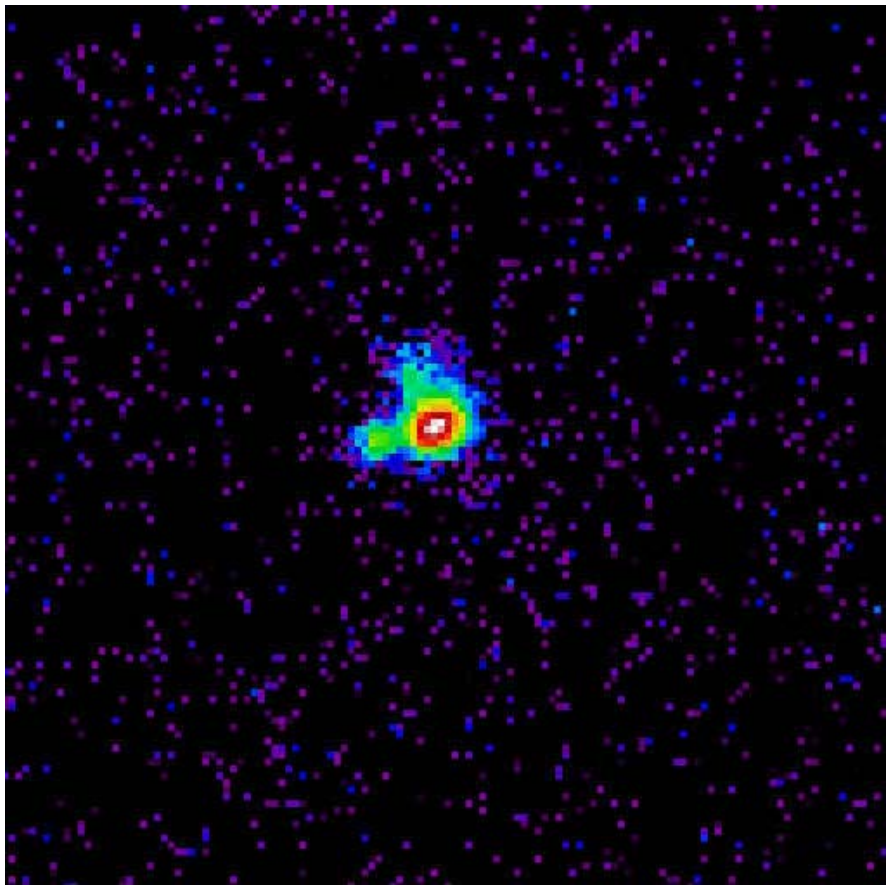
Financiado por el Gobierno de Canarias



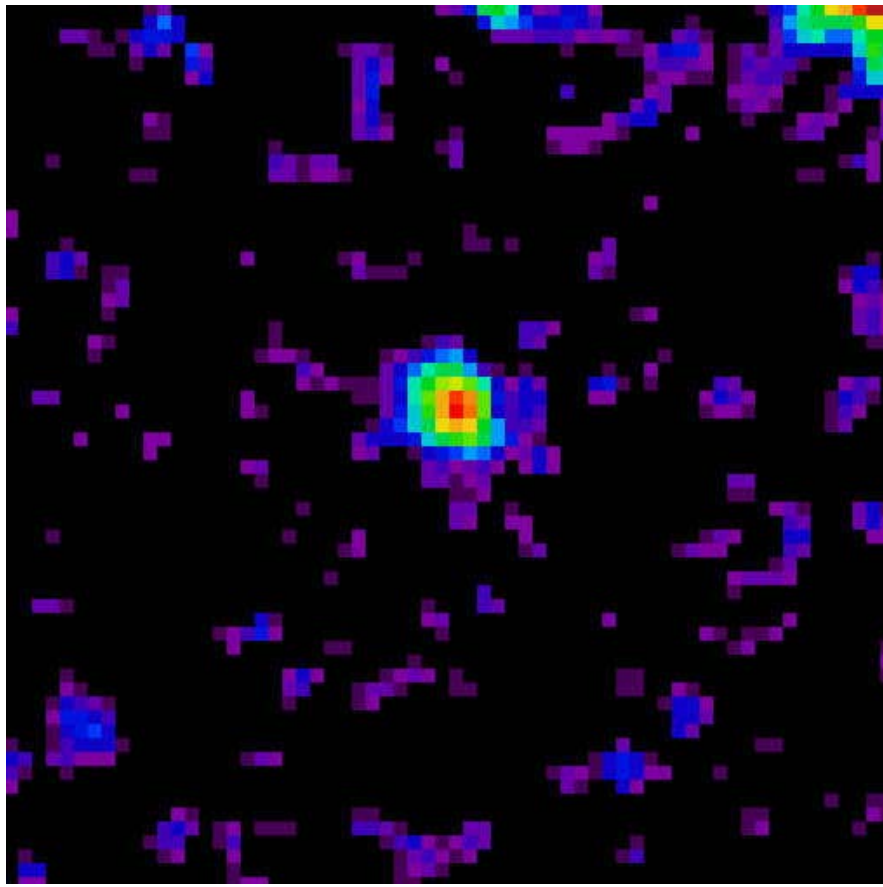
Atlas de Galaxias con Formación Estelar Observadas desde Canarias

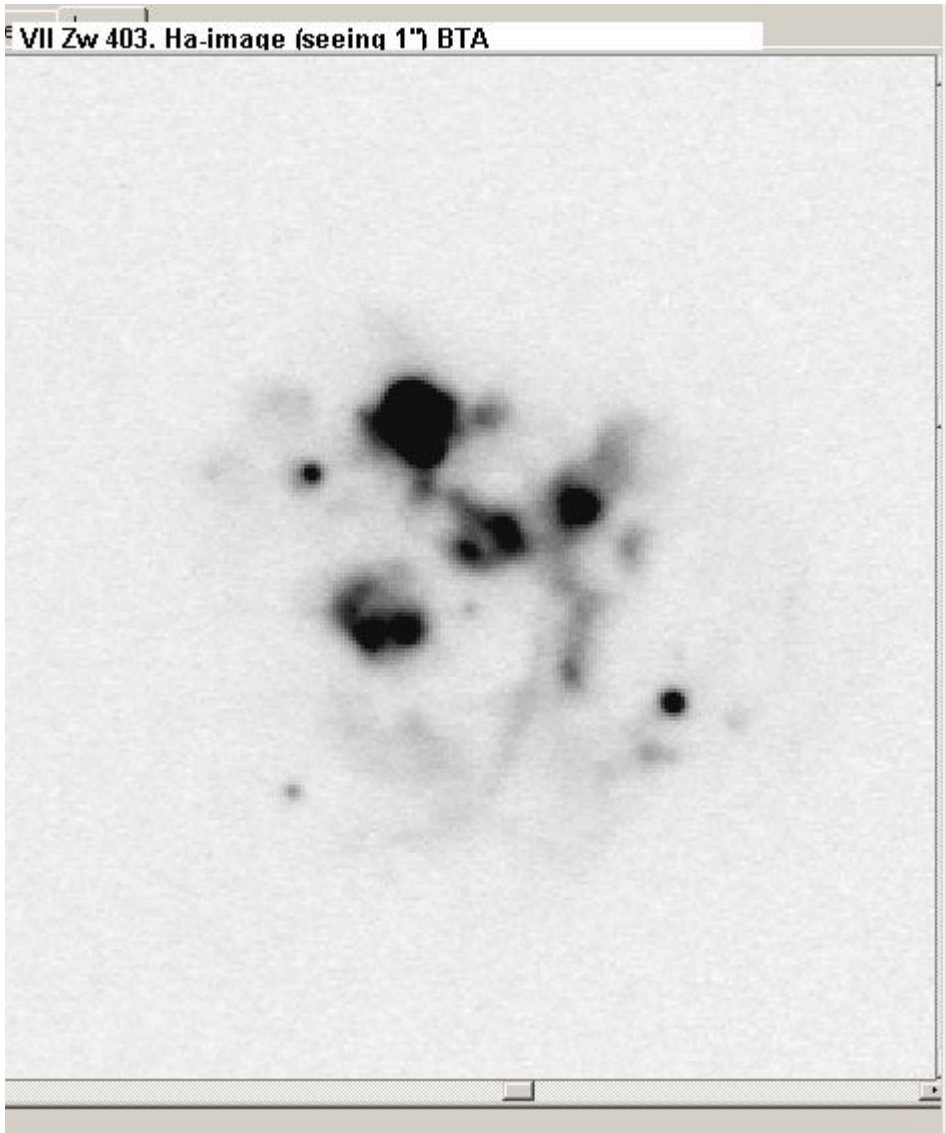
Investigador Principal: Ana M. Pérez García (IAC)
Co-investigadores: Jose A. Acosta Pulido (IAC) - M. Begoña García-Lorenzo (ING) - Verónica Melo (IAC) M. Antonia Varela (IAC) - Jonay Isaí González Hernández
Investigadores Senior asociados al proyecto: Casiana Muñoz Tuñón - Jose Miguel Rodríguez Espinosa

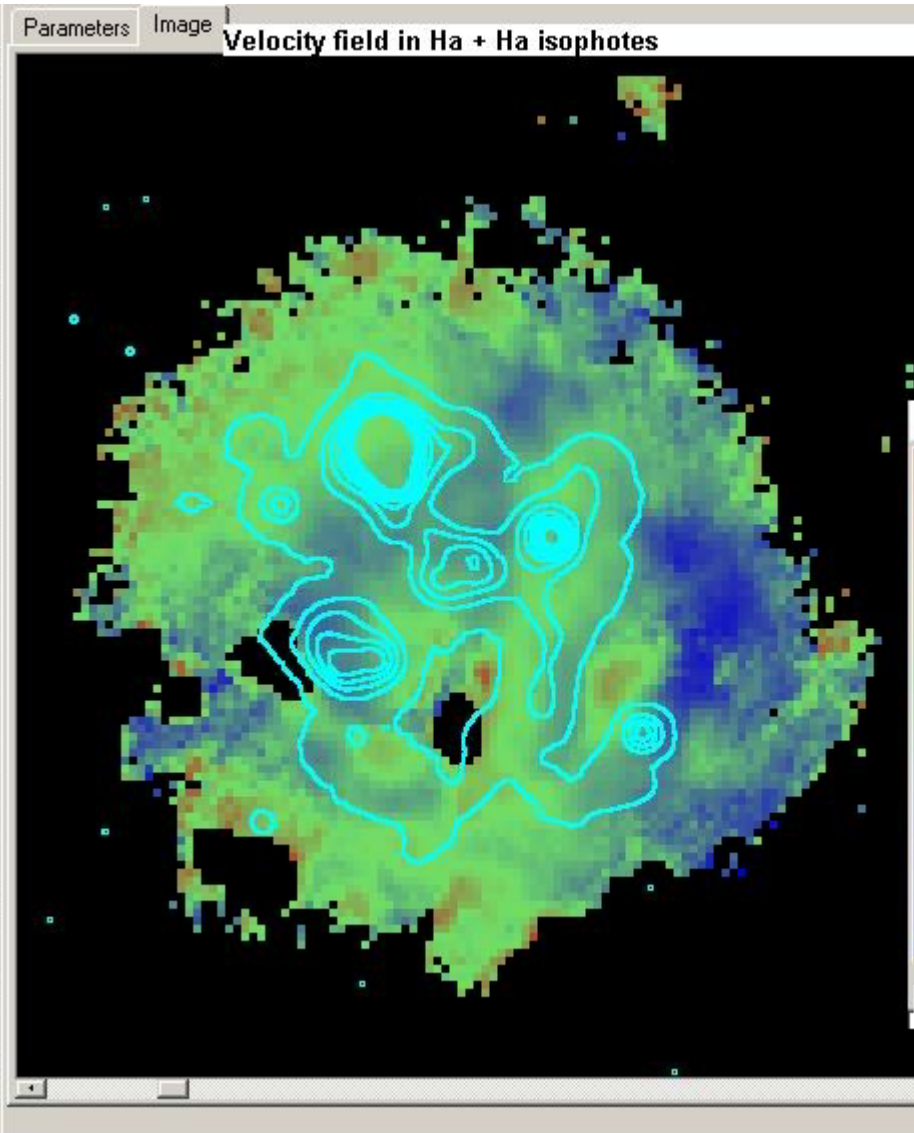
H_alpha (JKT)

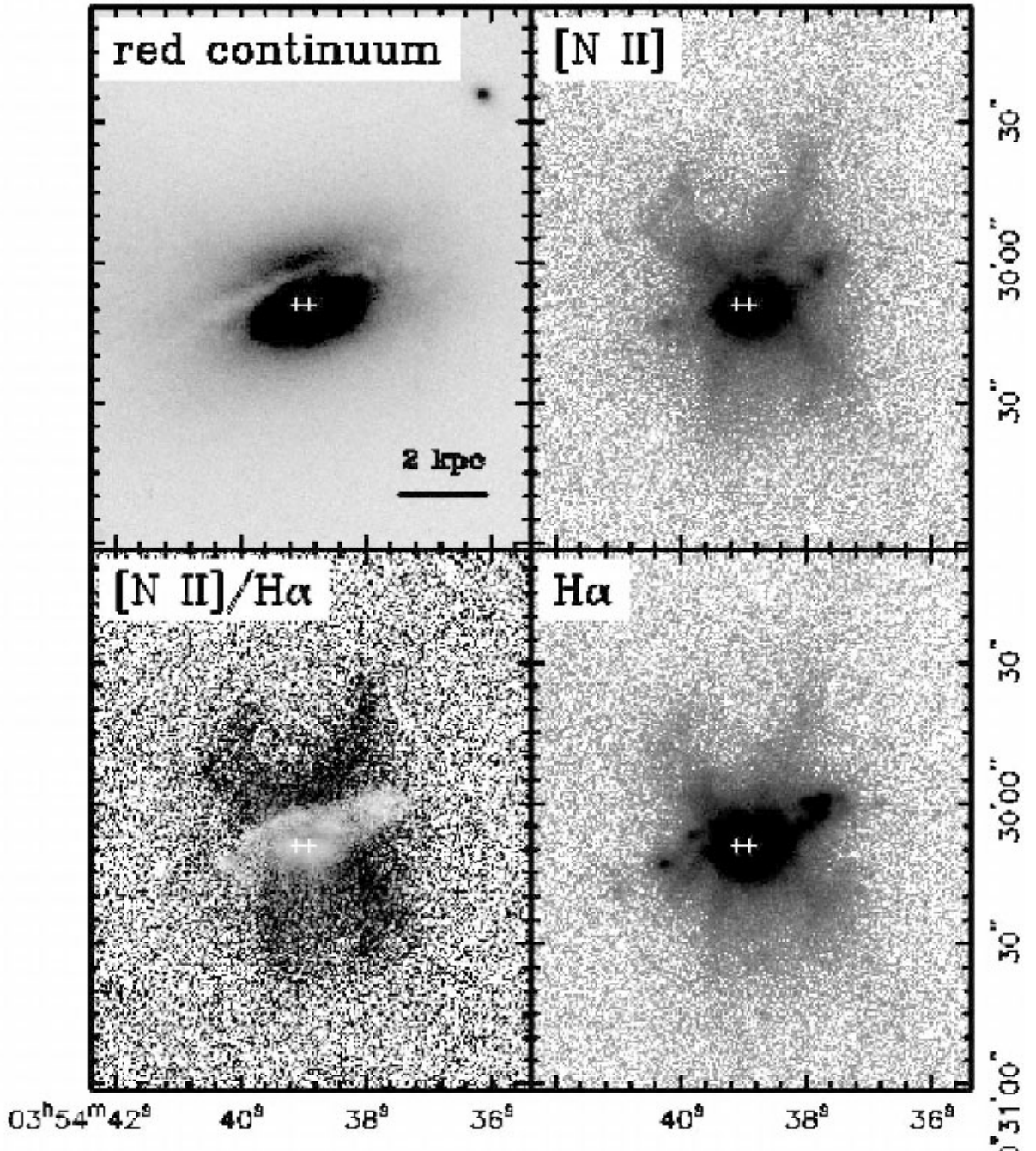


Filtro H (2MASS)




VII Zw 403. Ha-image (seeing 1") BTA


Parameters
Image
Velocity field in Ha + Ha isophotes


red continuum
[N II]
2 kpc
[N II]/Hα
Hα
03h54m42s
40s
38s
36s
40s
38s
36s
30"
30'00"
30"
30"
30'00"
30"
31'00"

- Look for SGW in BCDs
- Kinematics (Fabry-Perot) studies
- Get the most from the known case (M82)
- Look for SGWs in big galaxies (other environments)
- More ingredients for the models...new models

Guillermo T-T, Veronica Melo, Luzma, Sergey Silich, Pepe Vilchez, Jorge Iglesias, Ismael MD, Jose Miguel RE, Begoña GL, Ana Pérez, Jose Acosta, Denise Gonzalves, Nicola Caon, ...et future etal..