COMPUTADOR PARA ALTO DESEMPENHO EM ASTRONOMIA

Angelo Fausti Neto,

Horacio Dottori, Marcio Ramos de Oliveira, Irapuan Rodrigues, IF-UFRGS

O CPADA foi adquirido em 2002 com recursos do Instituto do Milênio.

Sao apresentados alguns trabalhos realizados nesse computador, com o objetivo de divulgar e trocar experiências com outros grupos que realizam projetos semelhantes.

O CPADA tem atendido ~15 usuários da Astronomia e Física da UFRGS e da UFSC.

PhD de Leandro Kerber e MsC de Angelo Fausti Neto.

ANATOMY OF ACTIVE NUCLEI OF GALAXIES

THE Sy2 NGC 1241: THE INNERMOST SPIRAL STRUCTURE. C-STARS IN THE NUCLEAR REGION?

M83: The double nucleus, cirpass kinematics

Dottori, H[(1)],

Diaz, R[(2)], Carranza, G[(2),] Villamizar, N[(1,3)] Lipari, S [(2)].

(1) I. de Física, UFRGS, Brasil, (2) O. Astronómico, UNC, Argentina,

(3)INAOE, Mexico.

10^6 pc – 10^{10} años

FLUJOS RADIALES INDUCIDOS POR EL AMBIENTE METAGALÁCTICO

10^5 pc – 10^9 años (Fuentes externas)

Escenario similar al de Díaz et al. (2000)

↓

INESTABILIDADES GRAVITACIONALES INTERNAS EN DISCOS GALÁCTICOS

$10^{3\text{-}4}$ pc – 10^8 años (Fuentes internas)

↓

PERTURBACIONES A ESCALAS CIRCUMNUCLEARES

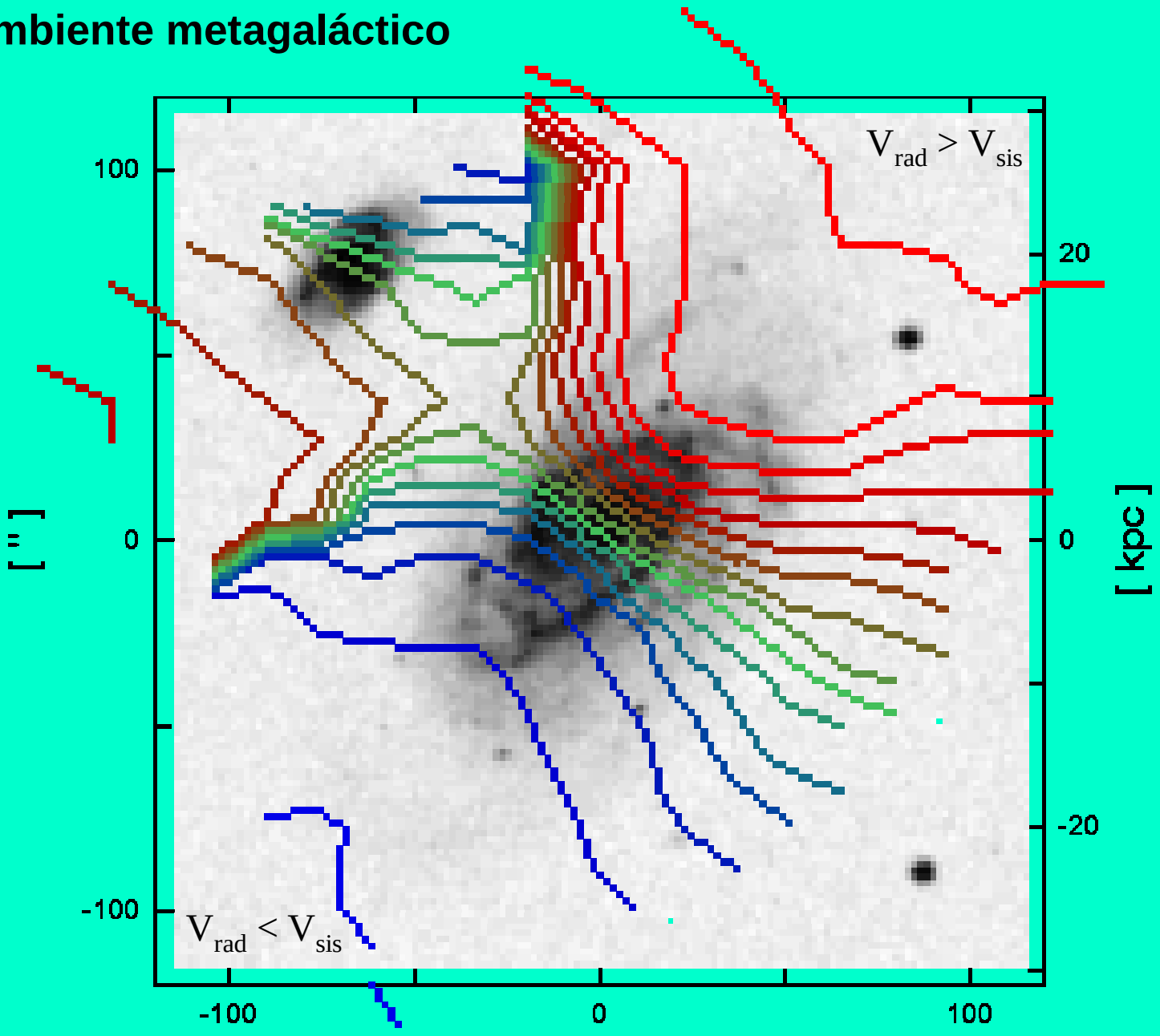
$10^{2\text{-}3}$ pc – $10^{7\text{-}8}$ años (Fuentes circumnucleares)

↓

ALIMENTACIÓN DIRECTA DEL OBJETO CENTRAL

$10^{0\text{-}2}$ pc – $10^{6\text{-}7}$ años (Fuentes locales)

NGC 1241: Ambiente metagaláctico



Campo de velocidades radiales de HI.
Digitalizado a partir de los datos de Nordgren et al. (1997)

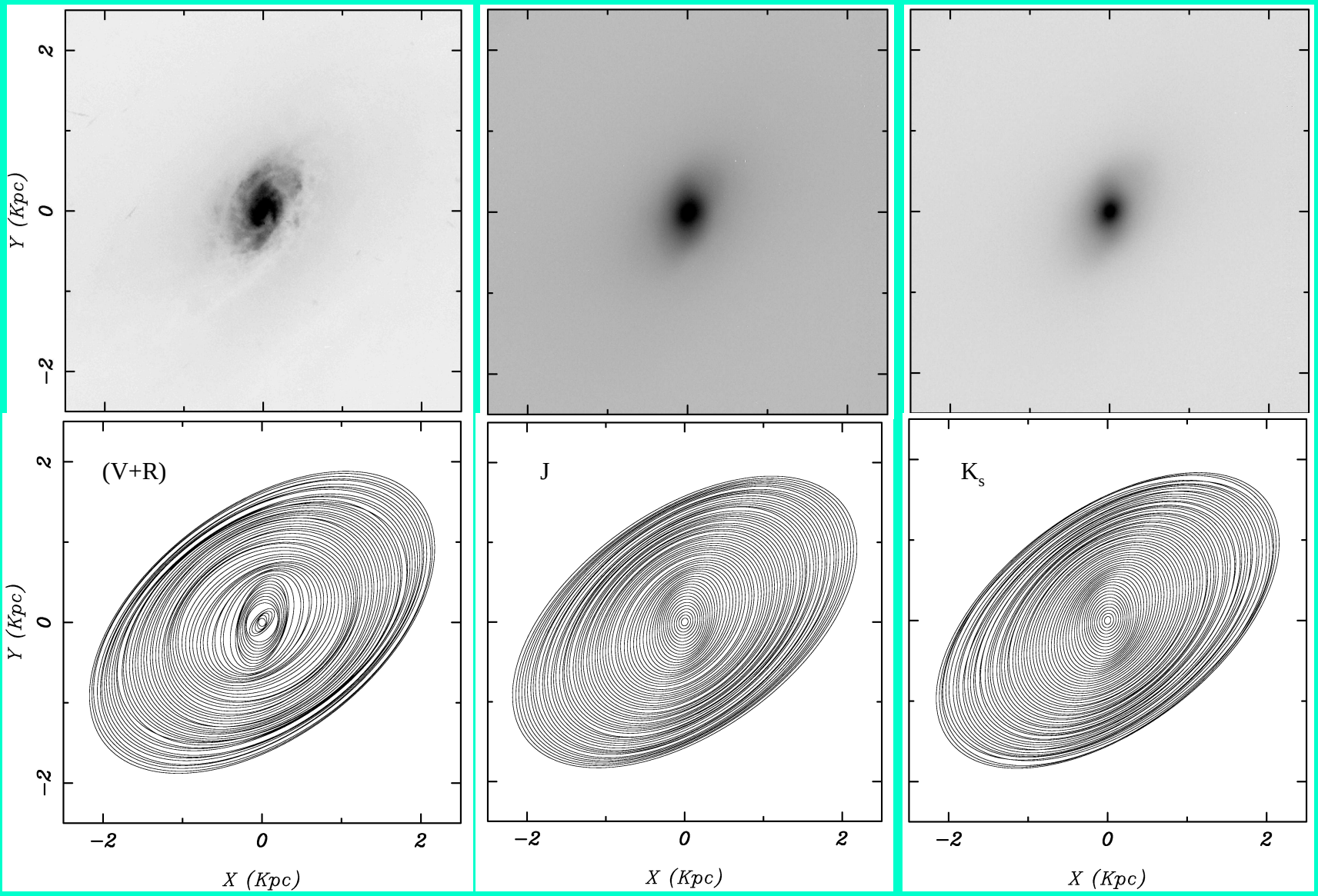
Observations

- GEMINI N + AO System Hokupa'a, J-band (0.4 arcsec) and K-band (0.3 arcsec).
- HST, NIC3 (0.2 arcsec), P_{α} with filter tunned to the galaxy redshift and WFPC2, (V+R) (0.1 arcsec).
- Córdoba 1,54 mts reflector, optical-spectroscopy with MIFiS in long slit mode. Seeing = 1.5" and instrumental width of night sky lines = 90km/sec.

CCD Imagery

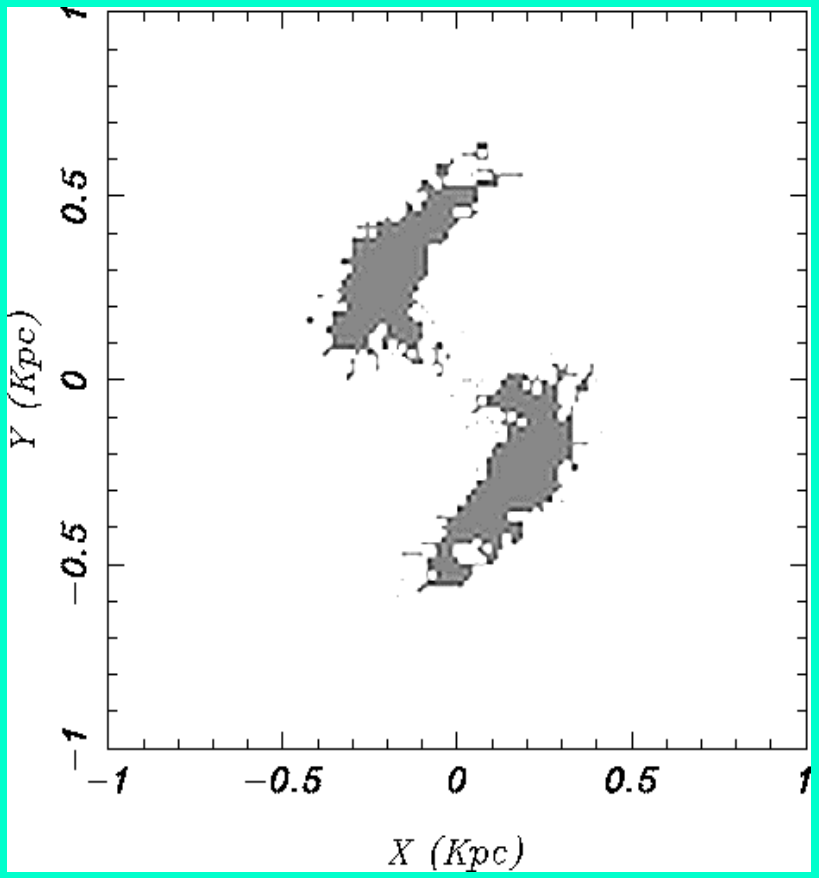
- Circumnuclear spiral structures are very weak features (contrast arm-disk ~ 0.1 m (Englmaier & Shlosman 2000).
- We used IRAF ellipse program to enhance these features.
- 2-D and 1-D azimuthal Fourier Transforms (Puerari & Dottori 1996, Villamizar et al. 2001) are used to:

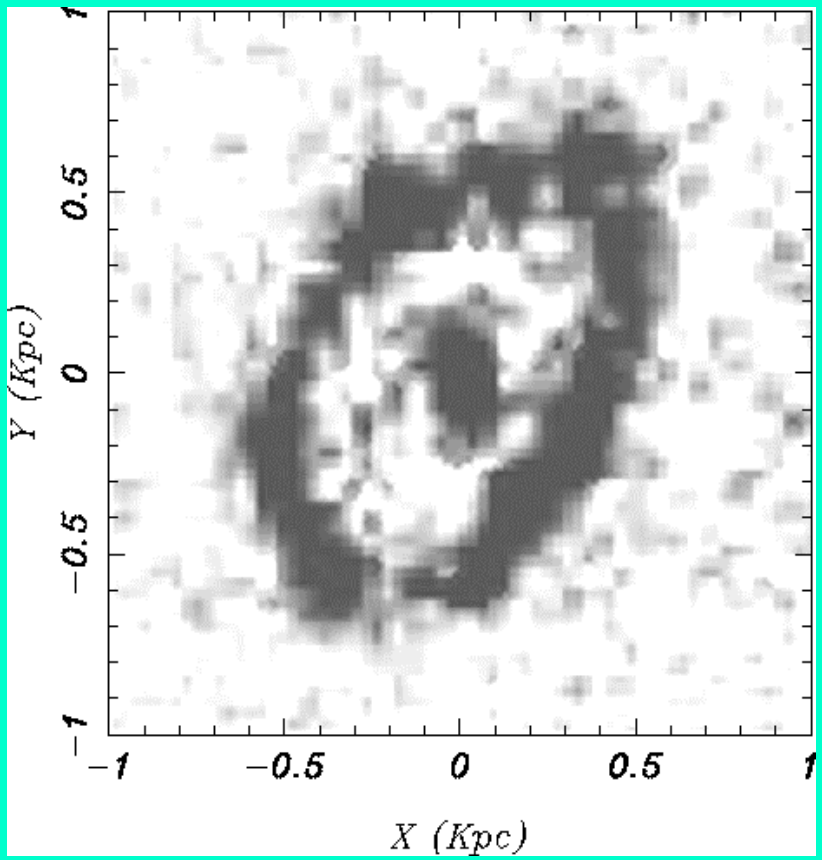
- a) Characterize the arms structure.
- b) To check phase differences between different colors in order to search for resonances.



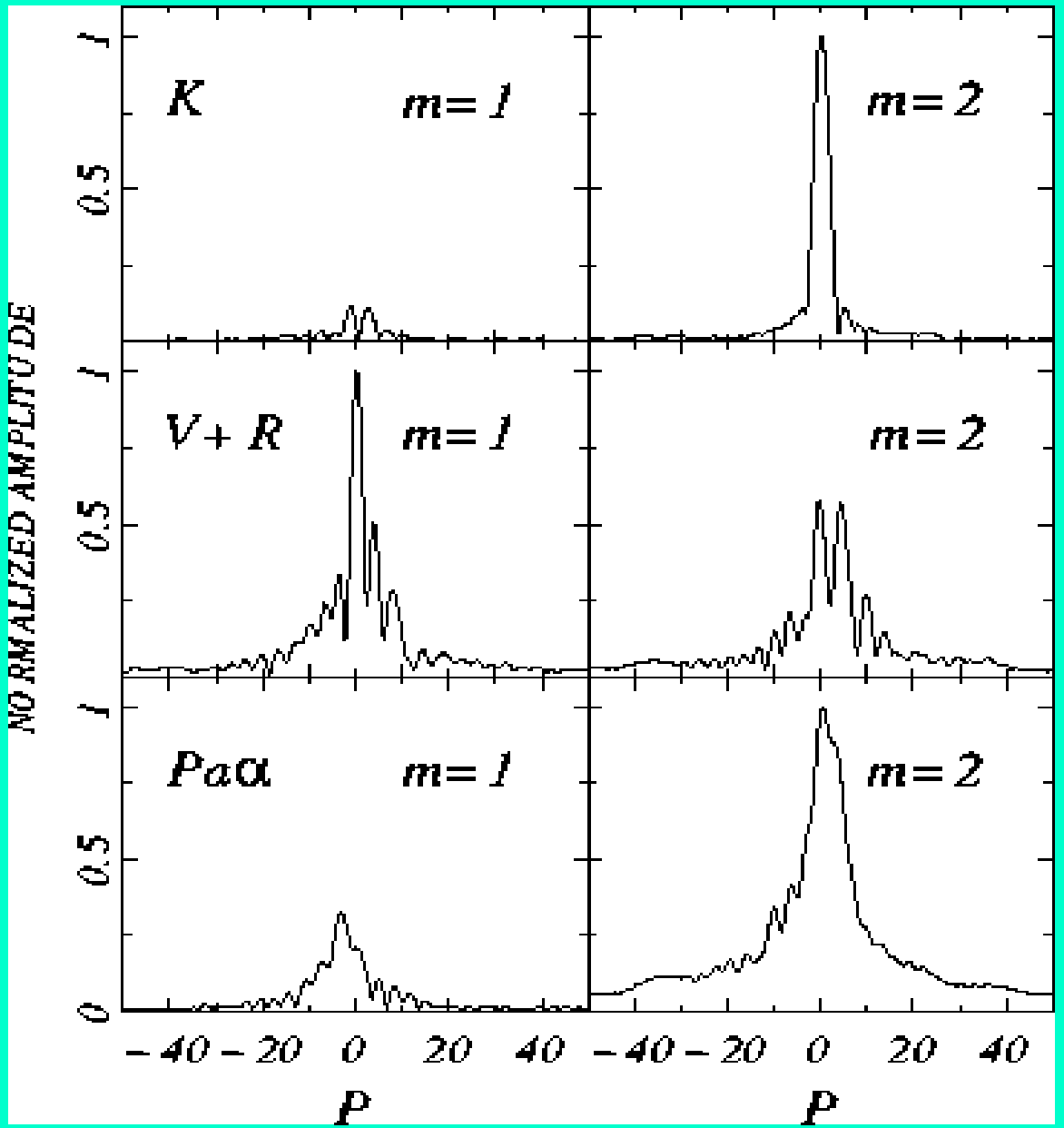
HST OPTICAL & Gemini N IR IMAGES OF NGC 1241 CENTRAL REGION
ELLIPSES FITS TO THE BRIGHTNESS DISTRIBUTION.

K-band innermost 2-arm spiral (left) and surrounding Paα emitting ring and enclosed small bar (right)



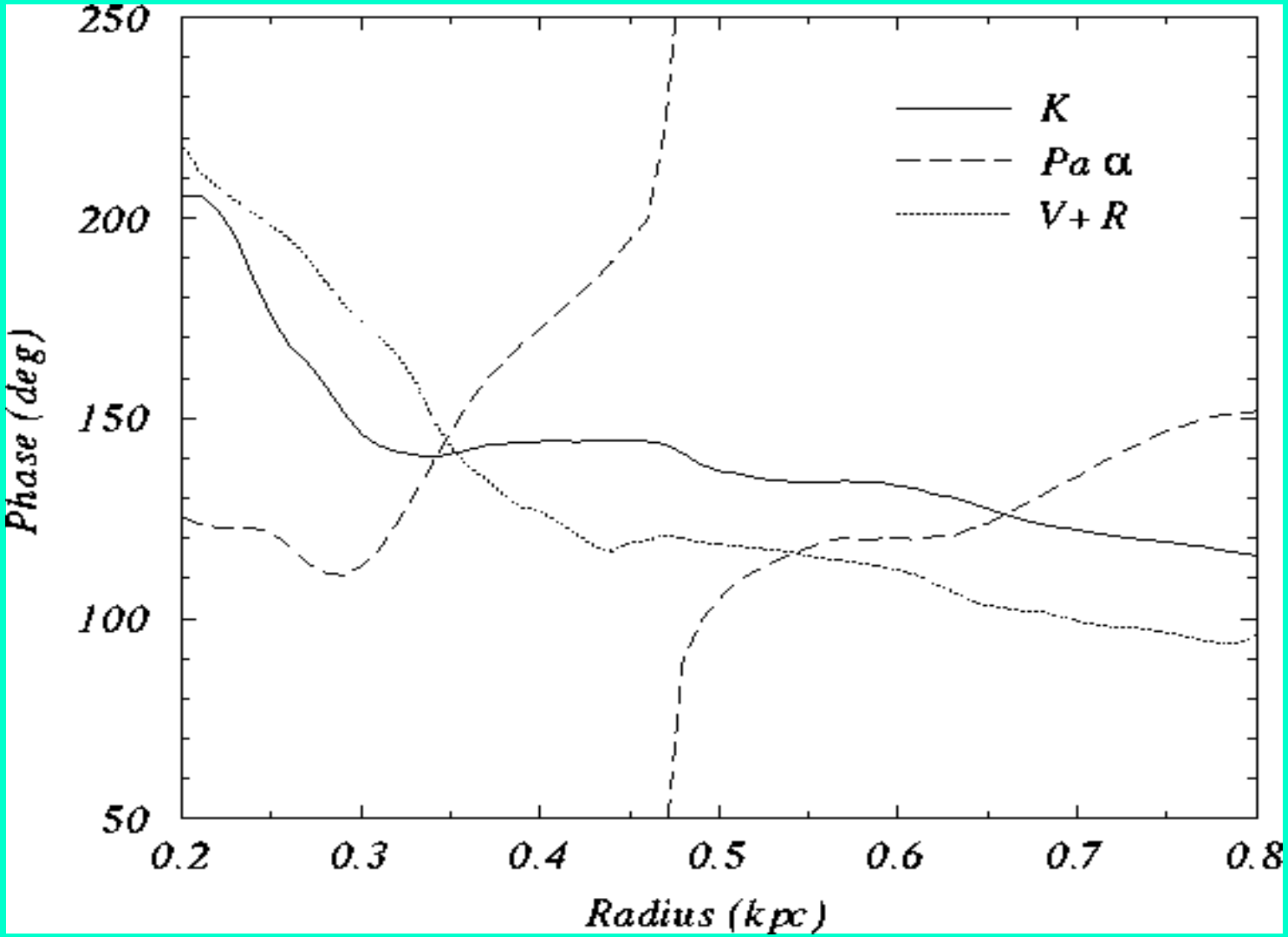


Main Fourier components

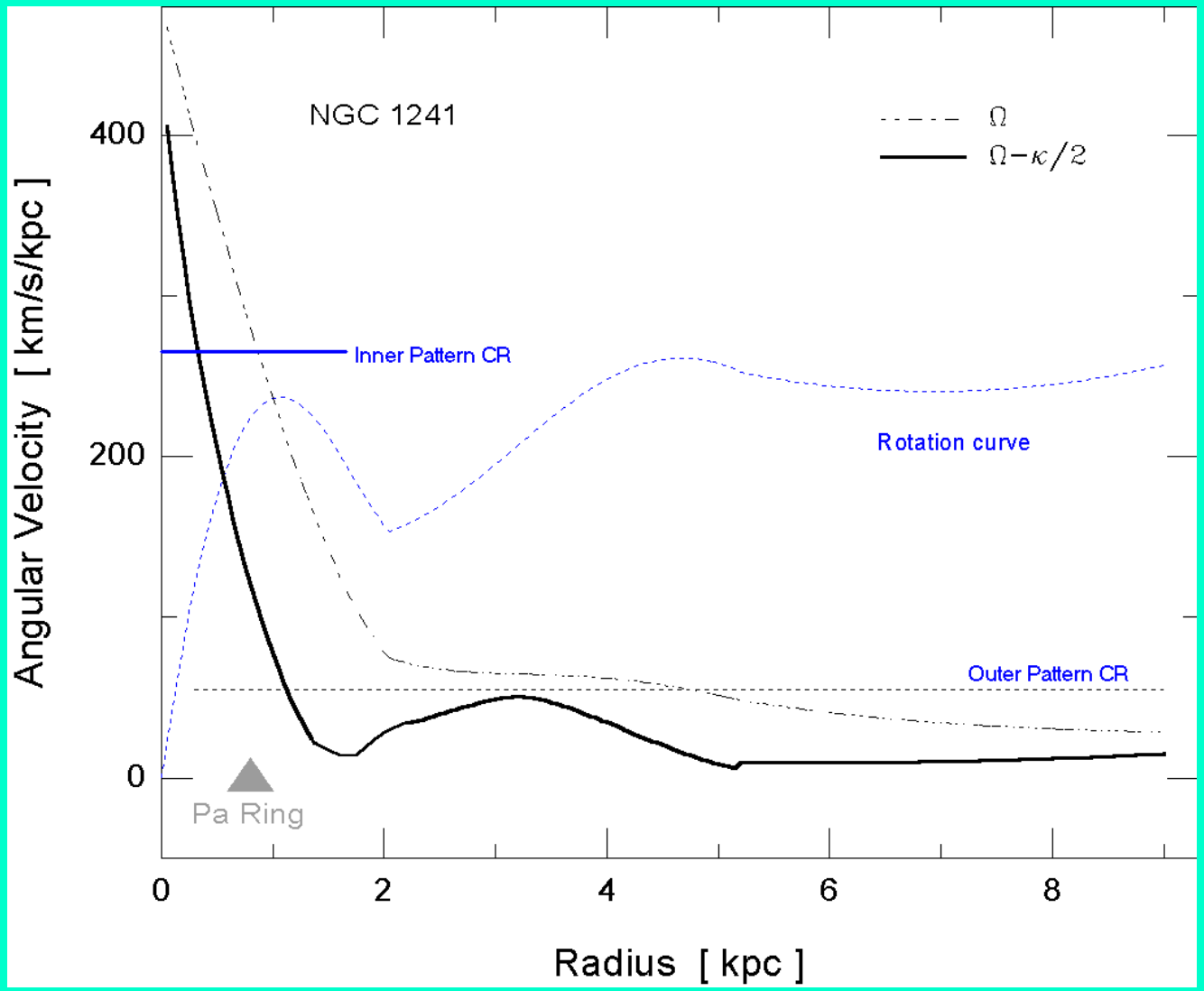


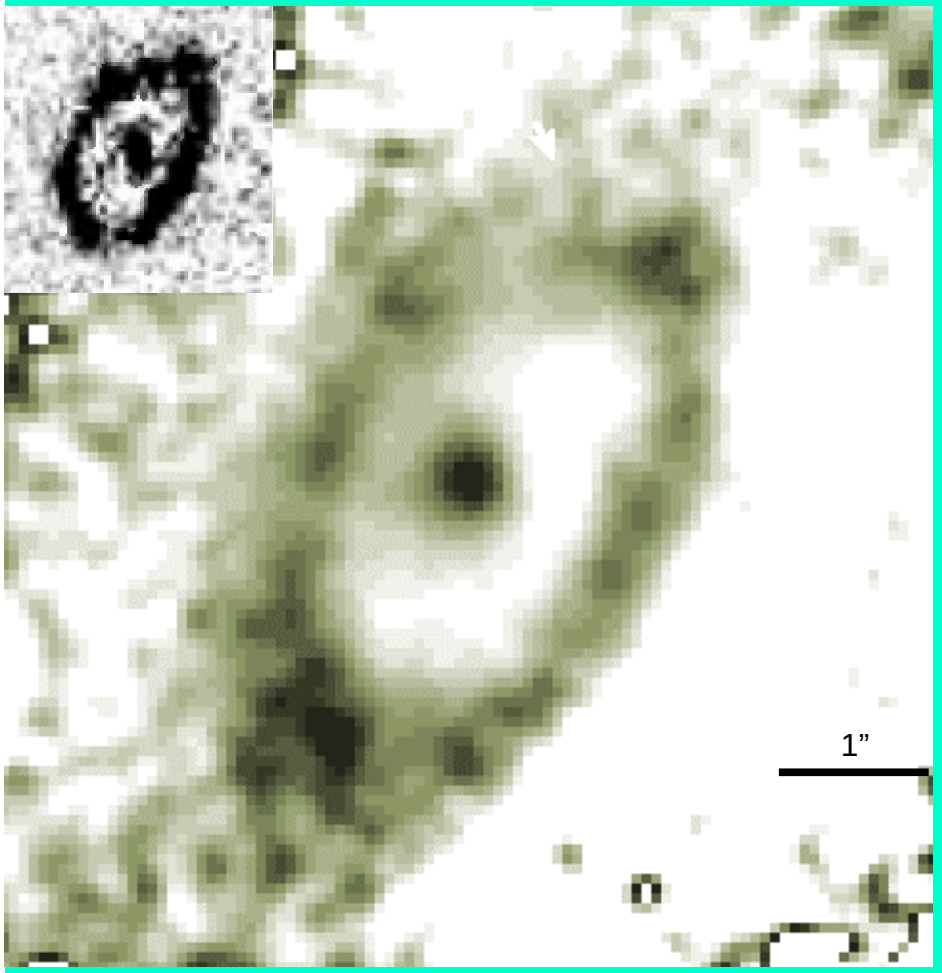
Phase angle showing the CR Position r~350 pc

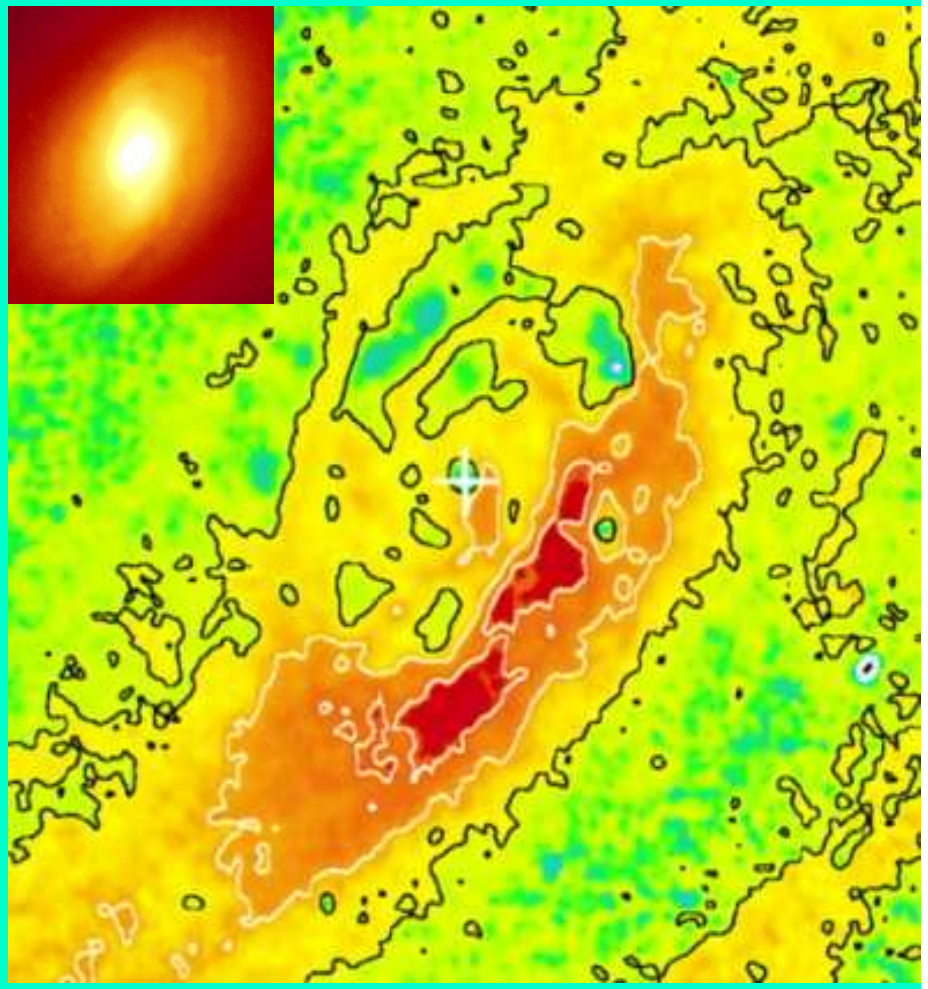
(Villamizar, Dottori, Puerari and de Carvalho, ApJ 2001)

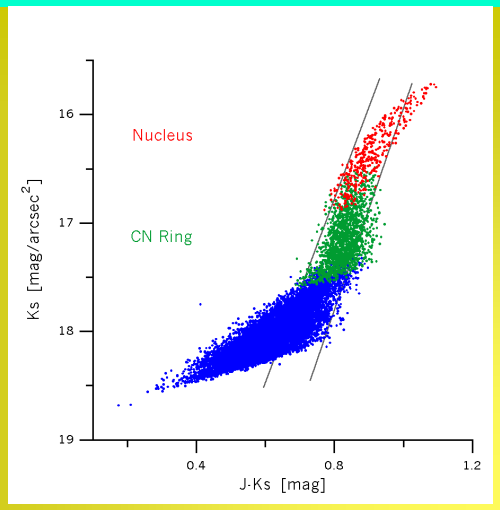


Angular Velocity behaviour

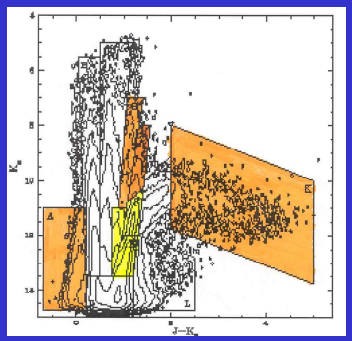


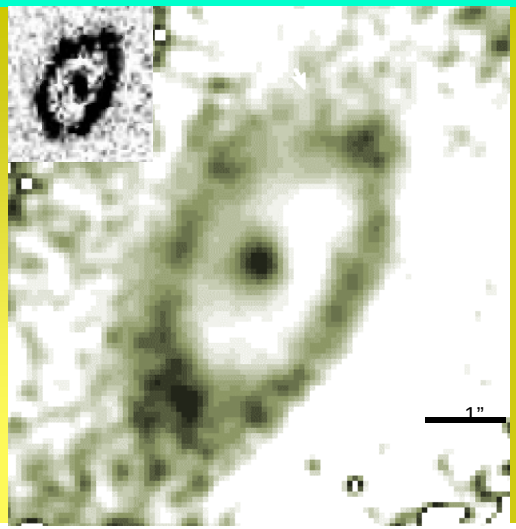

1”

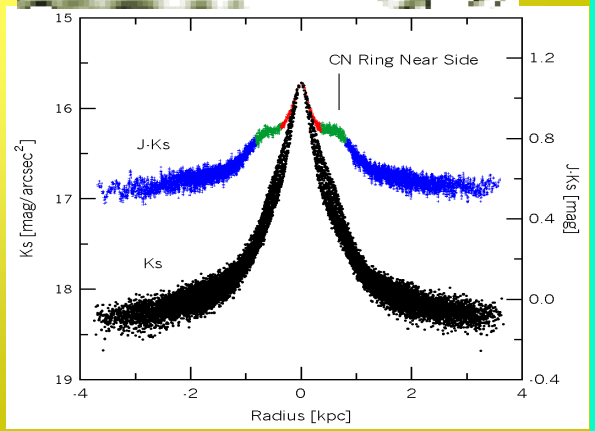


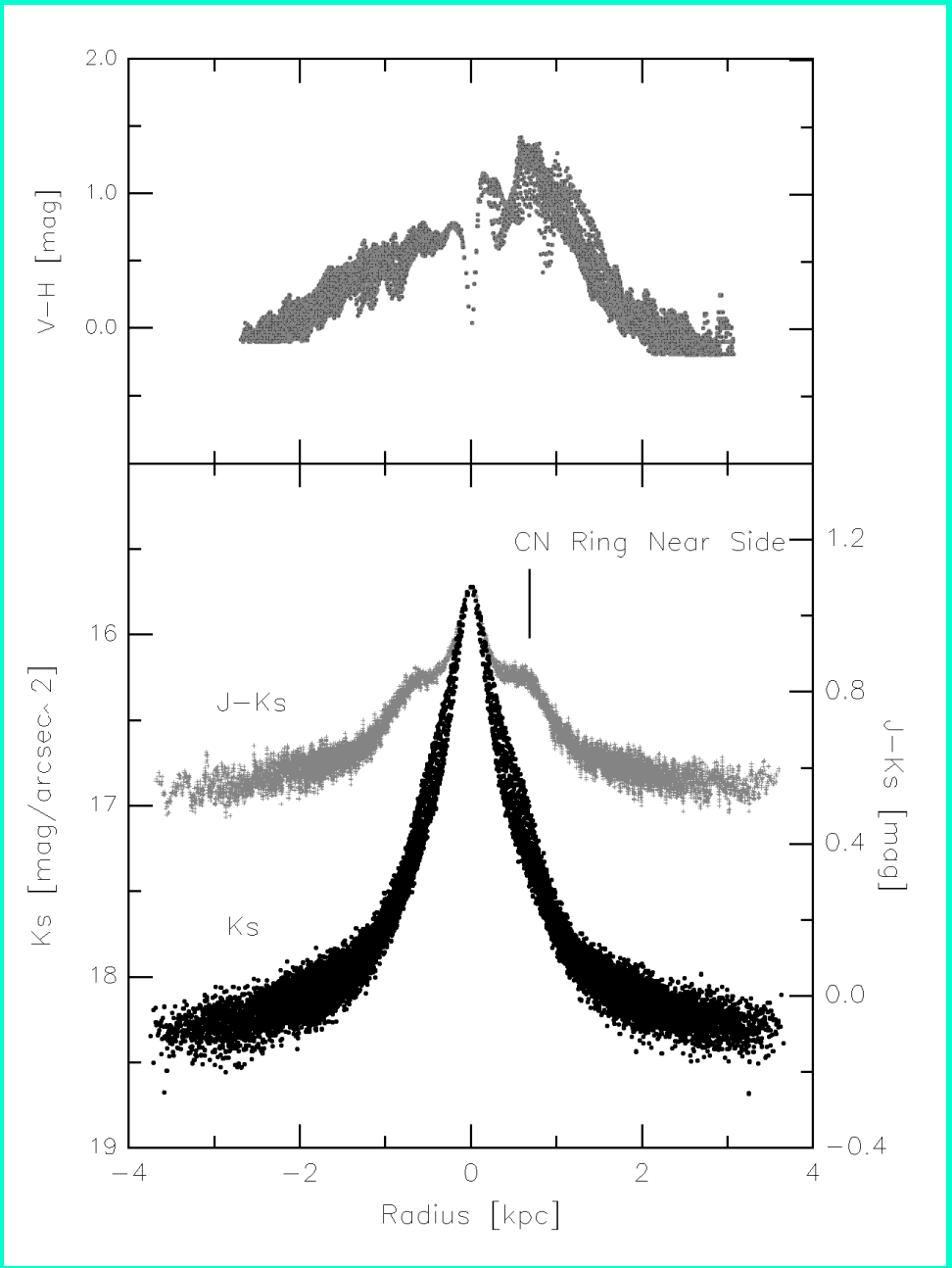

Nucleus
CN Ring
Ks [mag/arcsec^2]
J-Ks [mag]
16
17
18
19
0.4
0.8
1.2

2-MASS CMD




1”


CN Ring Near Side
J-Ks
Ks
Ks [mag/arcsec^2]
J-Ks [mag]
Radius [kpc]
15
16
17
18
19
1.2
0.8
0.4
0.0
-0.4
-4
-2
0
2
4


2.0
1.0
0.0
V−H [mag]
CN Ring Near Side
1.2
16
0.8
J−Ks
17
0.4
Ks [mag/arcsec^2]
J−Ks [mag]
Ks
18
0.0
19
−0.4
−4
−2
0
2
4
Radius [kpc]

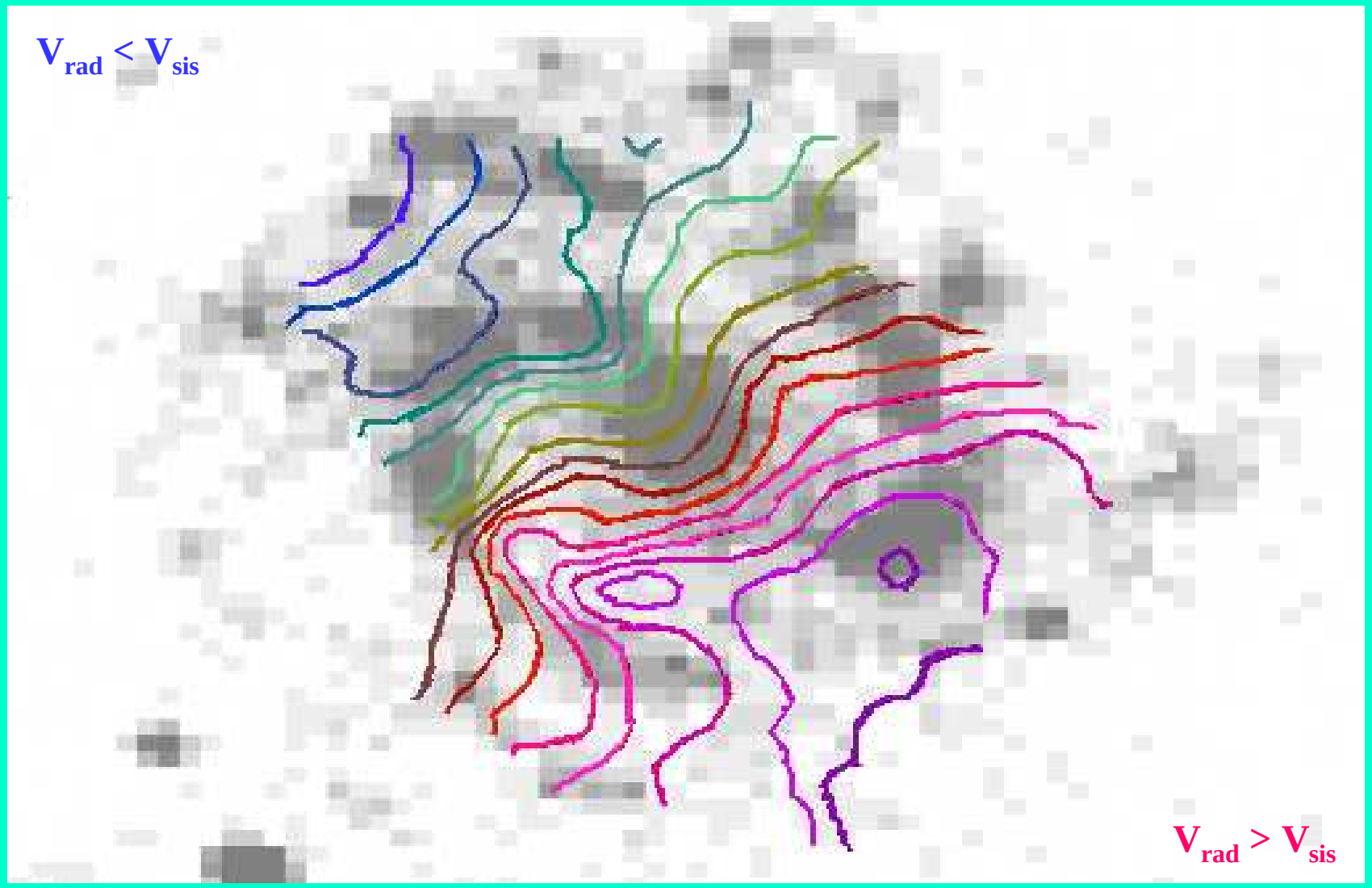
Concluding remarks

- Bars inside bar
- Leading and trailing circumnuclear features
- Angular velocities of the inner and outer patterns are strongly different
- ¿Pattern richness linked to the galaxy interaction?
- Comparison of our data with Junqueira & Combes (1996) models of perturbations in disks of gas+stars, lead to a very young pattern age (few 10^7 y).
- 500 C-Stars+corresponding O-Stars of ~6Msol allows to explain the nuclear color. As 6-2 Msol stars undergoes the C-Star cycle, it allows to form an enriched nuclear medium that twice, mau feed the nuclear activity and take account of the systematically observed CN enrichment in Sy2.

MESSIER 83

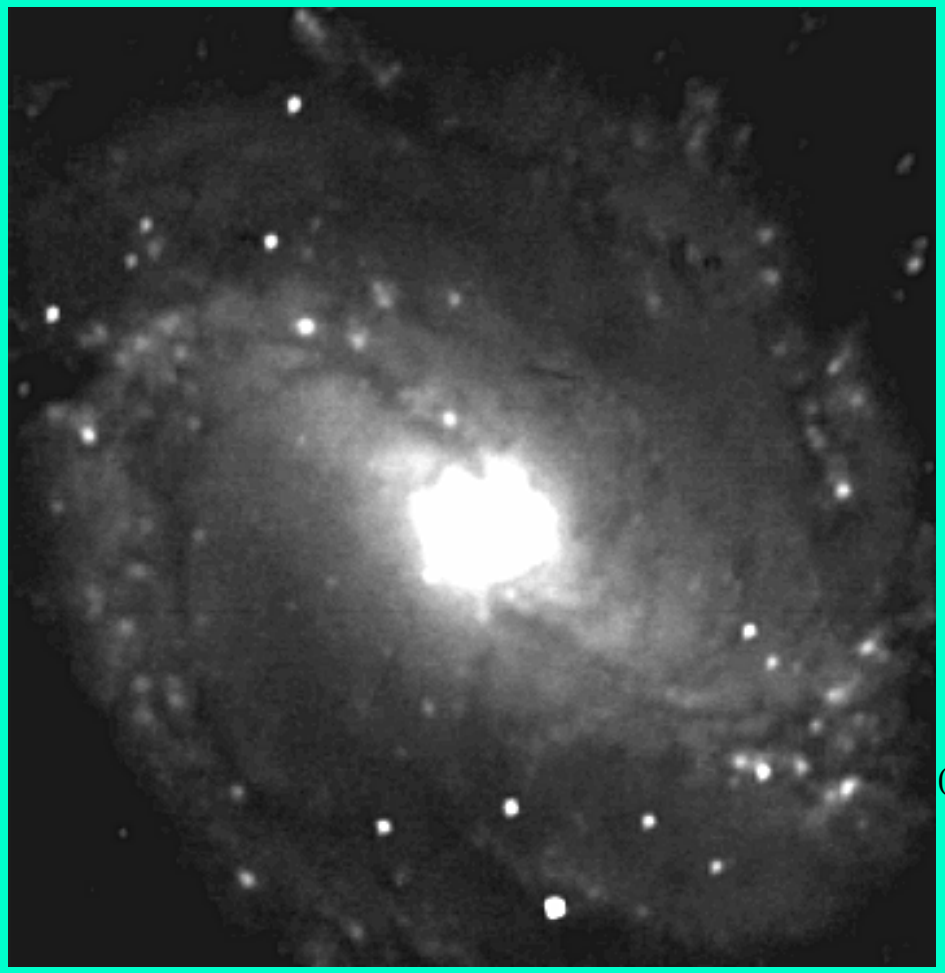
CIRCUMNUCLEAR STRUCTURES

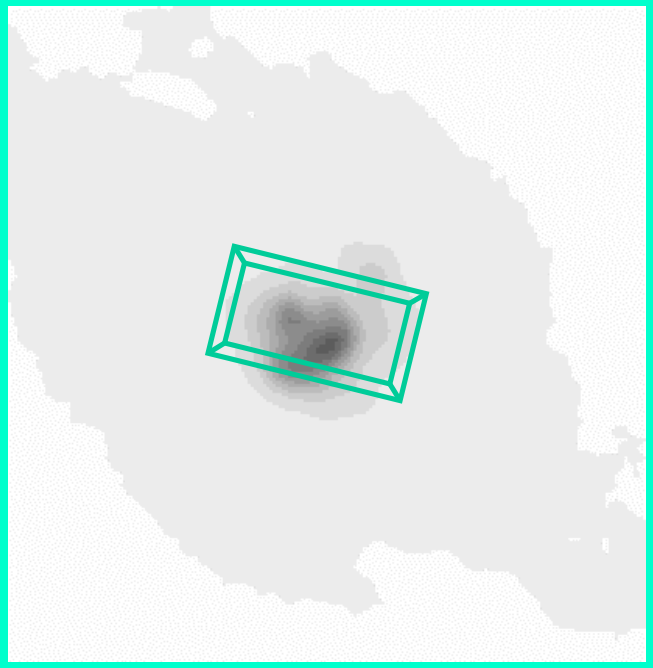
M 83: Perturbaciones globales



Campo de velocidades radiales de Hα, superpuesto al brillo Hα.
Oddone et al. (2000)

ESPECTROSCOPÍA ÓPTICA TRIDIMENSIONAL





(50”)

(4’)

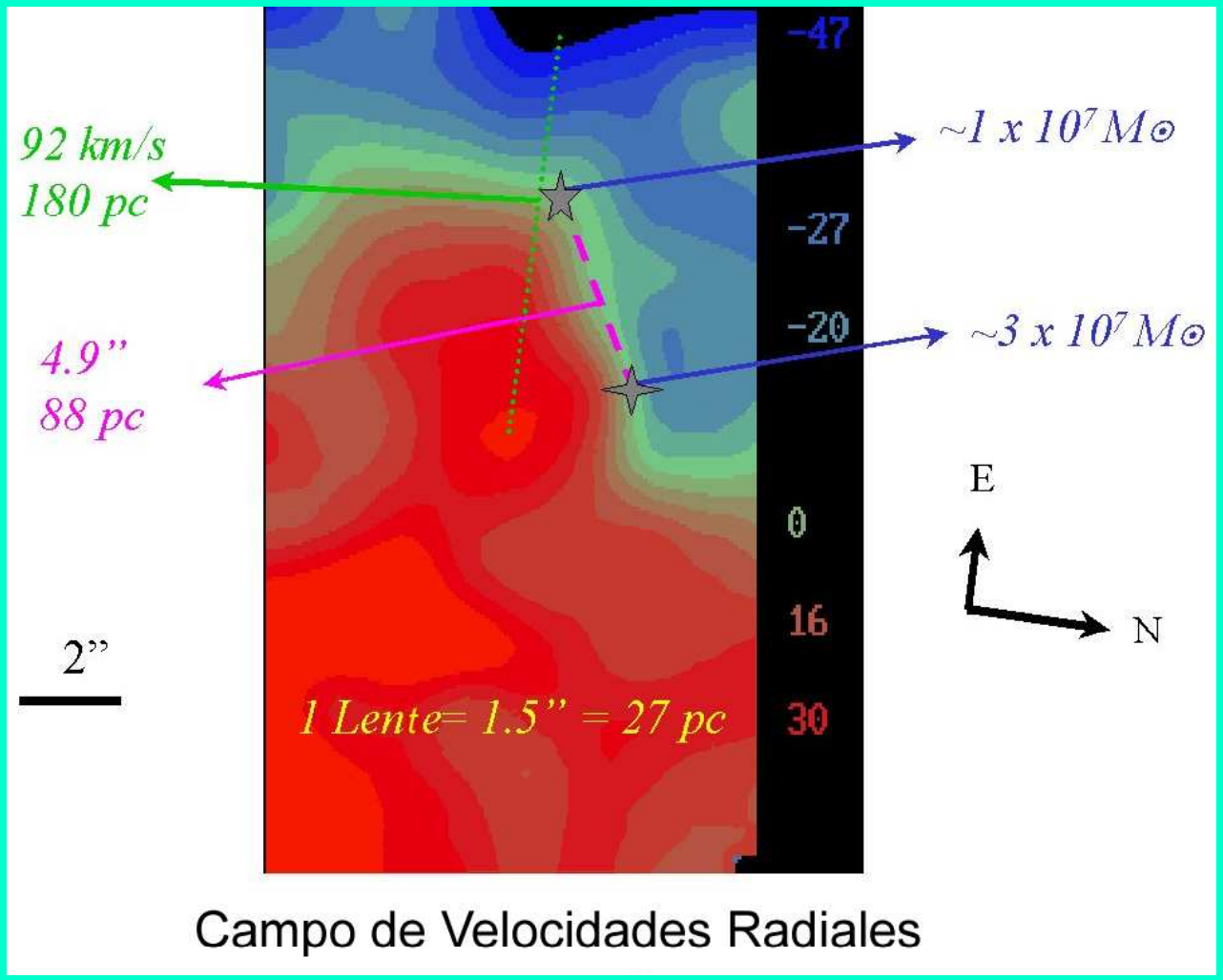
N

E

M 83. Banda R (BAlegre).
Nótese la estructura compleja del núcleo, que es uno de los núcleos *starburst* más cercanos.

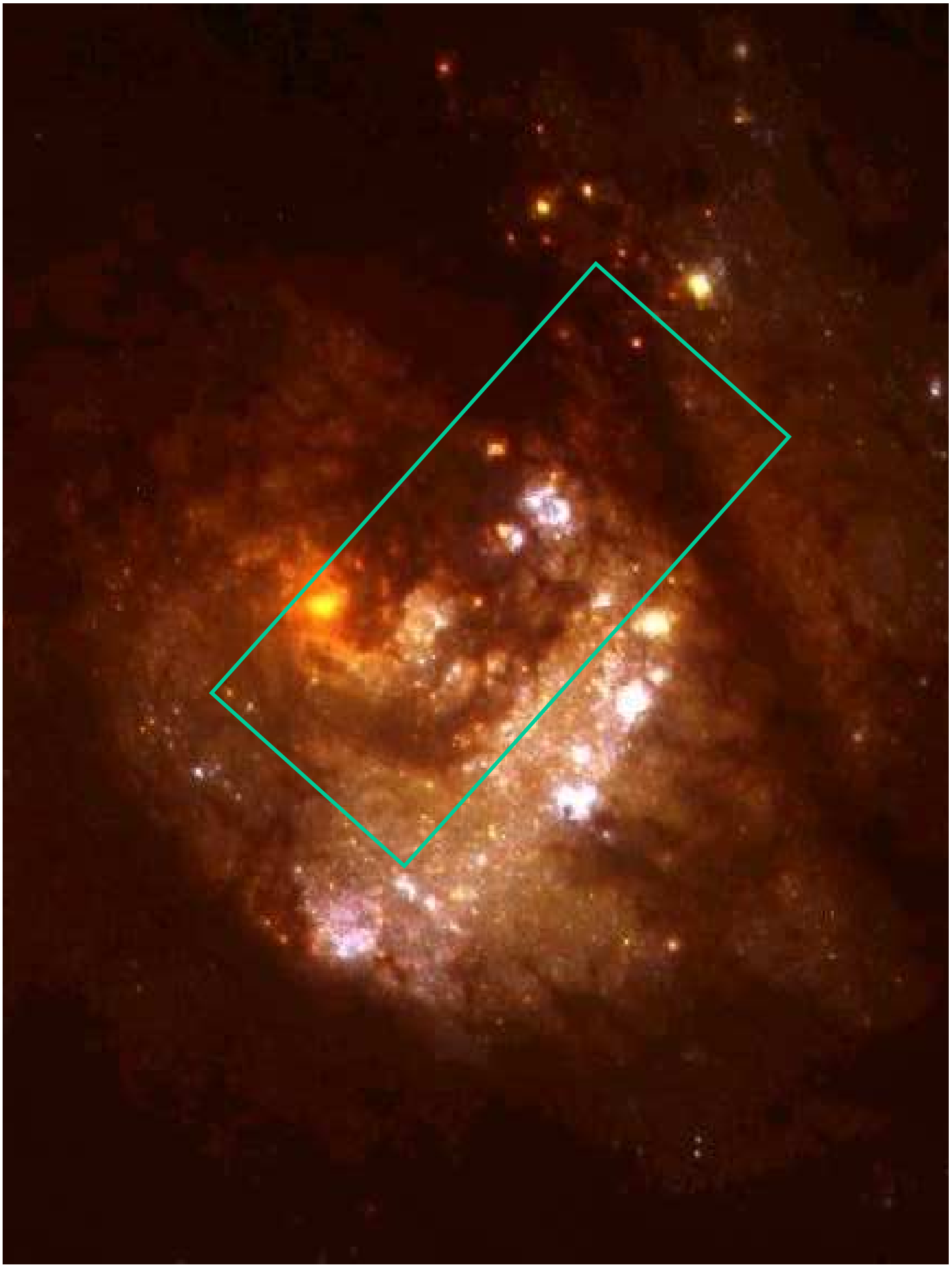
CIRCUMNUCLEAR SCALE PERTURBATIONS

3-D optical spectroscopy: MPP-B.Alegre



Campo de Velocidades Radiales

Mast et al. (2002).



Gemini Sur

CIRPASS

Espectroscopía 3D en el IR cercano

Muestreo directo en el foco f/6 del telescopio
Modos:

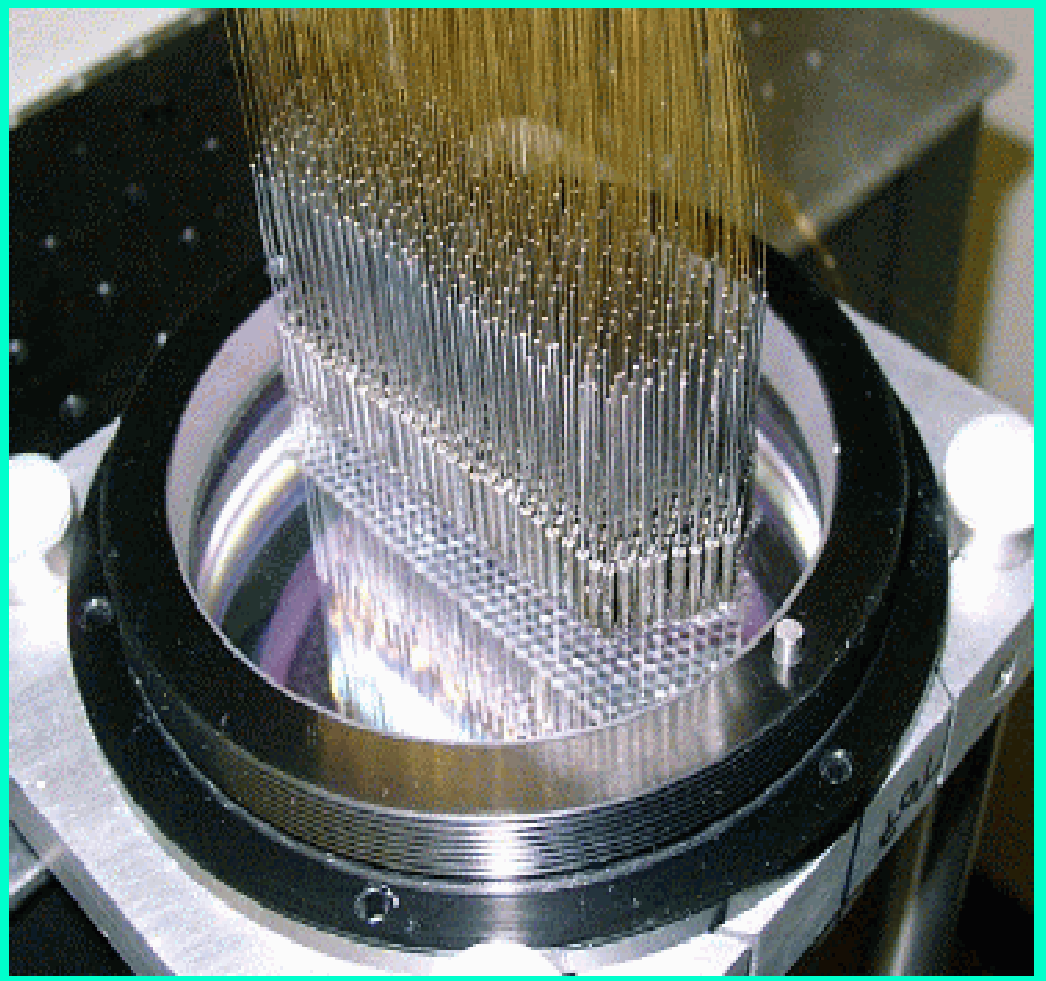
- Multiobjeto

  150 objetos

- Unidad de Campo Integral (IFU)

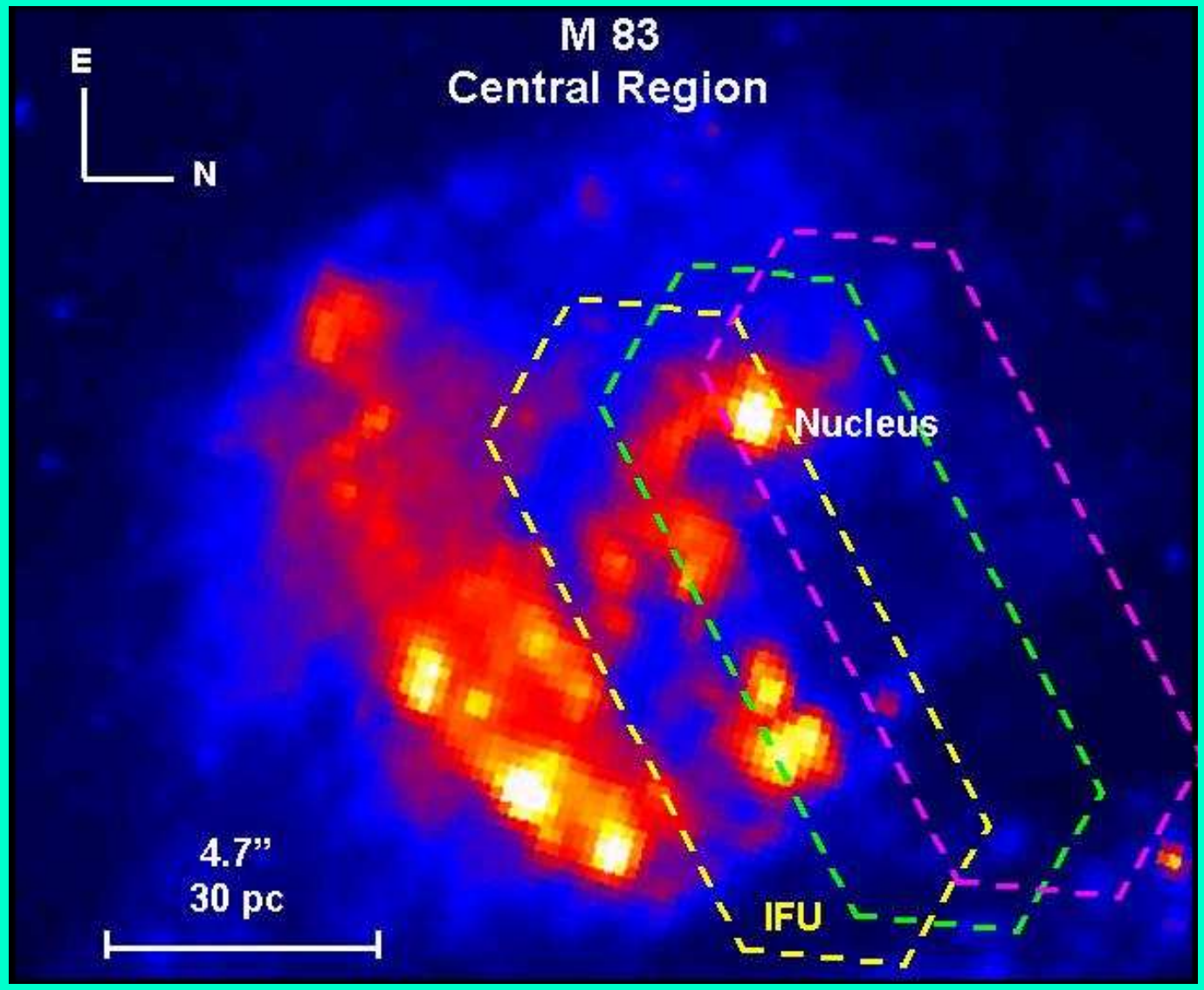
  490 espectros

13.0” x 4.7”, 0.36” p/fibra
9.3” x 3.5”, 0.25” p/fibra

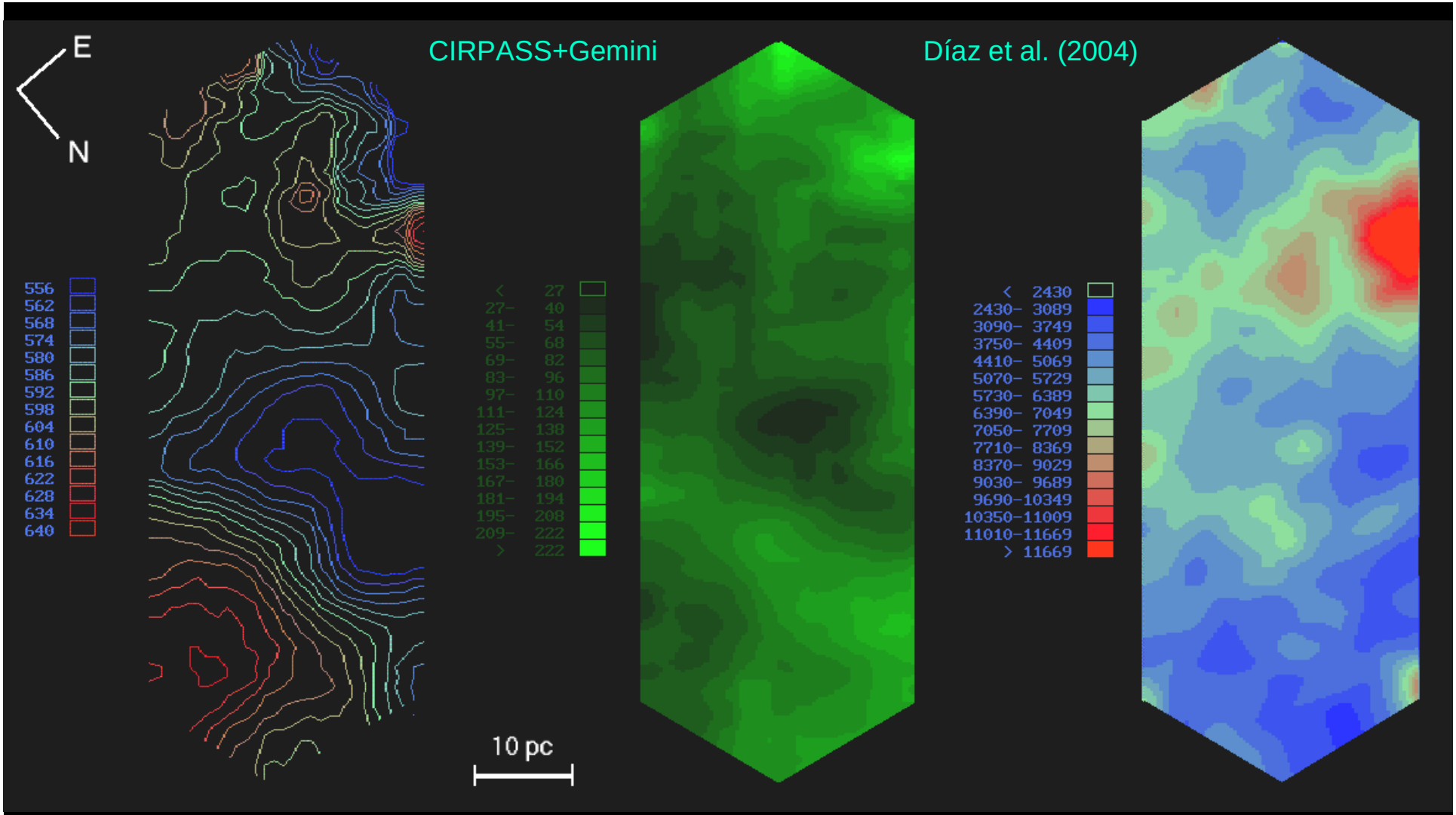


- **CCD:** Hawaii-I HgCdTe (Rockwell)
- **Formato:** 1024 x 1024, píxel de 18.5 um
- **Respuesta espectral:** 1-2.6 microns;
  Filtro de corte en 1.67 um para
  reducir el fondo térmico.
- **Corriente de oscuridad:** 0.3 e^-/s/pix
- **Ruido de lectura:** 20 e^- rms
- **Gananacia:** 7.5 e^-/ADU
- **Saturación:** ~80000 e^-
- **EQ:** 45 % en J, 65% en H

OIWFS no disponible.



M 83 core (HST, 673N). Target position for GEMINI S+CIRPASS selected trough previous study with the 1.6mts reflector of C’ordoba Observatory.

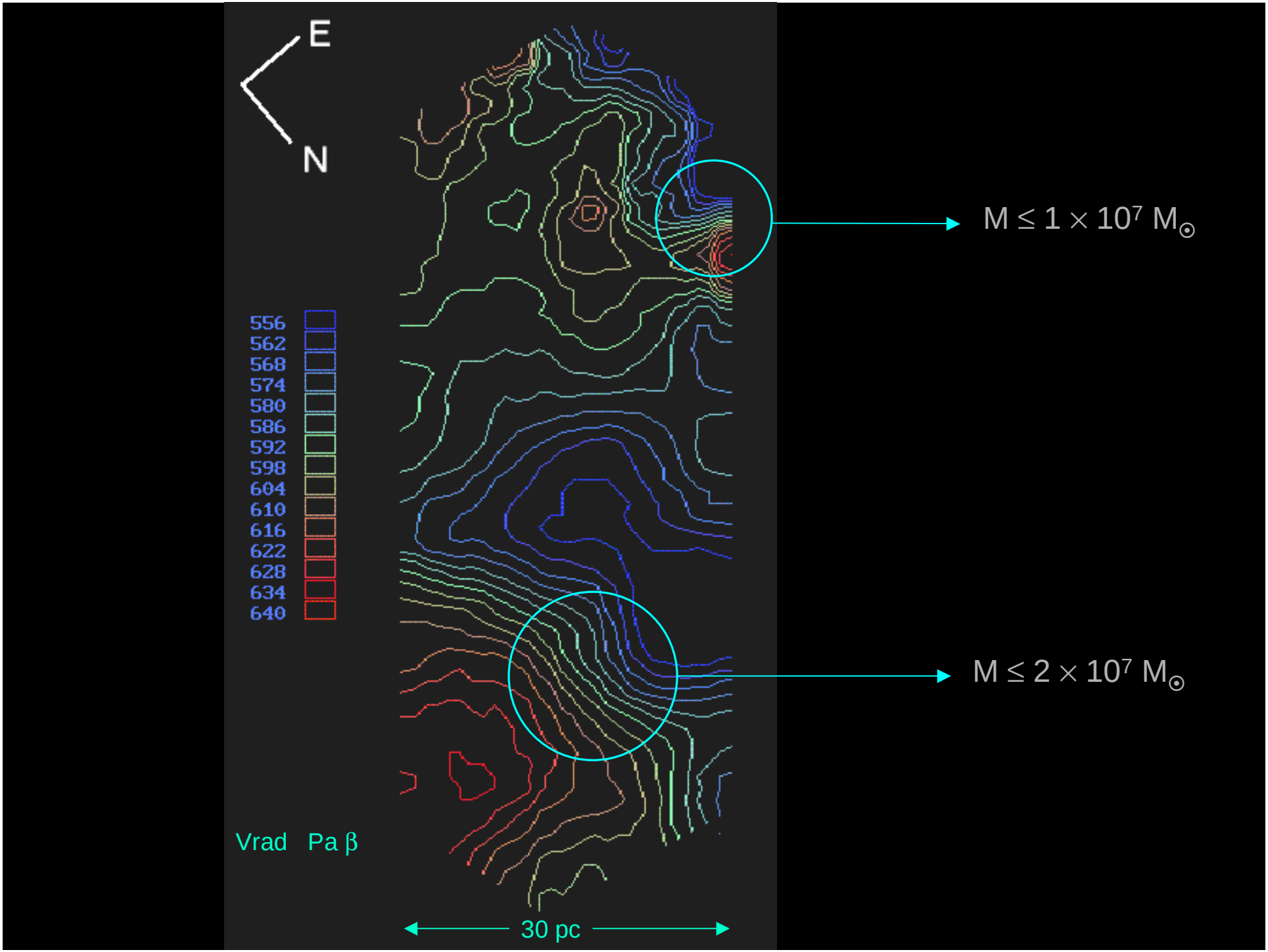


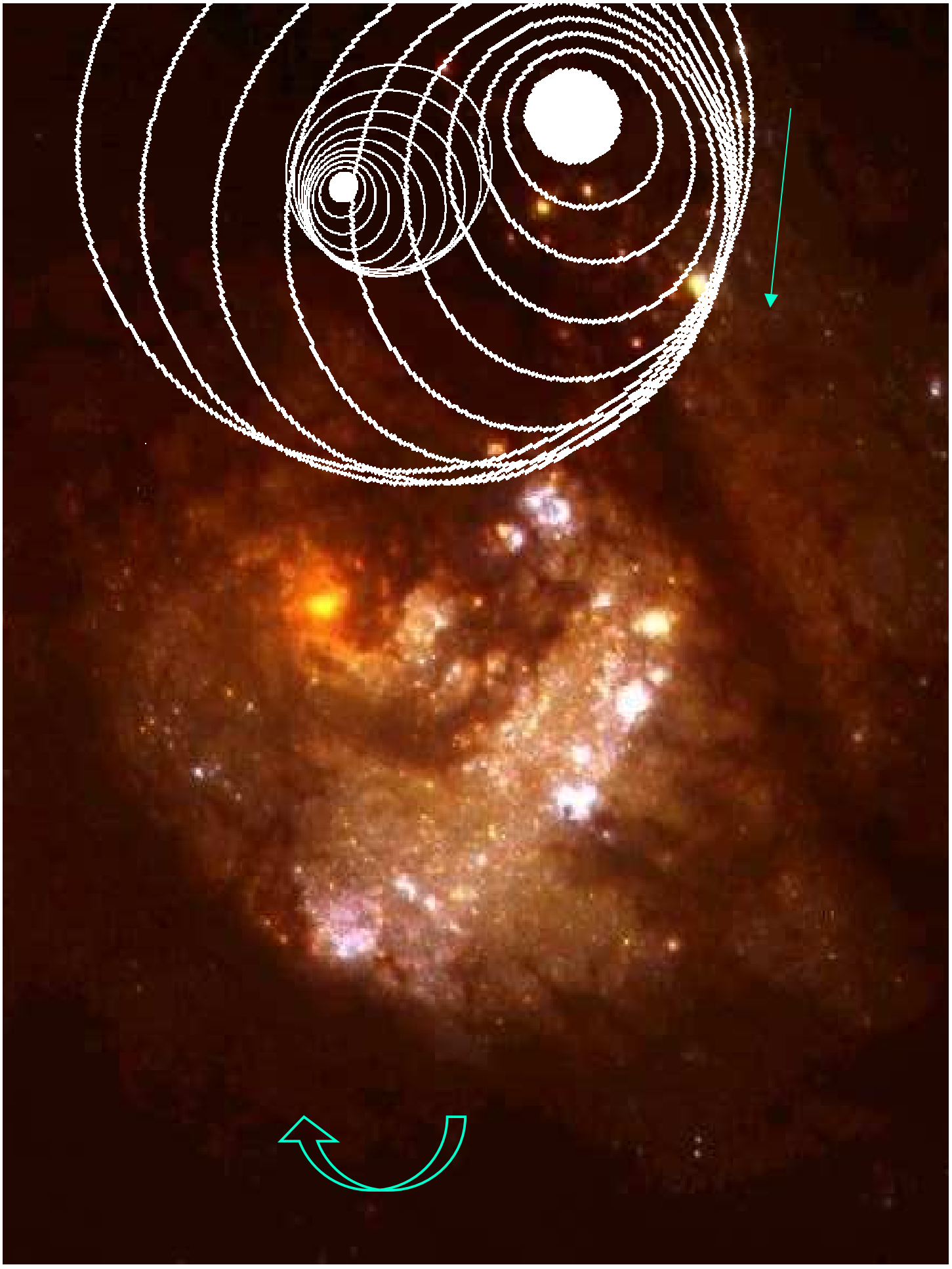
Vrad Pa β (λ ~ 1.3 μm) (field1)

FWHM Pa β (Deconv. FWHM sky)

Continuum 1.25 μm (relative flux)

The nucleus clearly does not coincide with the kinematical center, as can be seen by comparing the J continuum with the butterfly diagram.


E
N
556
562
568
574
580
586
592
598
604
610
616
622
628
634
640
Vrad Pa β
30 pc
M ≤ 1 × 10⁷ M⊙
M ≤ 2 × 10⁷ M⊙



We confirm the presence of a asymmetry in the central mass distribution of M83, one of the nearest spirals, with 3-D optical and infrared spectroscopy. The double nucleus seems to be the by product of a advanced smaller spiral fusion.

m83 IS the nearest starburst nucleus at the center of a Gran Design very regular spiral. The younger extreme of the starburst is located towards the kinematical center. Possible the violent star formation was triggered by an m=1 perturbation.

Phenomena at 10-100 pc scales can be analyzed as the large scale ones, kinematical behavior is similar, except the perturbing pattern is much more vigorous, with angular speed 10 or more times larger than the global pattern. Patterns coupling is possible but… for short times (centerforward-back example!!).

IR techniques are fundamental to penetrate the enshrouding dust layers.

Detailed analysis revealed the presence of different patterns in the optical and IR, in an efficient configuration to remove angular momentum (nuclear bar decoupled from global one, leading spiral, merger, etc.) High resolution allows to make a quantitative analysis of the morphology in brightness and colors at arcsec scales.