The kinematics of the barred spiral galaxy NGC 1291

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Why study barred spiral galaxies ?

Bars form naturally in unstable disks

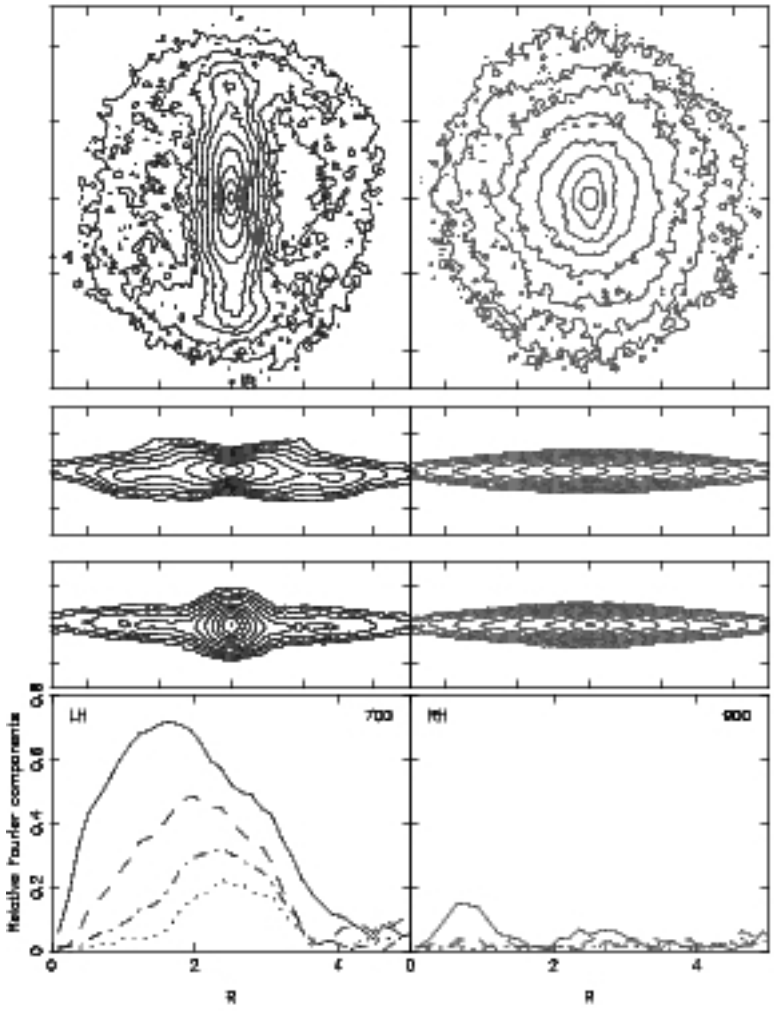
Bar fraction decreases with increasing z

Bar fraction is similar in field and clusters

Bars are internal evolution agents, and

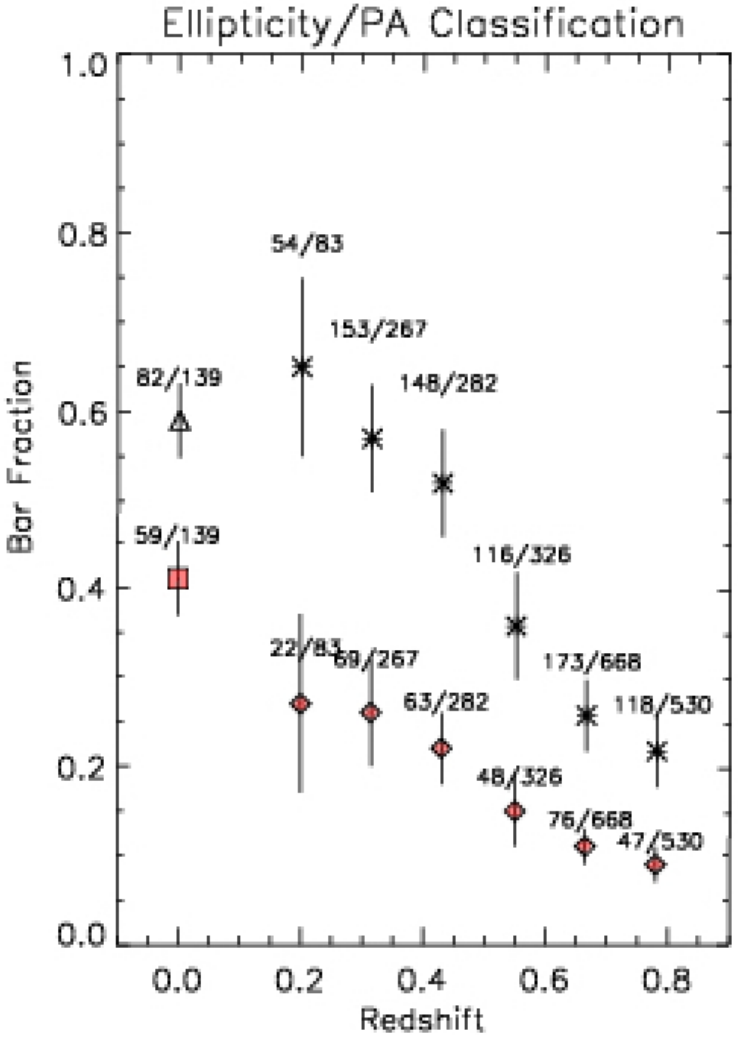
might tell us something about the dark halo

Athanassoula (2002)



Live halo Rigid halo

Sheth et al. (2008)

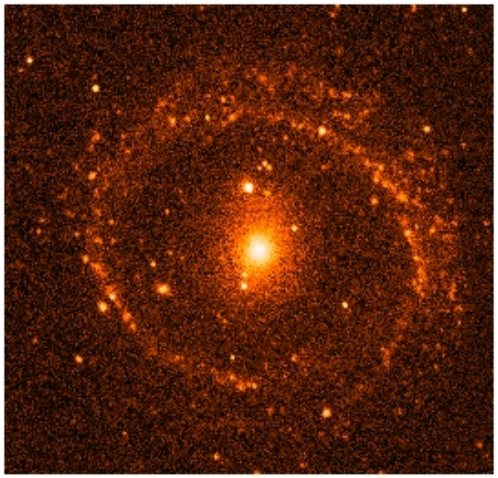


Barazzi et al. (2009) : little difference between cluster and field

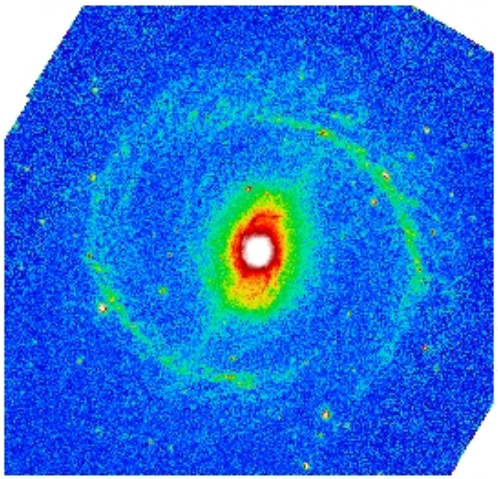
NGC 1291 prototype SB0/a barred spiral with outer ring

a bar within a bar

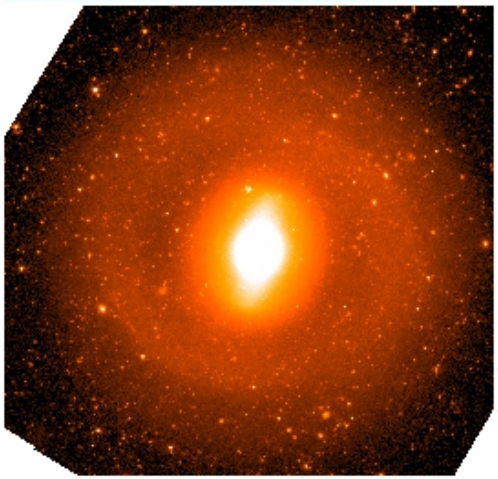
relatively isolated : two tiny companions



Galex NUV



IRAC 8.0 μm



IRAC 3.6 μm

240 sec vs. 7.8 sec

2MASS

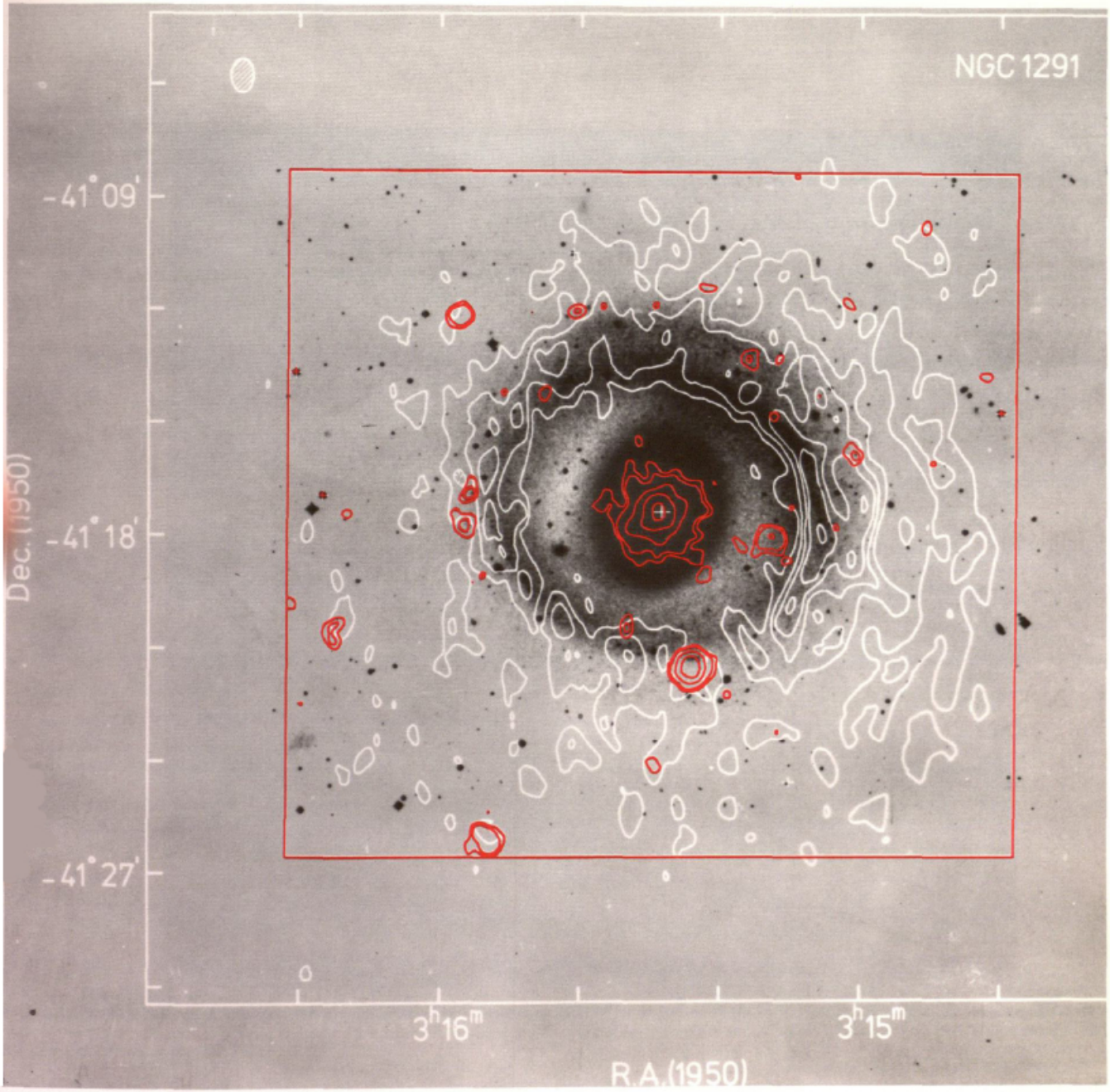


FIG. 5.—Blue optical image of NGC 1291 with the H I and X-ray emission contours superposed. The H I map has a resolution of 48″ × 48″ and the contou in white, are at $N_{H\,I} = 0.66, 1.3, 2.0, 2.6, 3.3 \times 10^{20}$ cm^{-2} (van Driel et al. 1988); the beam size is shown in the upper left. The X-ray emission in the 0.11–2. energy band has a resolution of about 25″, and the contour levels, in red, are those given in Fig. 1. The X-ray emission is coincident with the bulge, a region detectable H I emission.

ROSAT – PSPC
Bregman et al. 1995

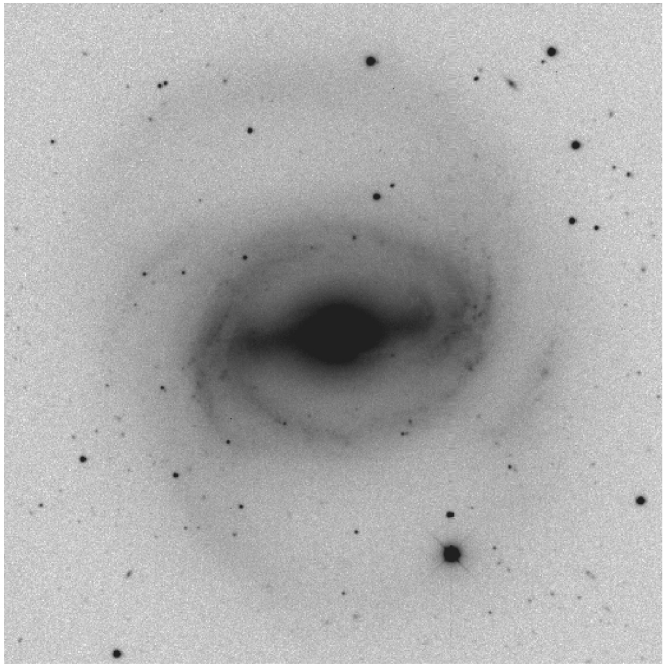
HI - VLA
Van Driel et al. 1988

metallicity problem -
Perez & Freeman
2006

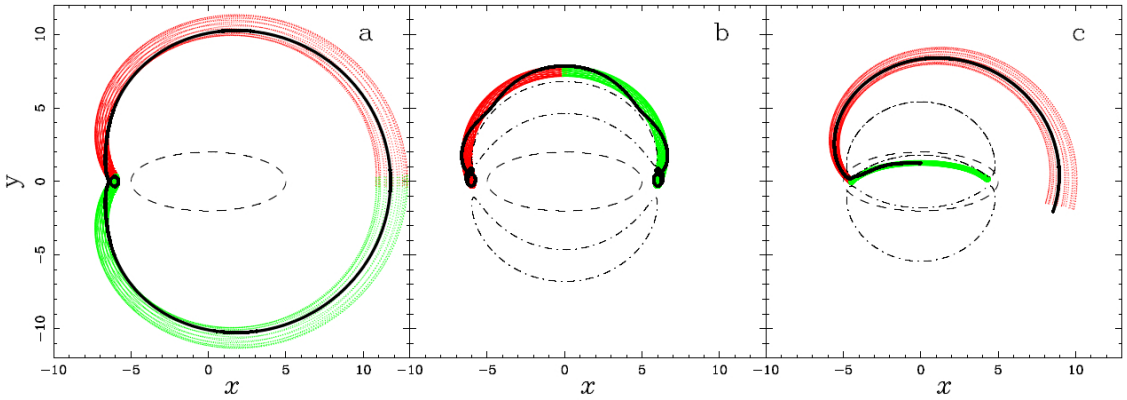
1. X-ray 0.1 x solar
2. stars 1.1 x solar
3. HII-regions solar

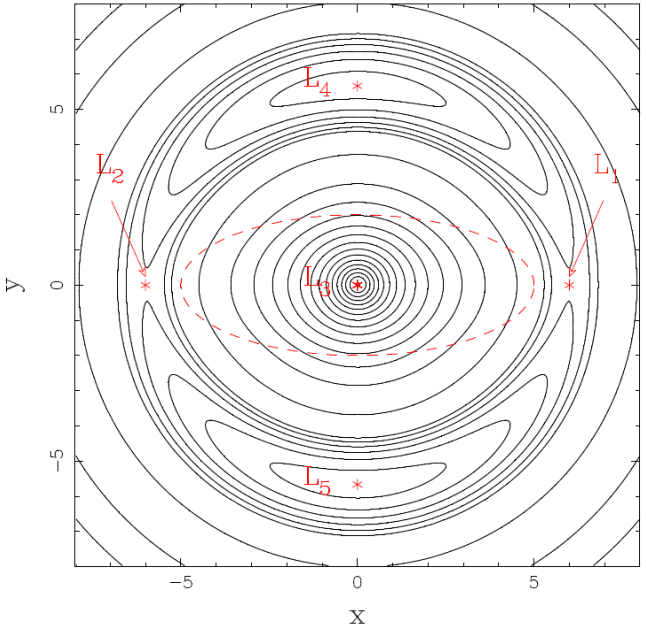
so how did the low metallicity gas arrive in the central parts ?

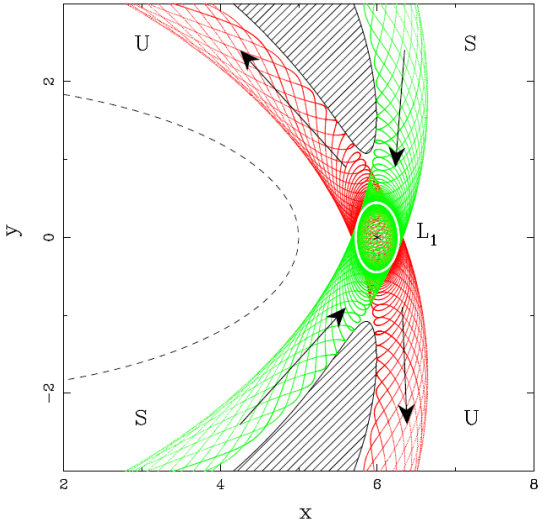
and why is the ring so metal rich ?



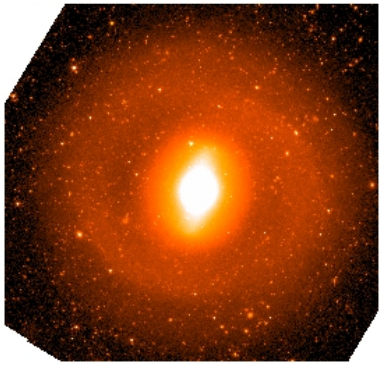
Invariant manifolds around L1 and L2 - these allow migration of stars from inner to outer regions, - smearing out of metallicity gradient

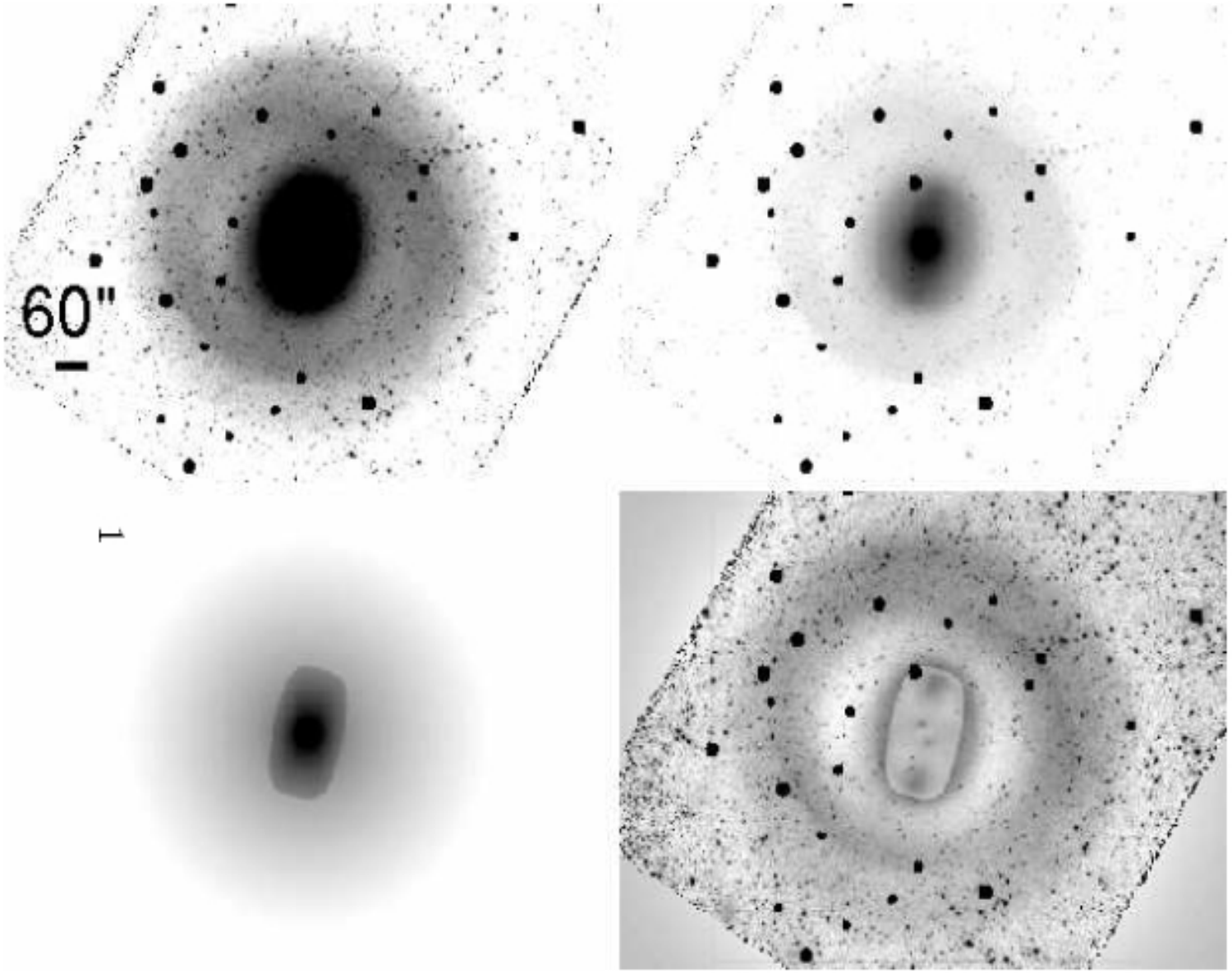






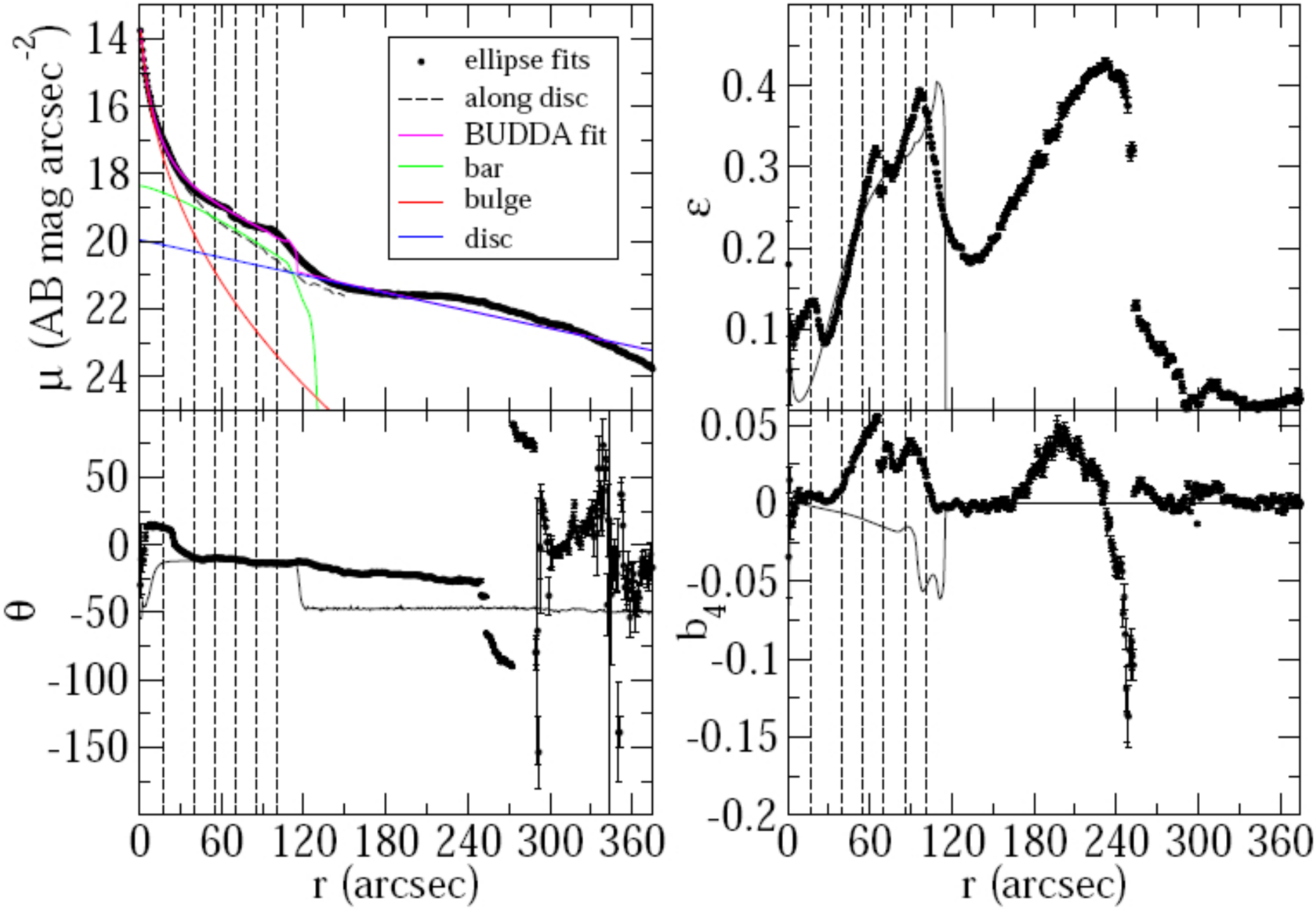
Romero-Gomez et al. 2006,
Romero-Gomez et al. 2007,
Athanassoula et al. 2008

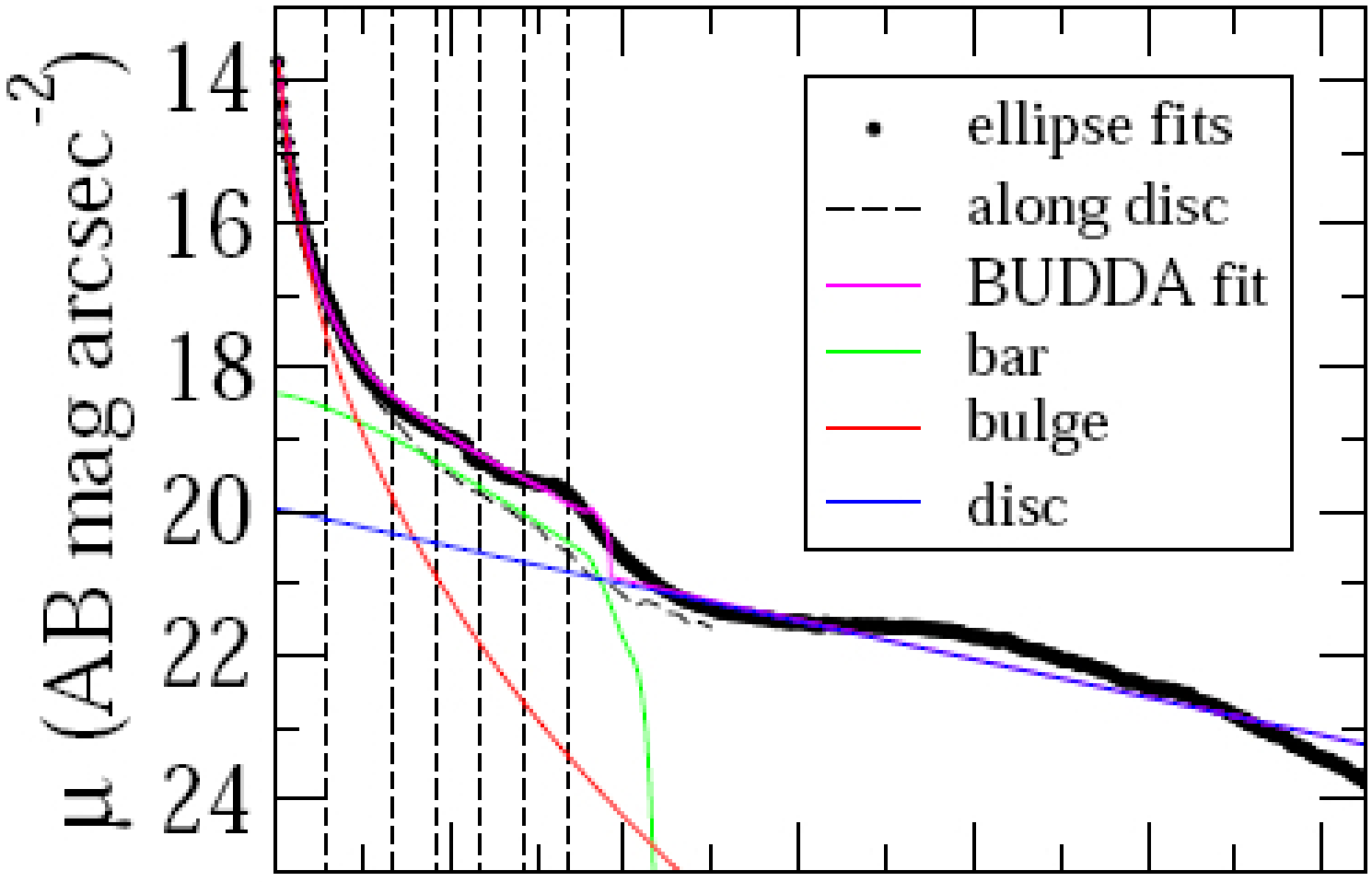




BUDDA decomposition code

(see Gadotti 2008 a & b for more work with this code)


ellipse fits
along disc
BUDDA fit
bar
bulge
disc
μ (AB mag arcsec-2)
θ
ε
b4
r (arcsec)
r (arcsec)


μ (AB mag arcsec^{-2})
14
16
18
20
22
24
ellipse fits
along disc
BUDDA fit
bar
bulge
disc

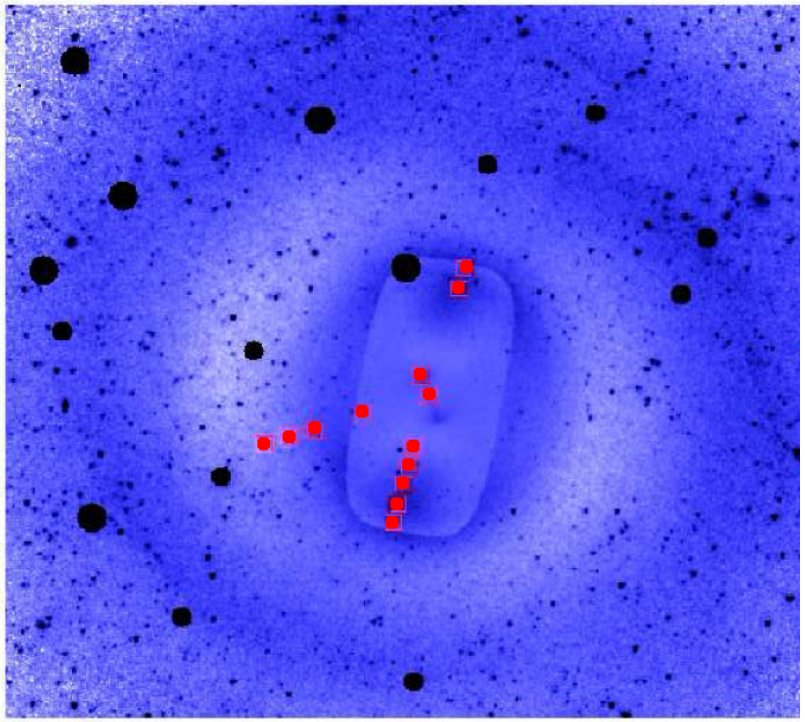
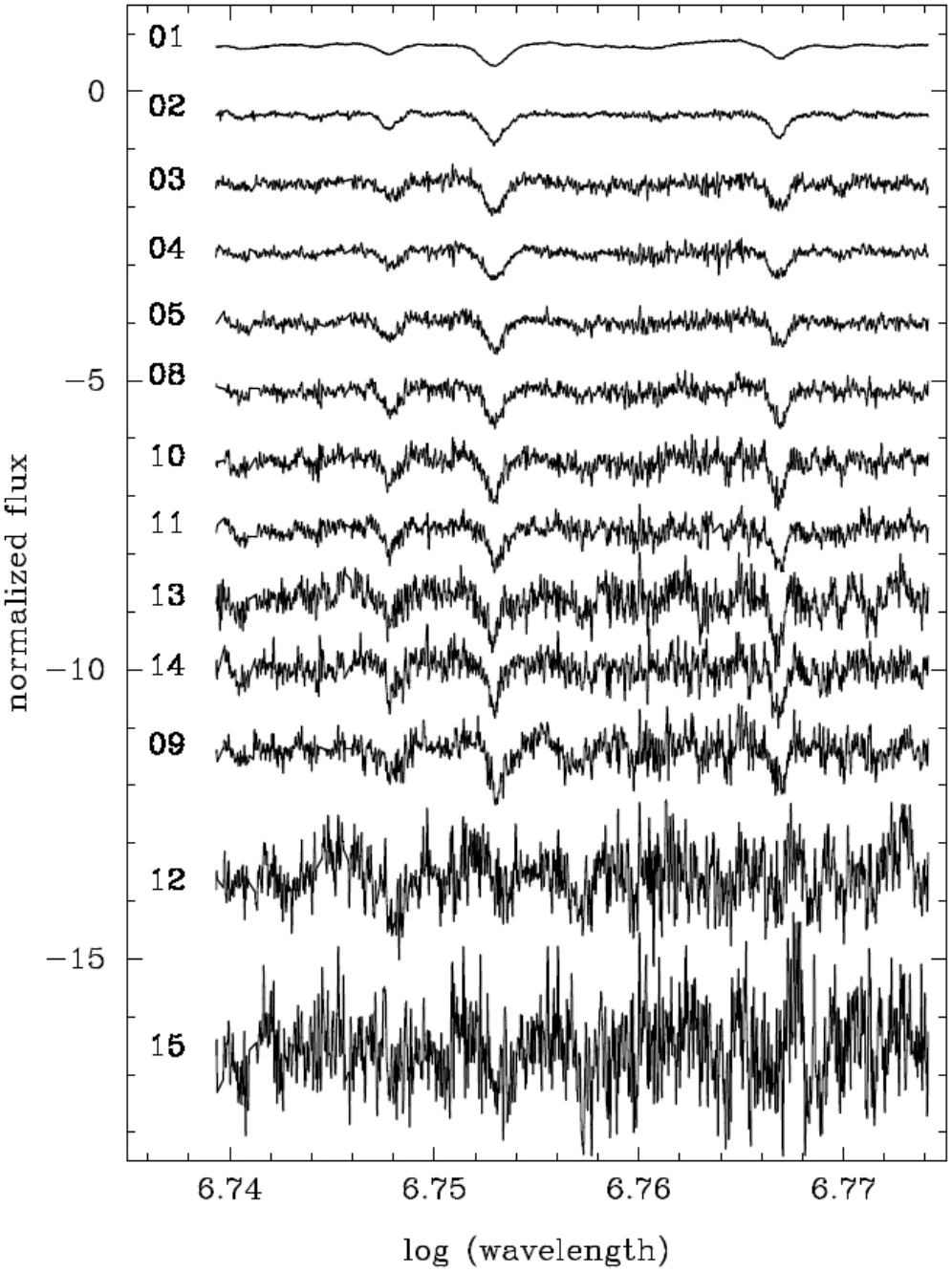
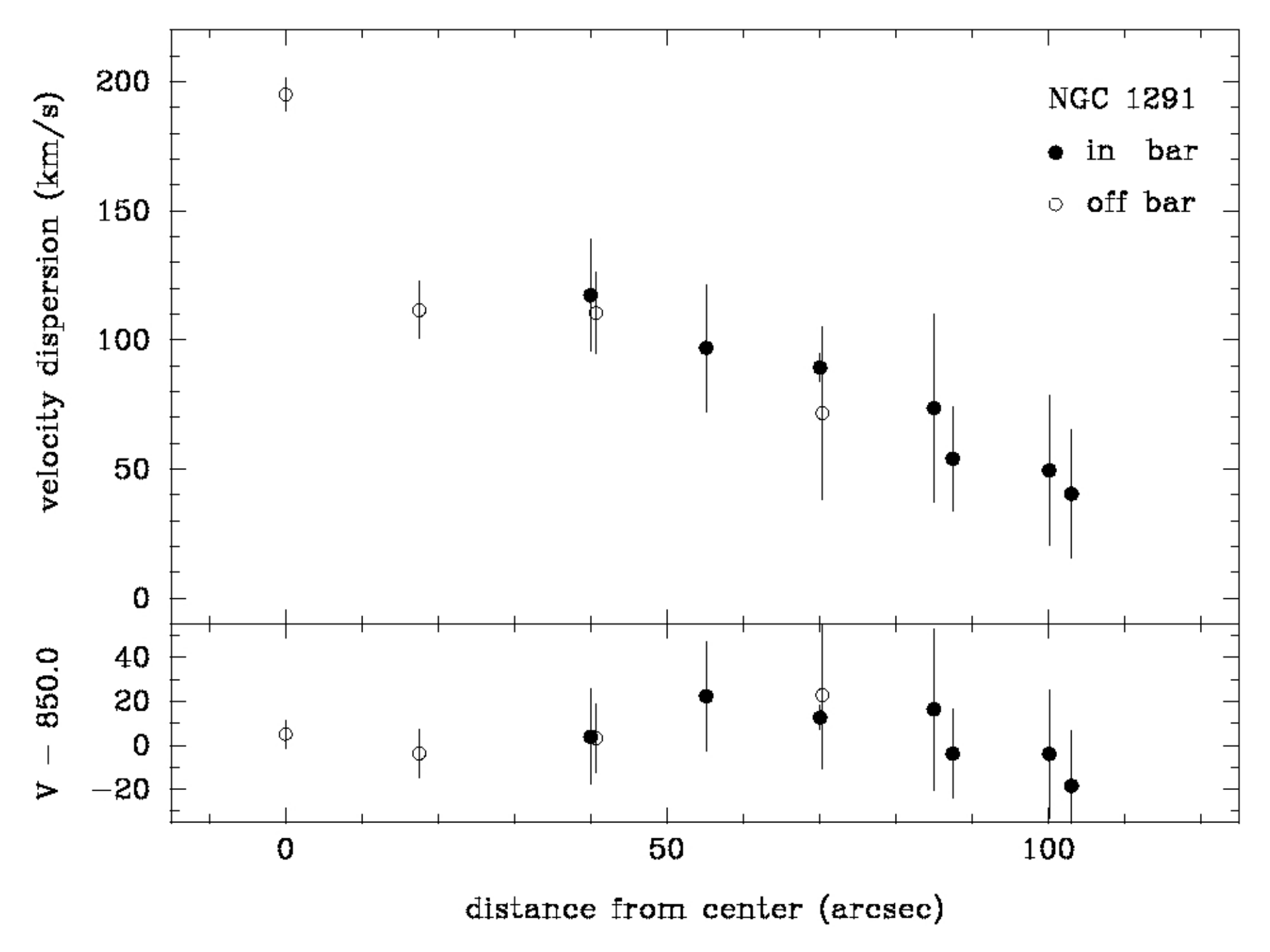


Figure 1: *left:* IFU positions for NGC 1291.

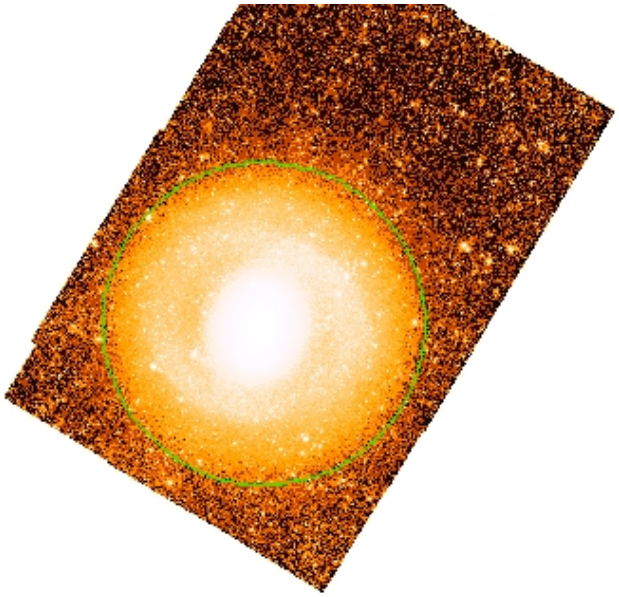


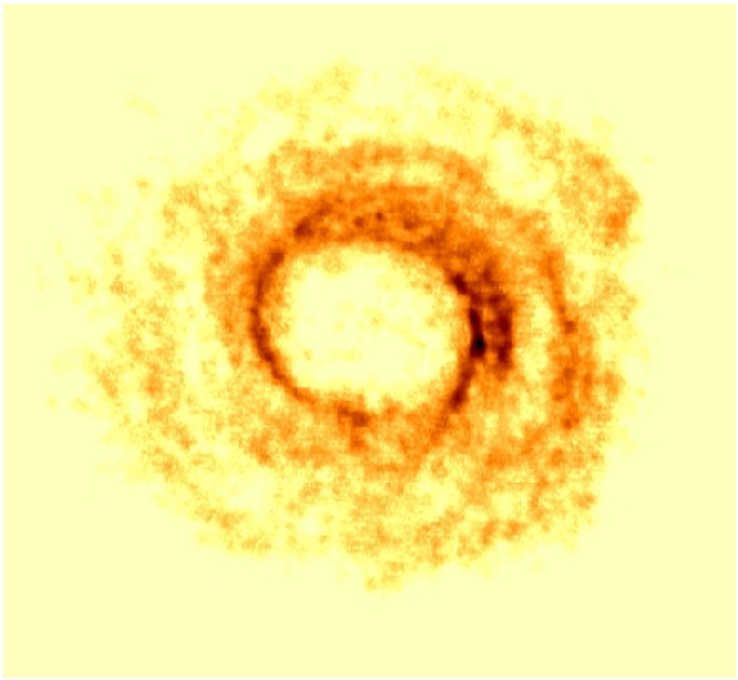
VLT observations

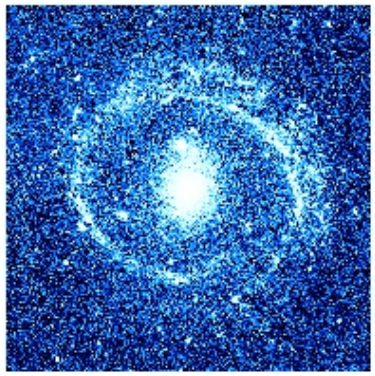
with GIRAFFE
Ca II triplet

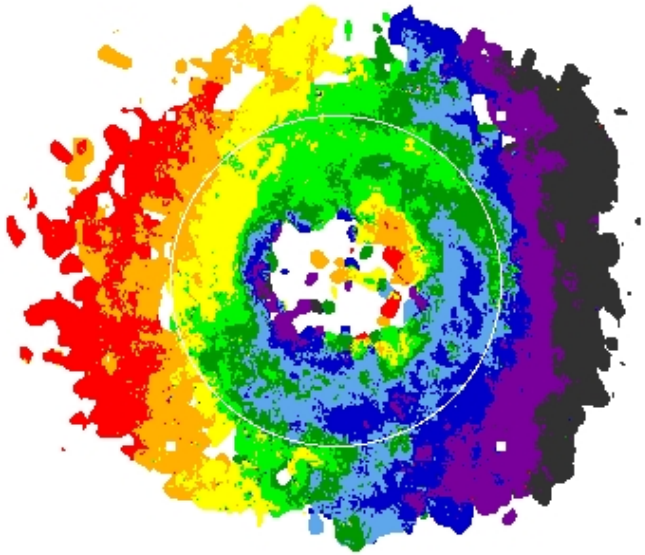

NGC 1291
in bar
off bar
velocity dispersion (km/s)
200
150
100
50
0
V − 850.0
40
20
0
−20
0
50
100
distance from center (arcsec)

HI data with Australia Telescope Compact Array

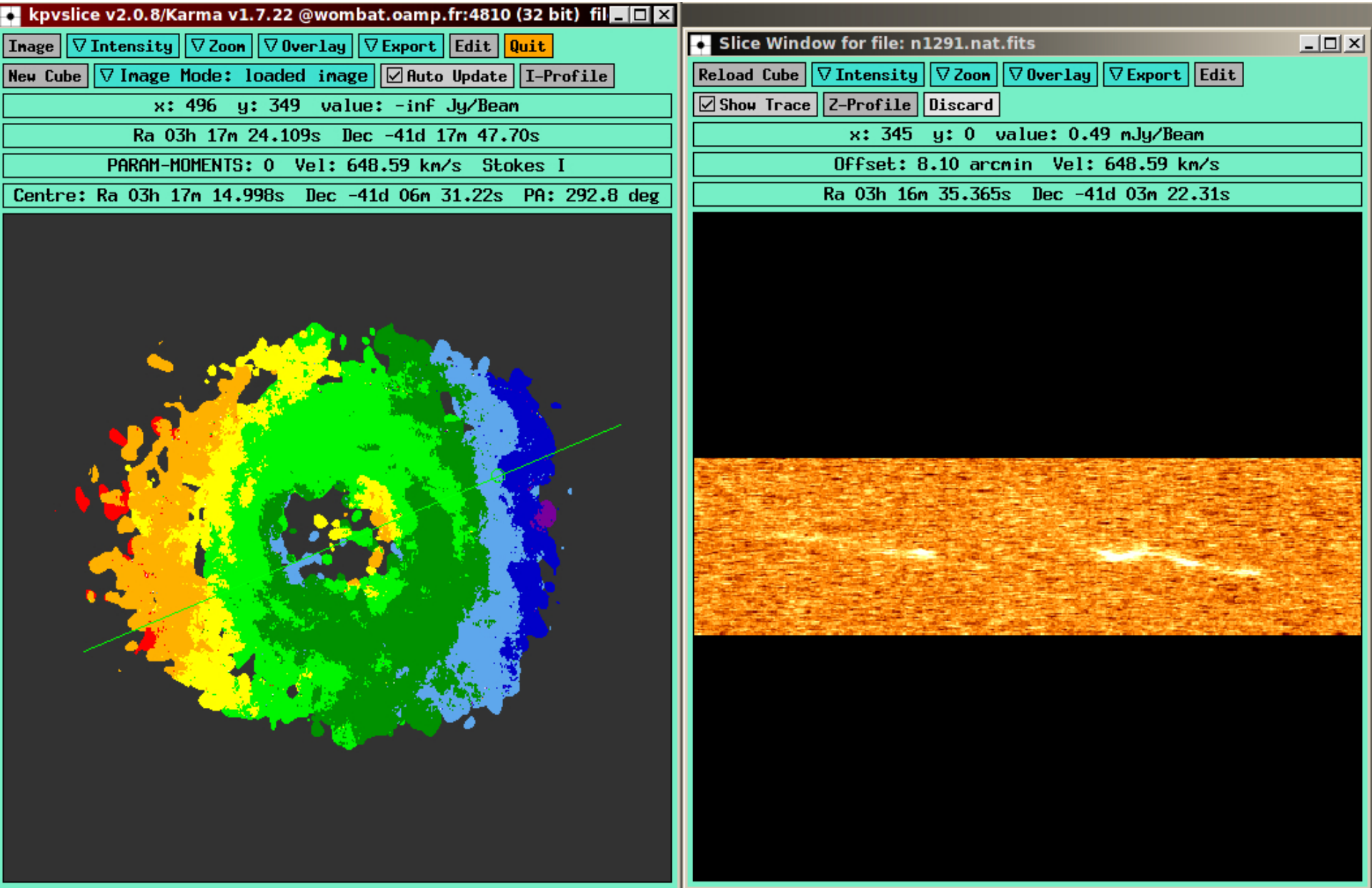






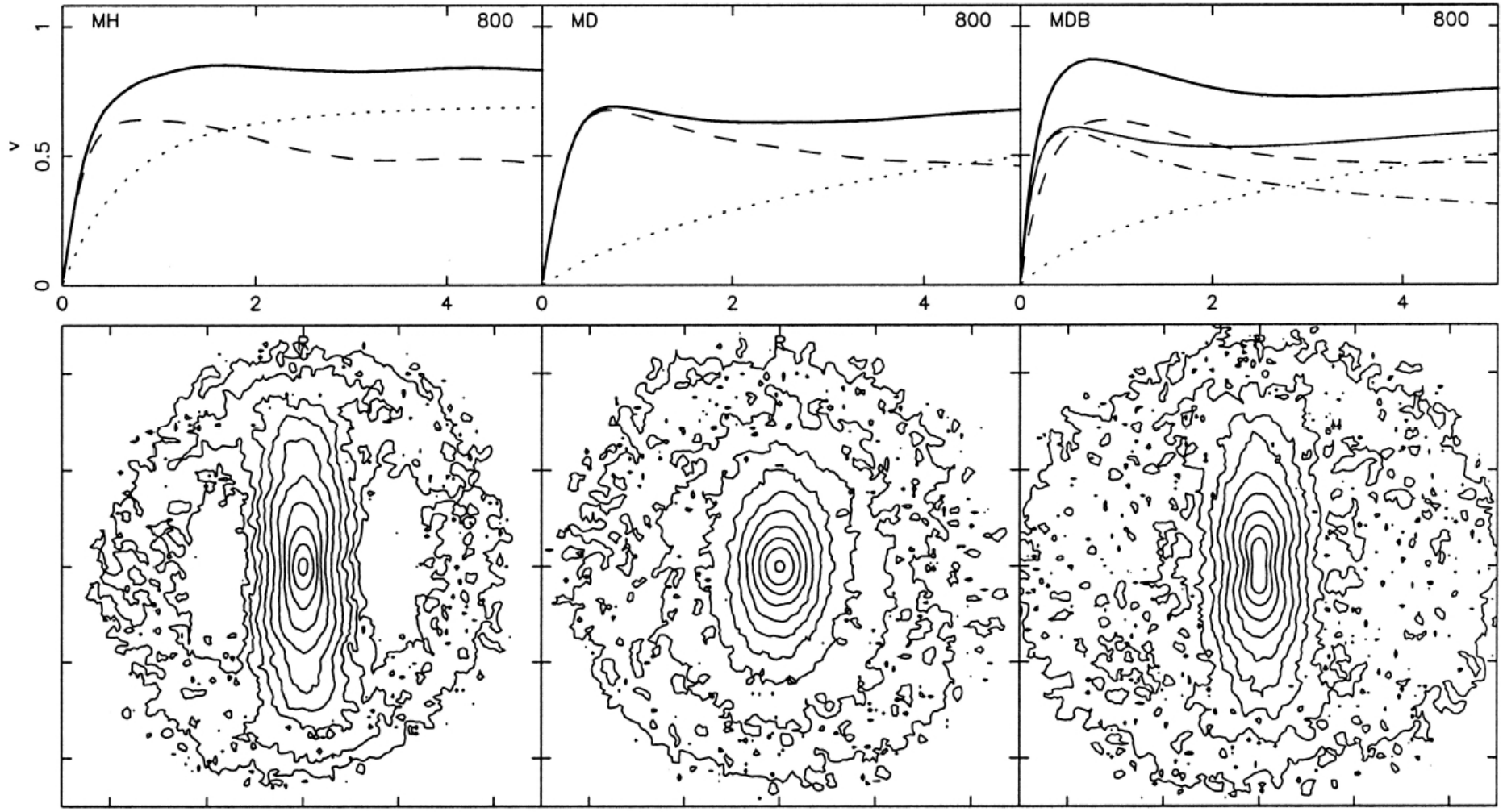


HI kinematics: position-velocity diagram



Comparison with numerical simulations

Athanassoula & Misiriotis (2002)



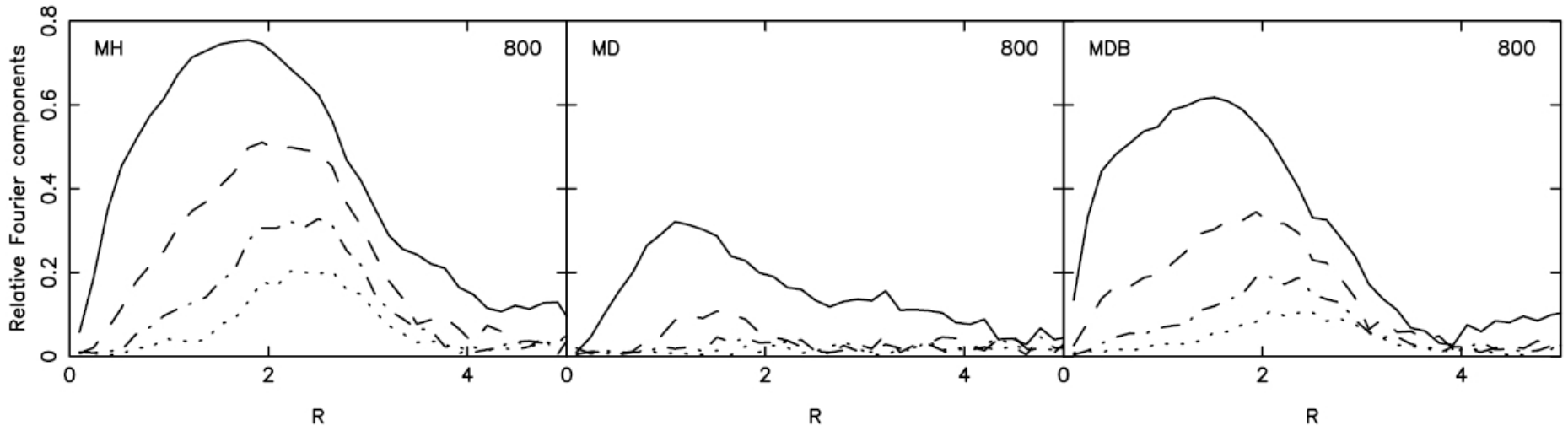
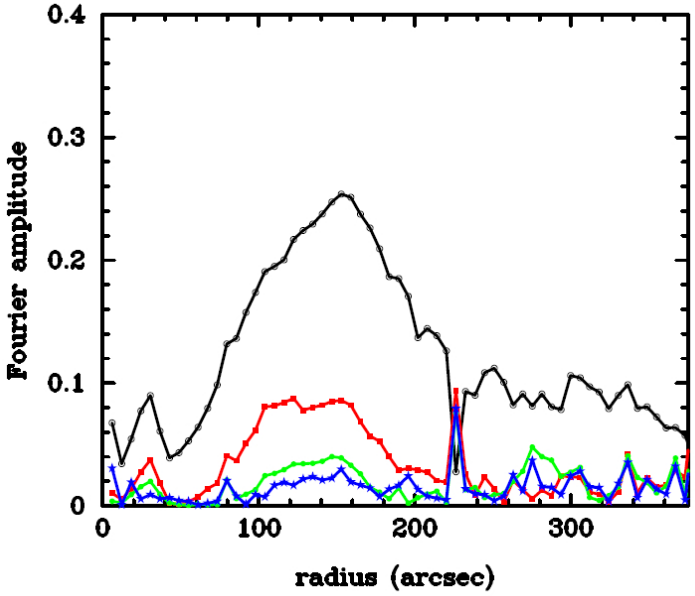


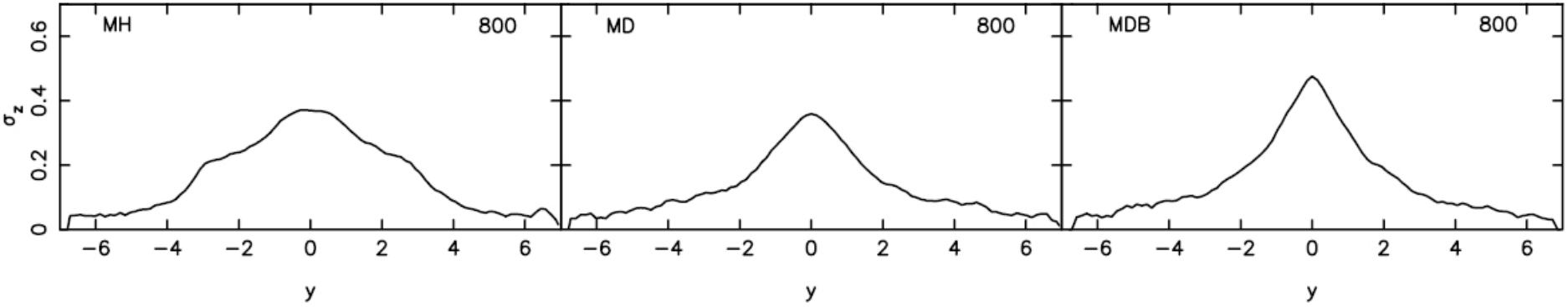
Figure 7. Relative amplitude of the $m = 2$ (solid line), 4 (dashed line), 6 (dot-dashed line) and 8 (dotted line) components of the mass or density. The left-hand panel corresponds to model MH, the middle one to model MD and the right-hand one to model MDB. The simulation number is given in the upper left-hand corner and the time in the upper right-hand corner of each panel.

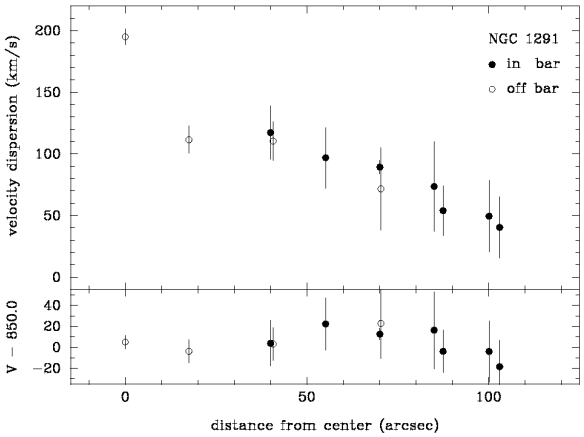
the 'bar within bar' is not simulated ...



Conclusion so far :

most likely, the bar is from a disk dominated case





S4G : Spitzer Survey of Stellar Structure in Galaxies

Sheth et al. (30 people) warm mission programme

- about 2300 galaxies within 40 Mpc
- 3.6 and 4.5 μm images
- some of the goals are :
    - the outer disks of galaxies
    - scaling relations, etc.
    - surveys of bars, rings, lenses, spiral arms
    - relation with environment
- website : http://s4g.caltech.edu