First Results of the VEGAS Survey: the SOs at the center of the Fornax cluster

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on the behalf of the VEGAS team:
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Partners

Italy: INAF (Napoli & Teramo); Univ. of Naples;
Univ. of Padova;
USA: Univ. of California; Lick Obs.
Australia: Swinburne Univ.

VEGAS: VST survey of Elliptical GAlaxies in the South hemisphere

Why VEGAS?

The large FOV, high efficiency, and spatial resolution of OmegaCAM @ VST allow us to map the surface brightness of galaxies from their cores to the regions where about 90% of the total light is enclosed.

VEGAS: Main Science Aims

- **SB out to 8-10 Re:** physical correlations among structural parameters (total luminosity, Sersic index, Re, ellipticity, boxiness/diskiness);

- **g-r, g-i colour gradients** to unprecedented galactocentric distances and the connection with galaxy formation theories;

- **Globular Clusters:** color and density distribution; luminosity function; comparison of GCs integrated colors to the theoretical models (multiple episodes of formation of GCs);

- **SB fluctuations:** for distance and chemical characterization of the stellar population out to 2-3 Re;

- **Stellar M/L:** stellar masses from SP synthesis models, M/L gradients;

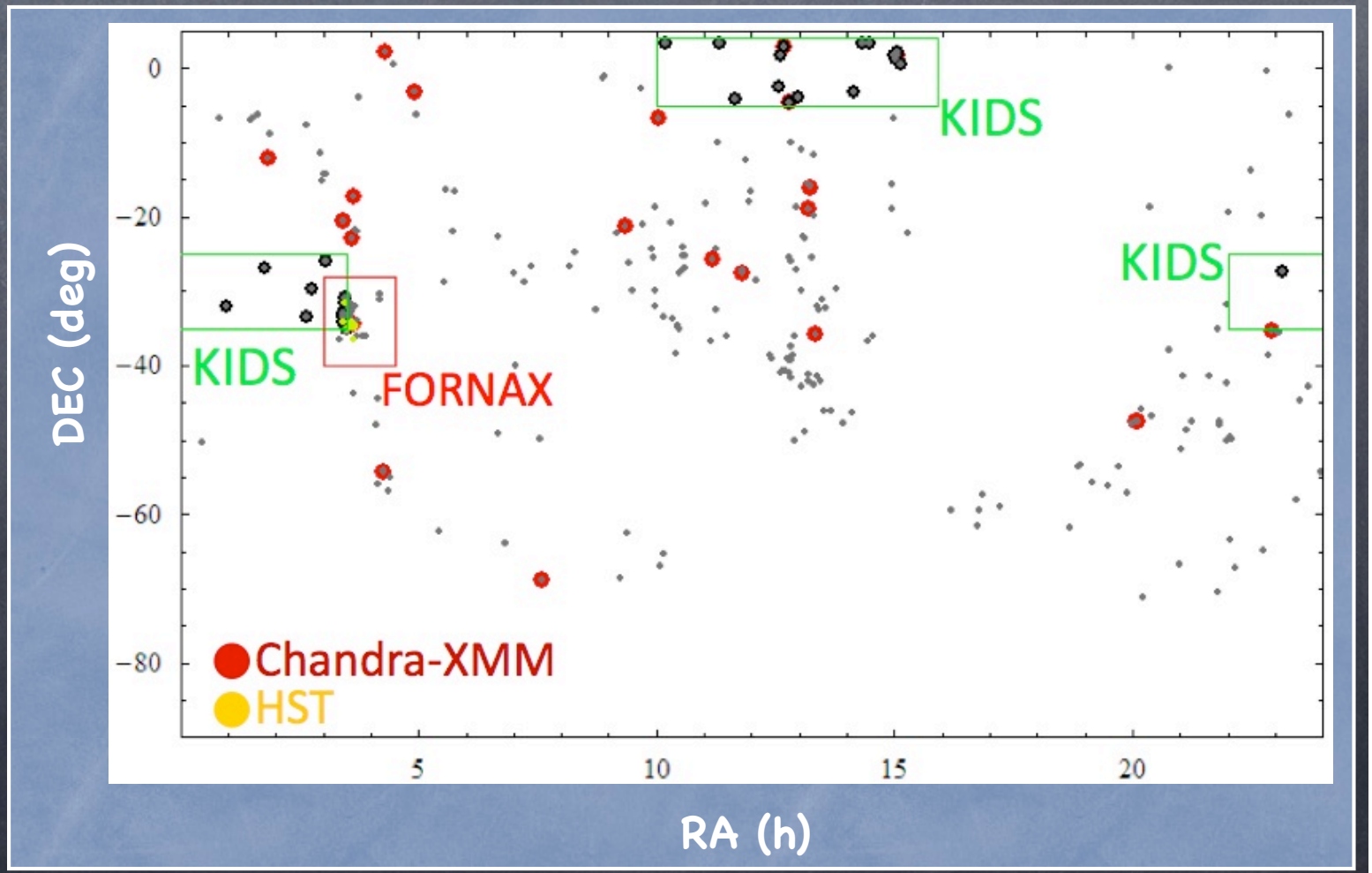
- **Long-lived external structures**, ICL, **connection with the environment**

- **Satellites galaxies:** mainly dwarfs

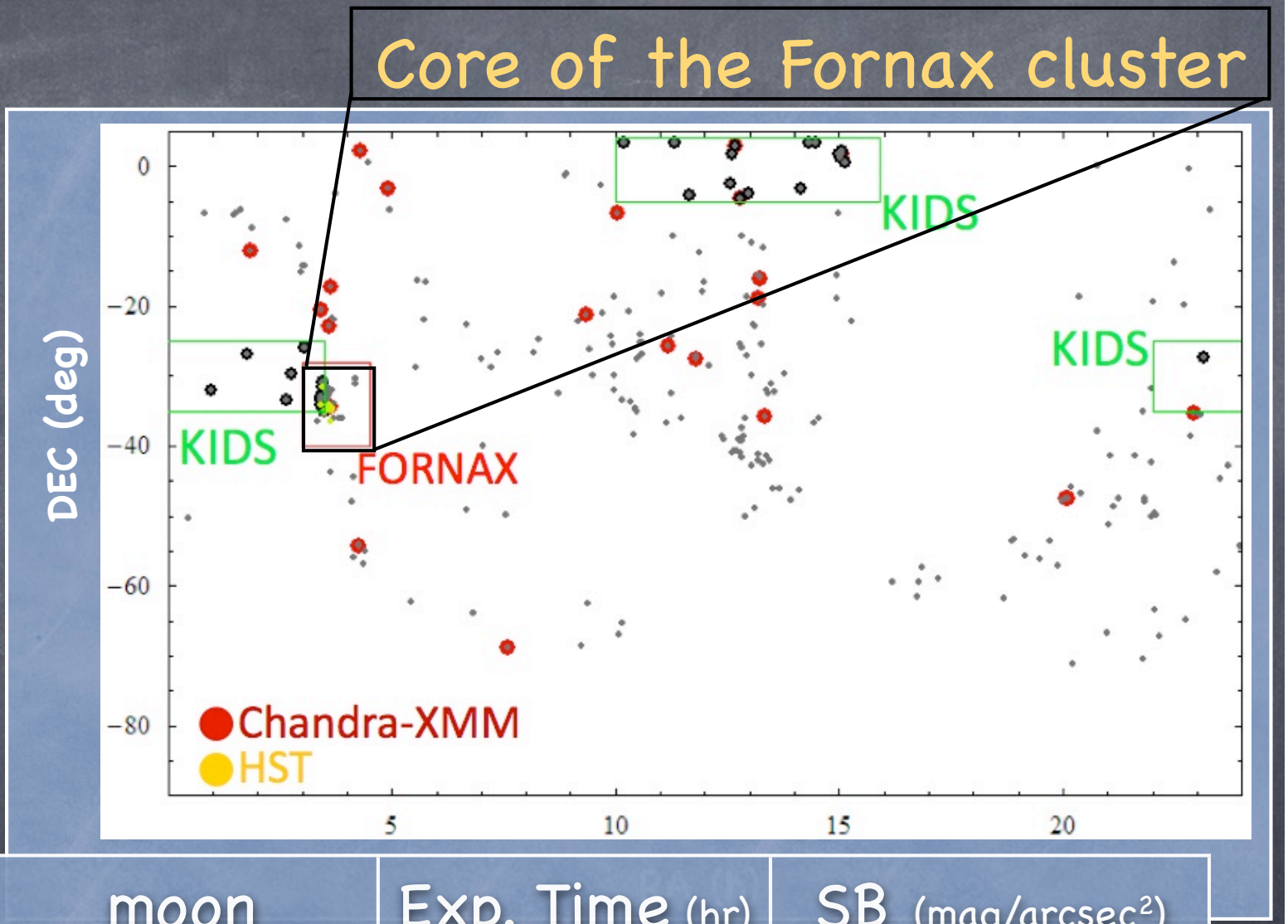
VEGAS: Survey Specifications

- **Multiband (u g r i) optical survey** of ~110 galaxies with V_{rad} < 4000 km/s in all environments (field to clusters)

- **Expected SB limits:** 27.5 g , 27.0 r , 26.2 i mag arcsec^{-2} (S/N=10 per arcsec^{-2}).



VEGAS first observations:



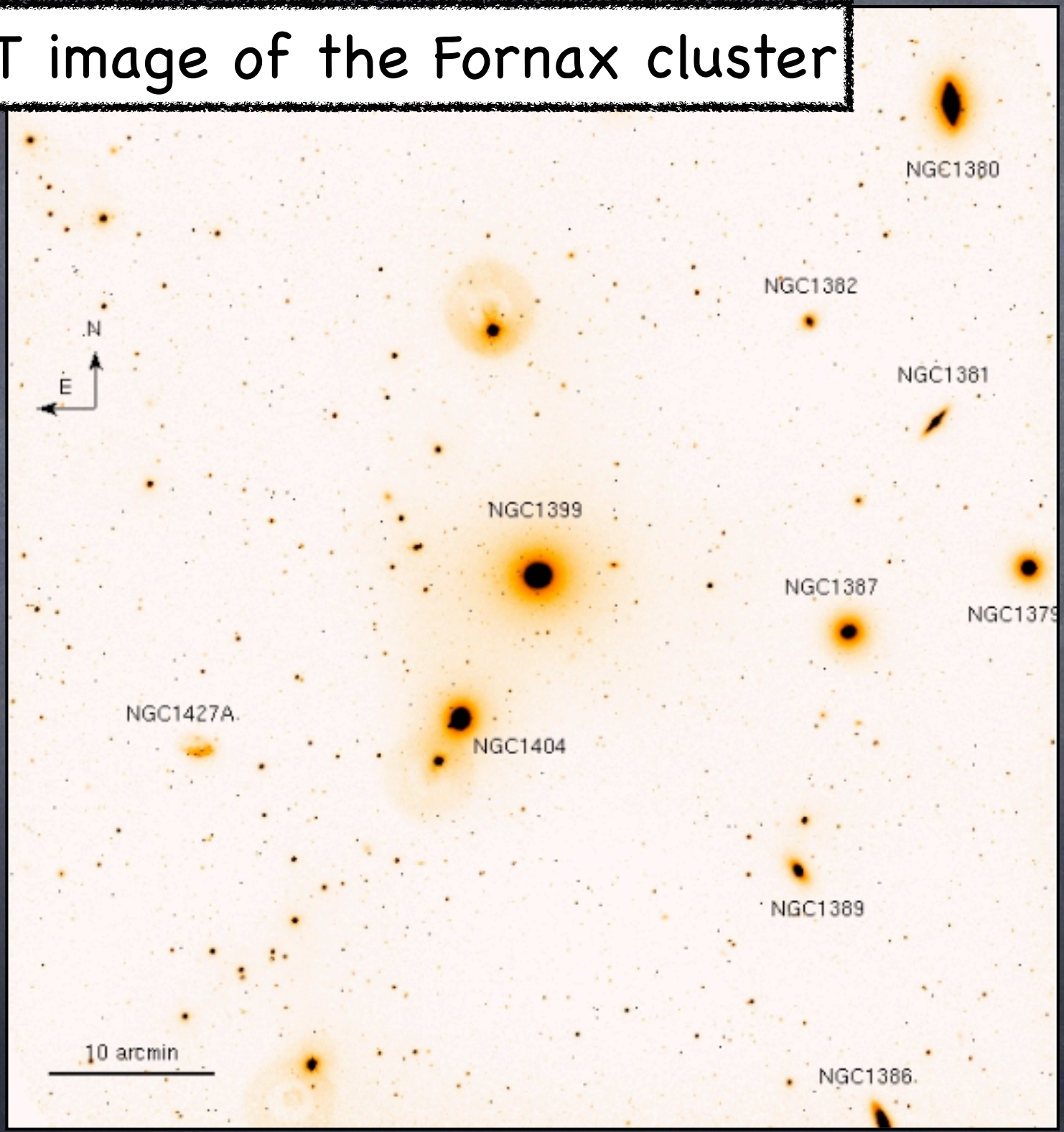
Band	moon	Exp. Time (hr)	SB (mag/arcsec²)
g	dark	1.7	27.5
r	dark	1.3	27
i	grey	1	26.2

Data reduction

Pipeline developed in Naples
by A. Grado & L. Limatola

- from raw data to fully calibrated images
- report on the data reduction (with QC plots)
- it includes a growing set of analysis tools, as:
  - mask of bright stars & halos
  - cold/hot pixel mask
  - aperture & PSF photometry
  - Surface Brightness Profile (SBP) tool for the background fit and profiles extraction

The VST image of the Fornax cluster



Background Removal

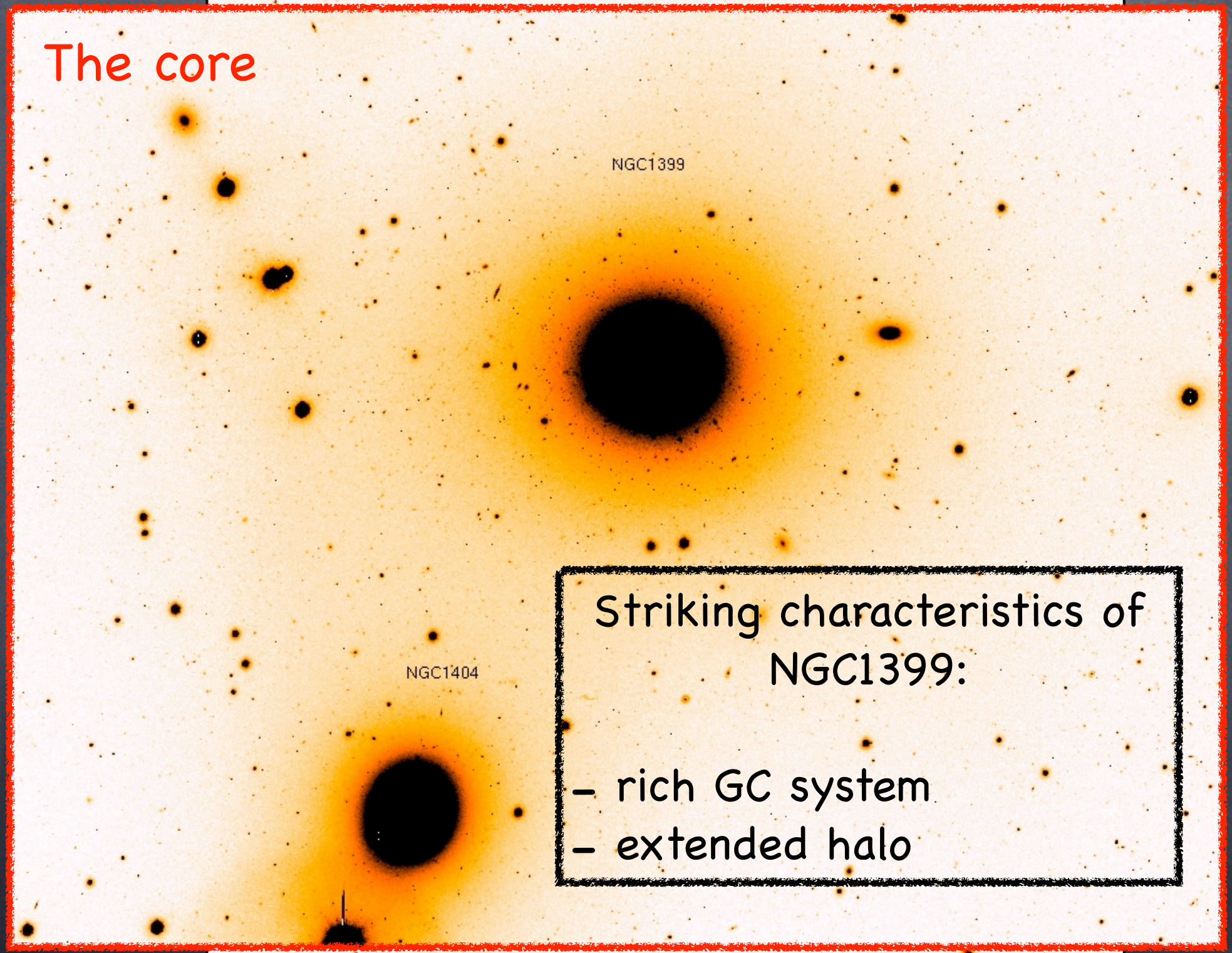
One needs to account for two signal components:
additive + multiplicative

Adopted steps:

- illumination correction to the whole field

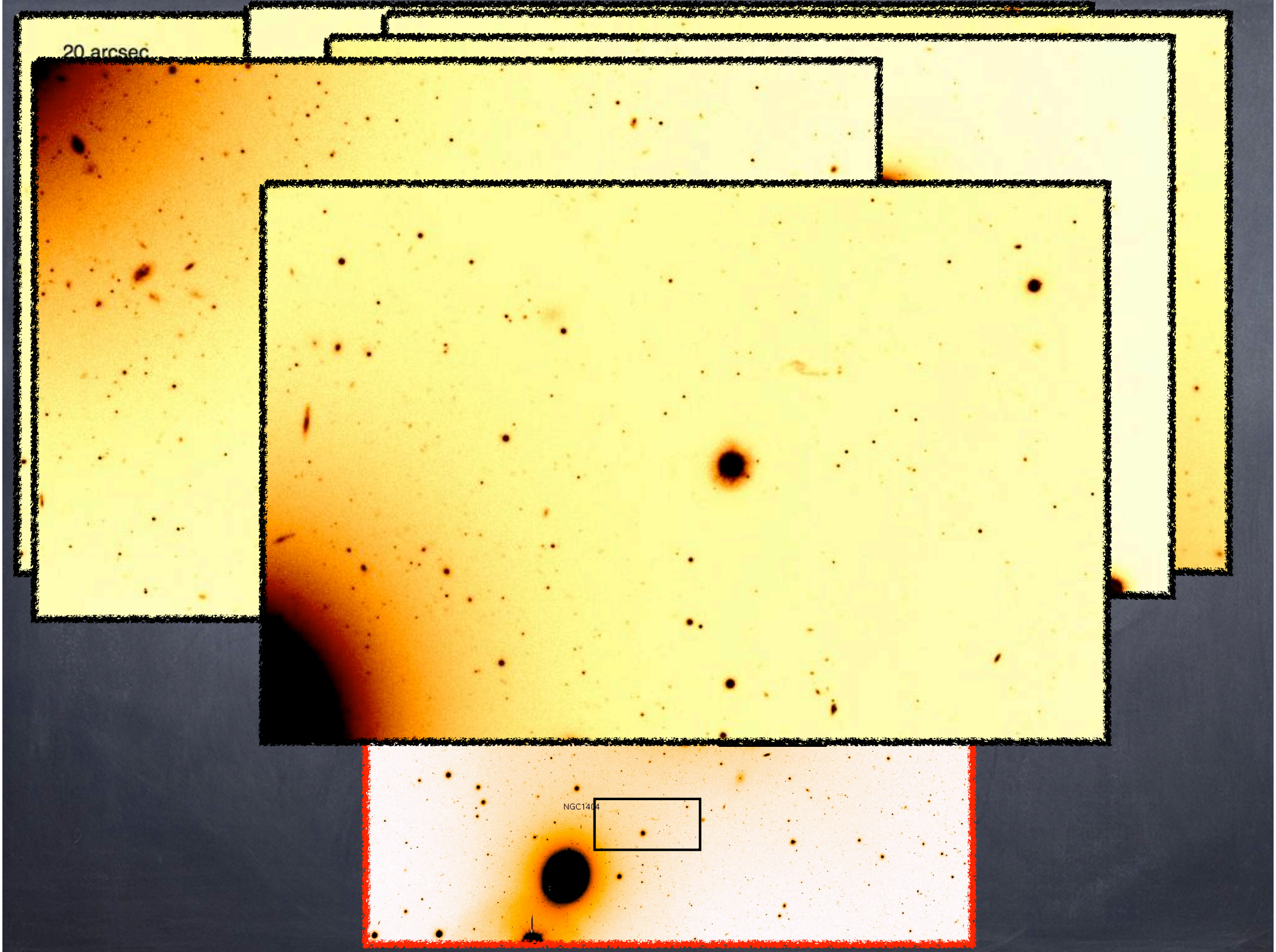
- fit of the residual background on a smaller area (≈ 3 times the galaxy diameter) around each galaxy, by using an higher order 2D polynomial

The core



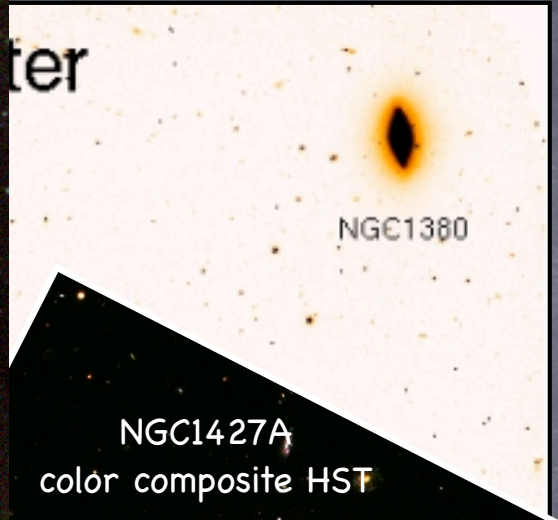
Striking characteristics of NGC1399:

- rich GC system
- extended halo

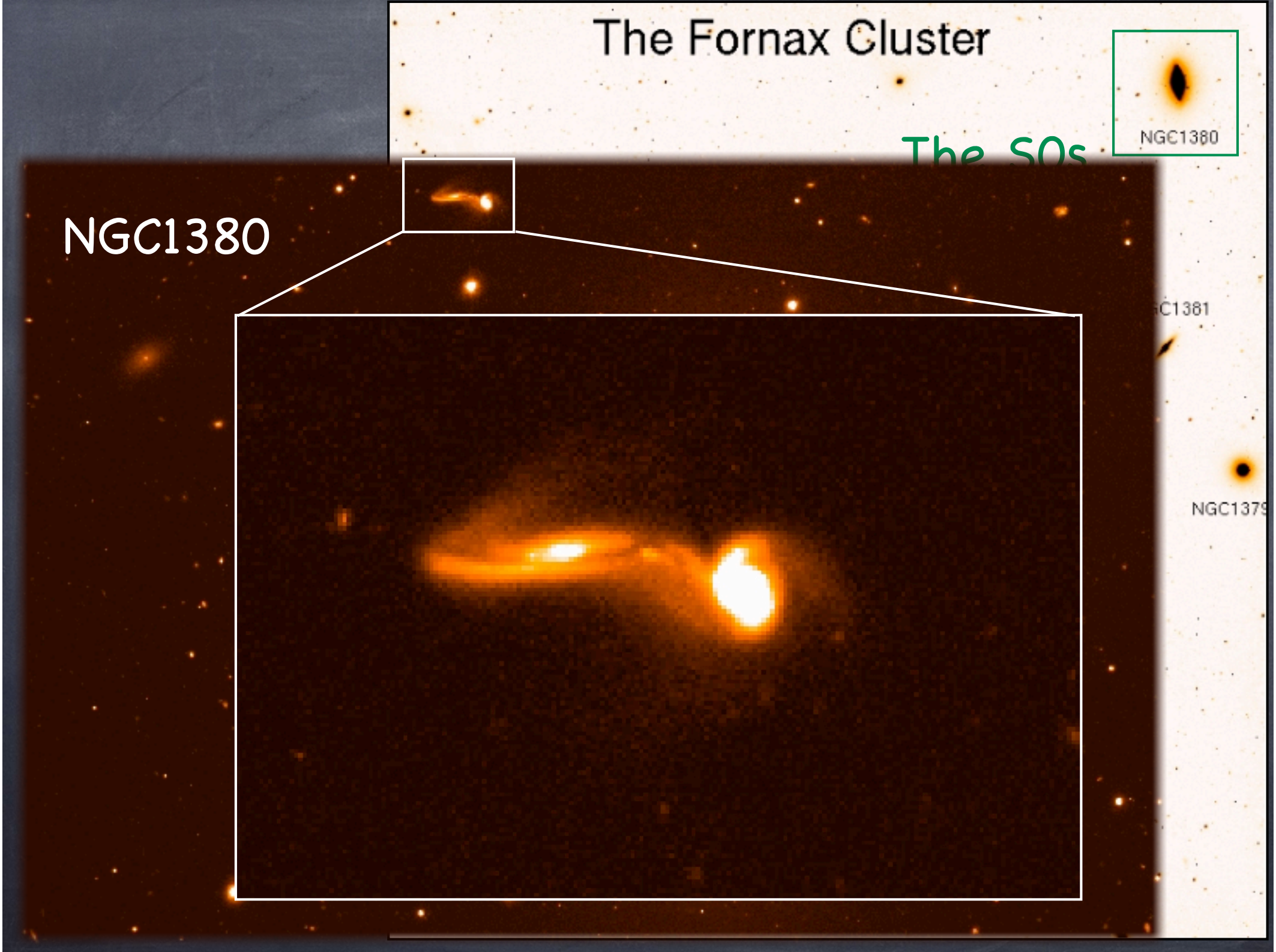

20 arcsec
NGC1404

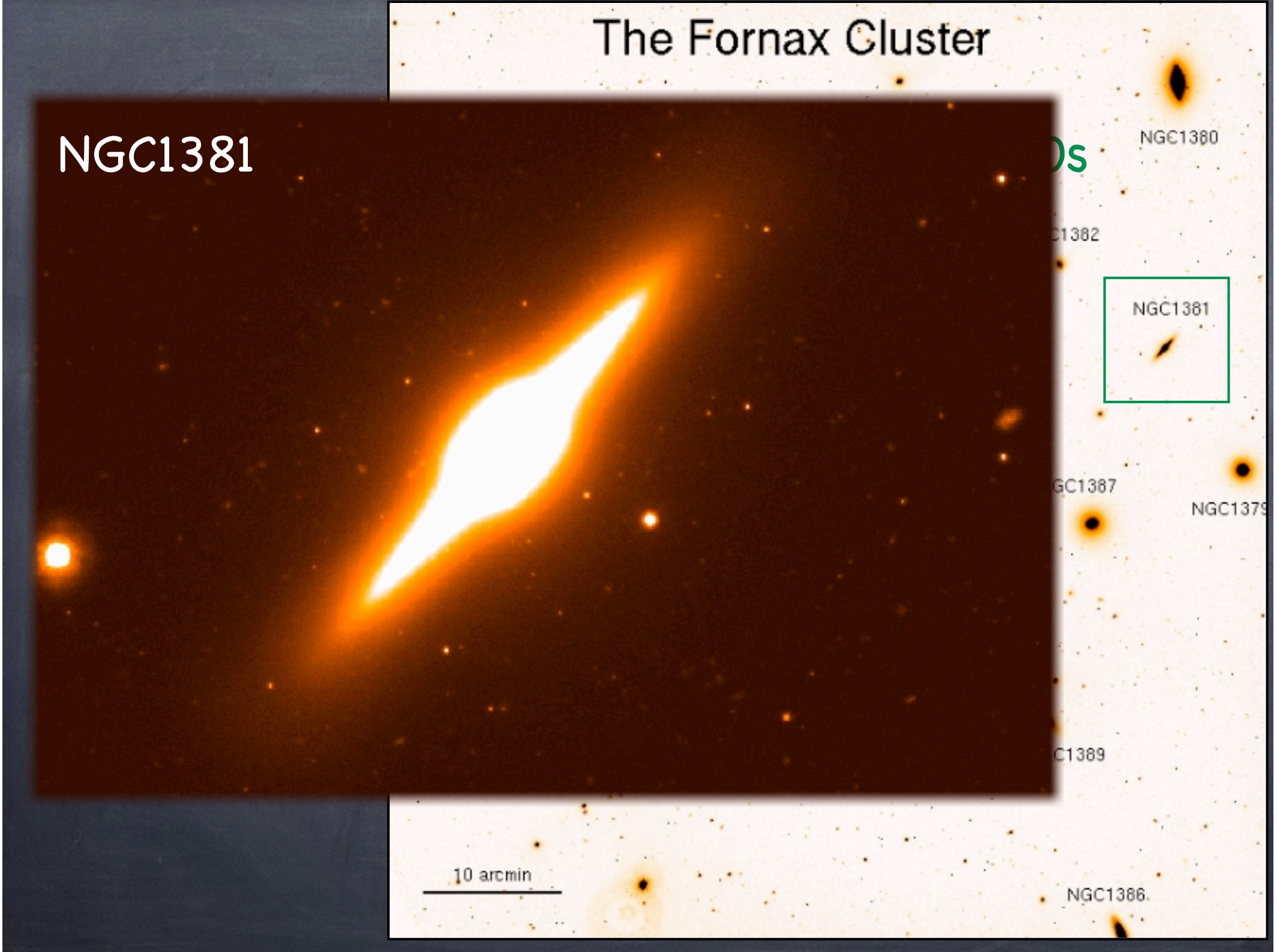
NGC1427A

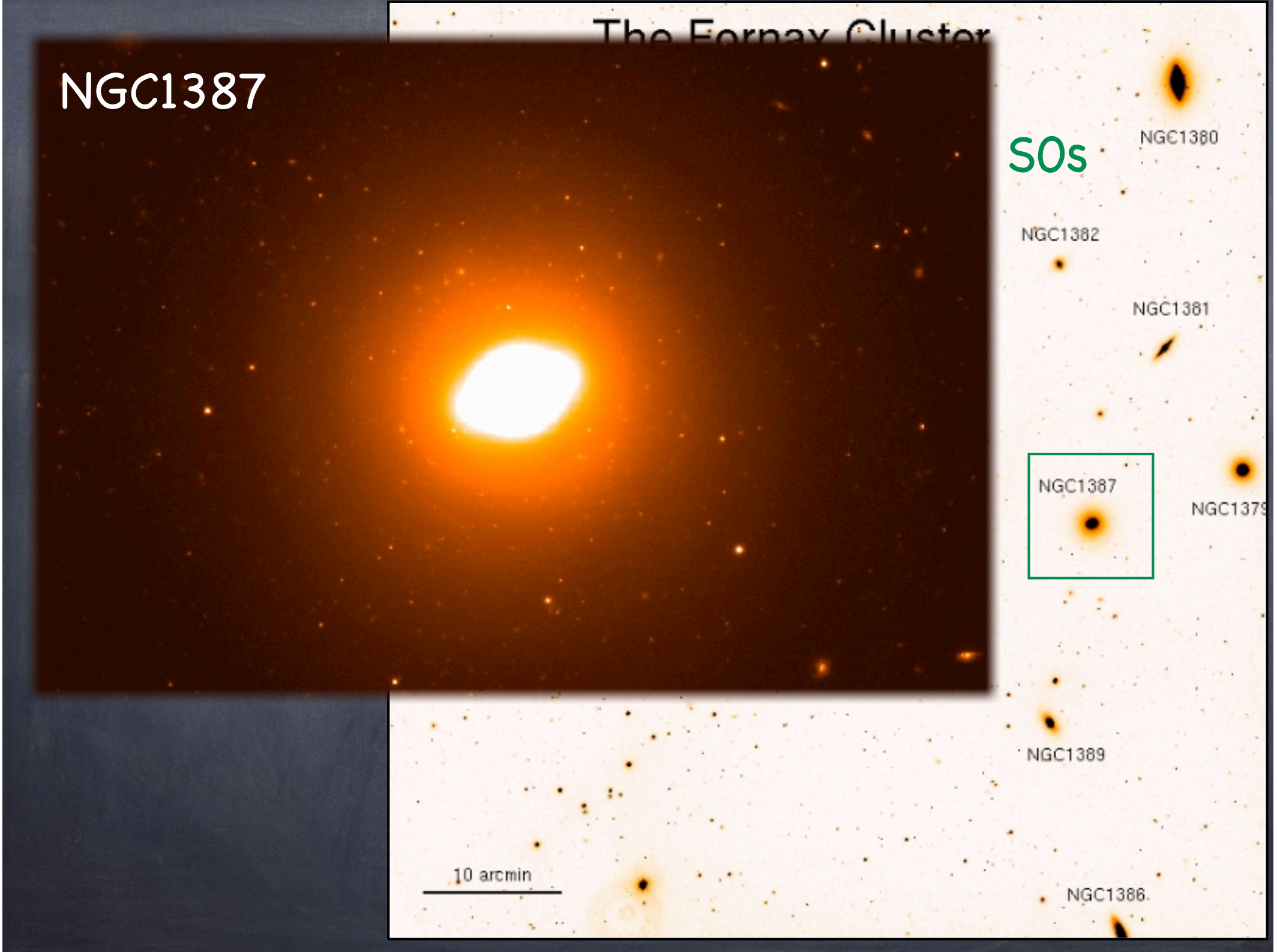
color composite VST g' r' i' bands,
by A. Grado

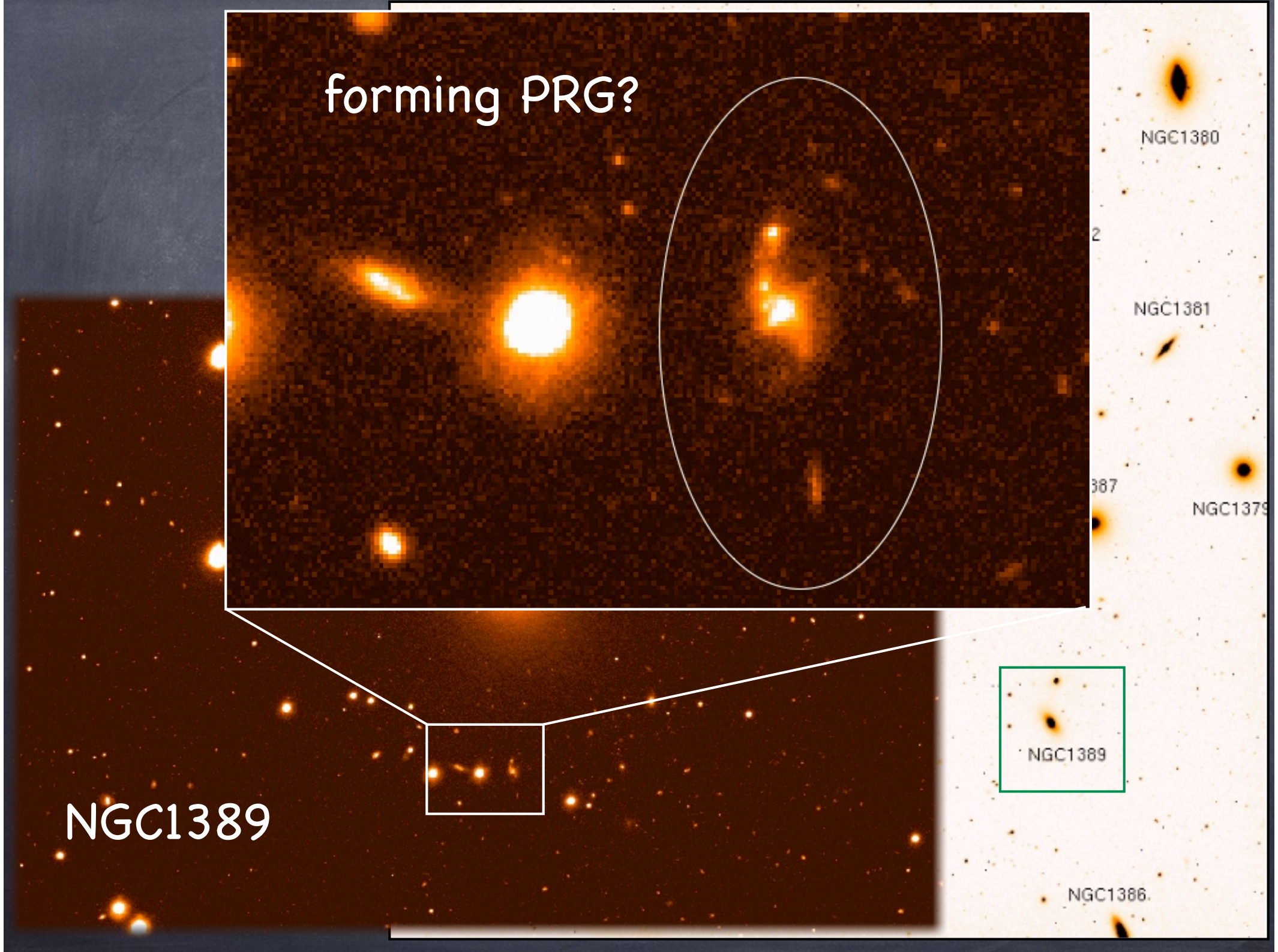


- the only gas-rich irregular galaxy in the cluster
- prominent blue knots of ongoing star formation
- isolated -> interaction with cluster

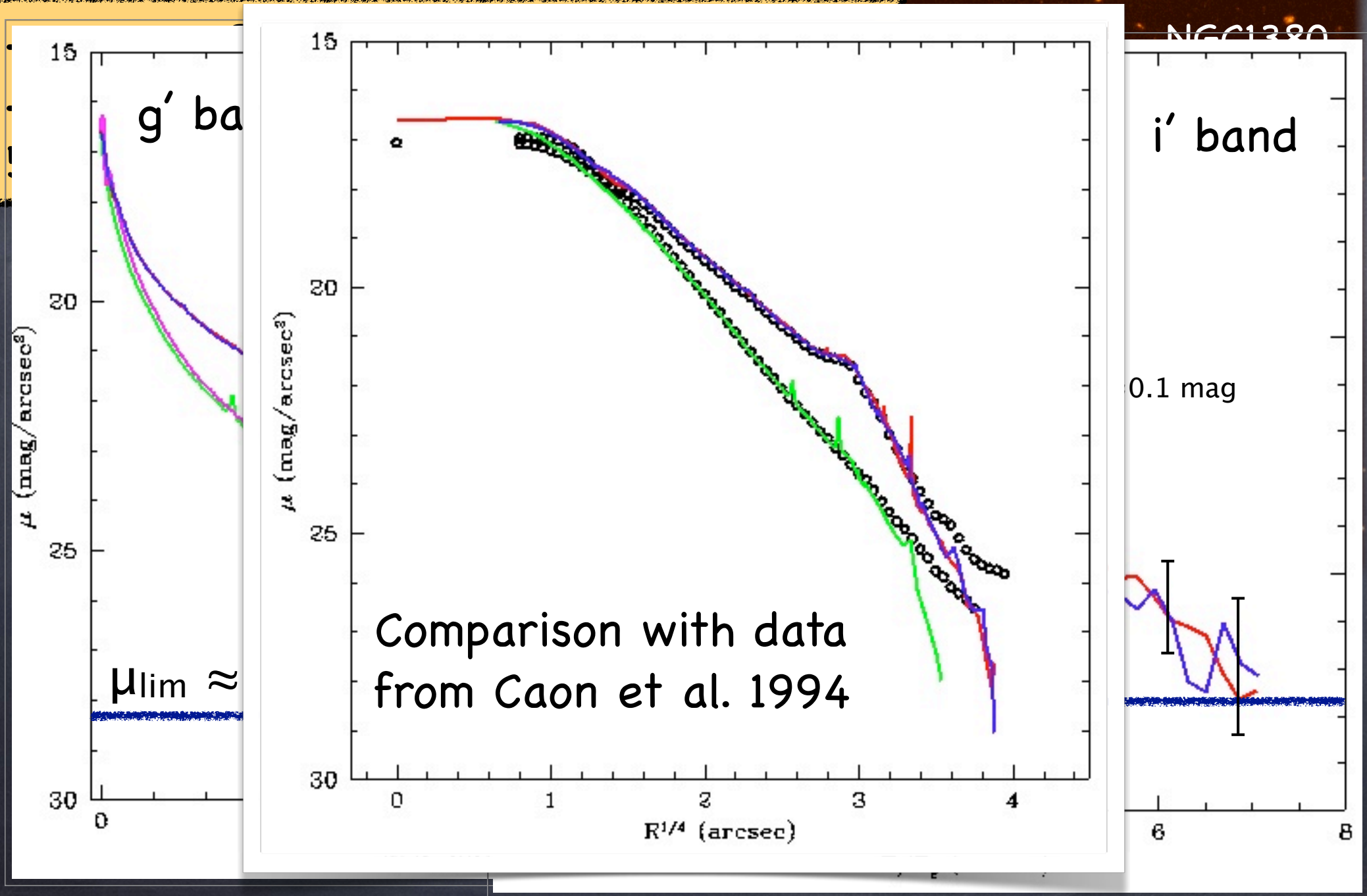

The Fornax Cluster
NGC1380
The S0s
NGC1380
C1381
NGC1379


The Fornax Cluster
NGC1381
NGC1380
NGC1381
NGC1387
NGC1389
NGC1386
10 arcmin


NGC1387
The Fornax Cluster
S0s
NGC1380
NGC1382
NGC1381
NGC1387
NGC1379
NGC1389
NGC1386
10 arcmin


forming PRG?
NGC1389
NGC1380
NGC1381
NGC1389
NGC1386

Light profiles along principal axes



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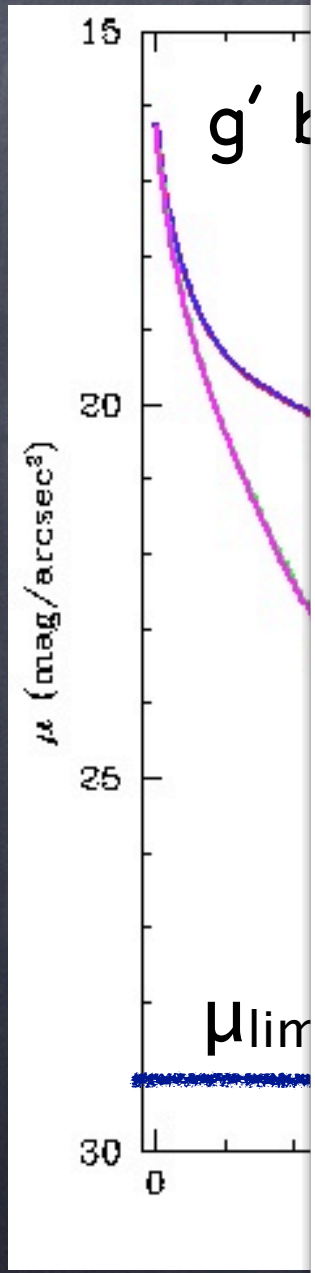
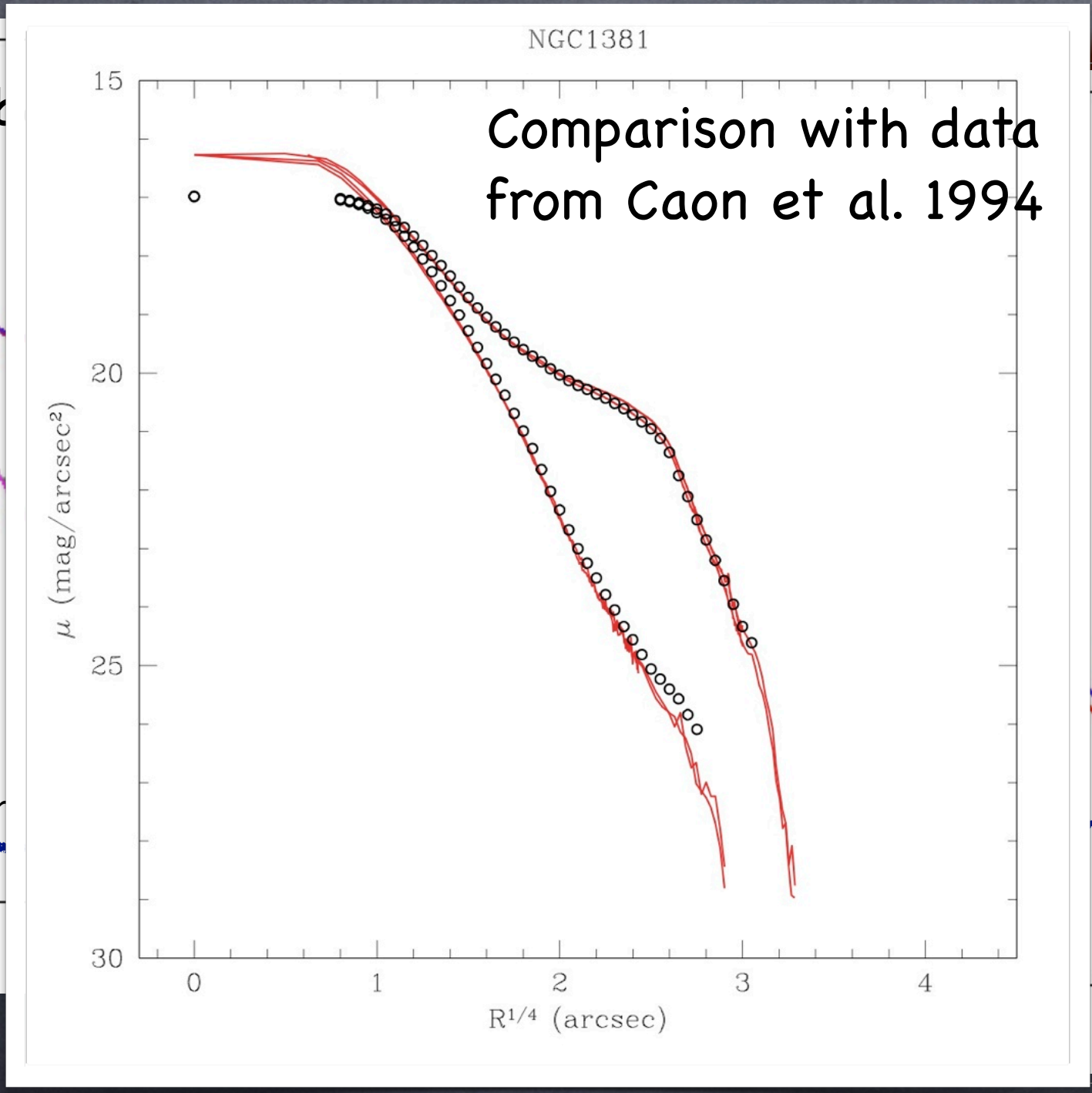
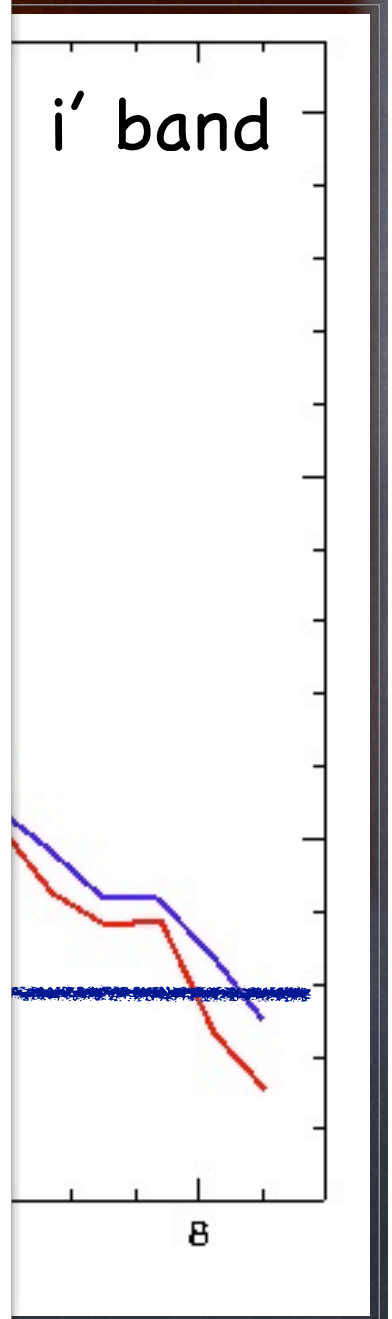
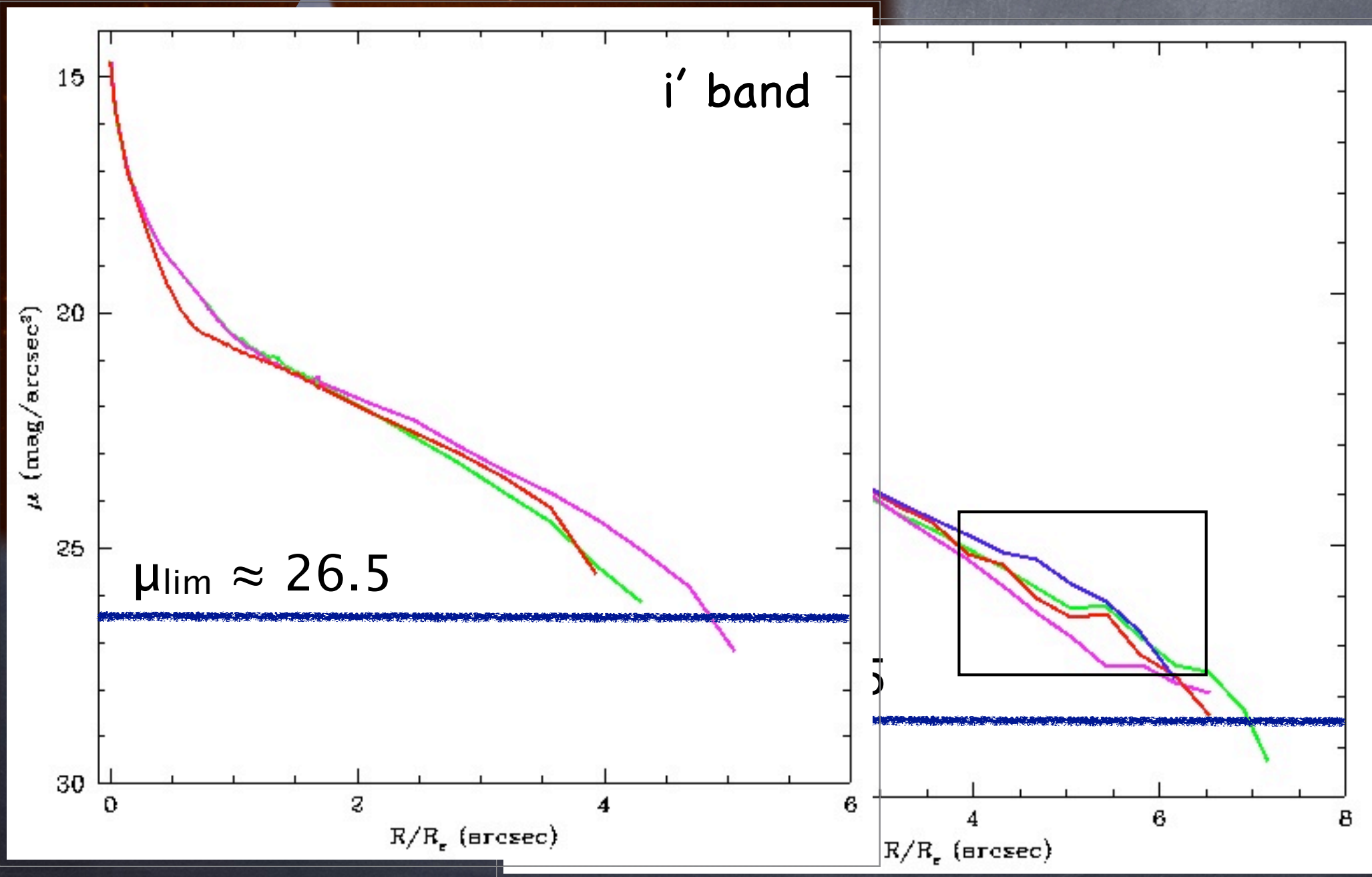




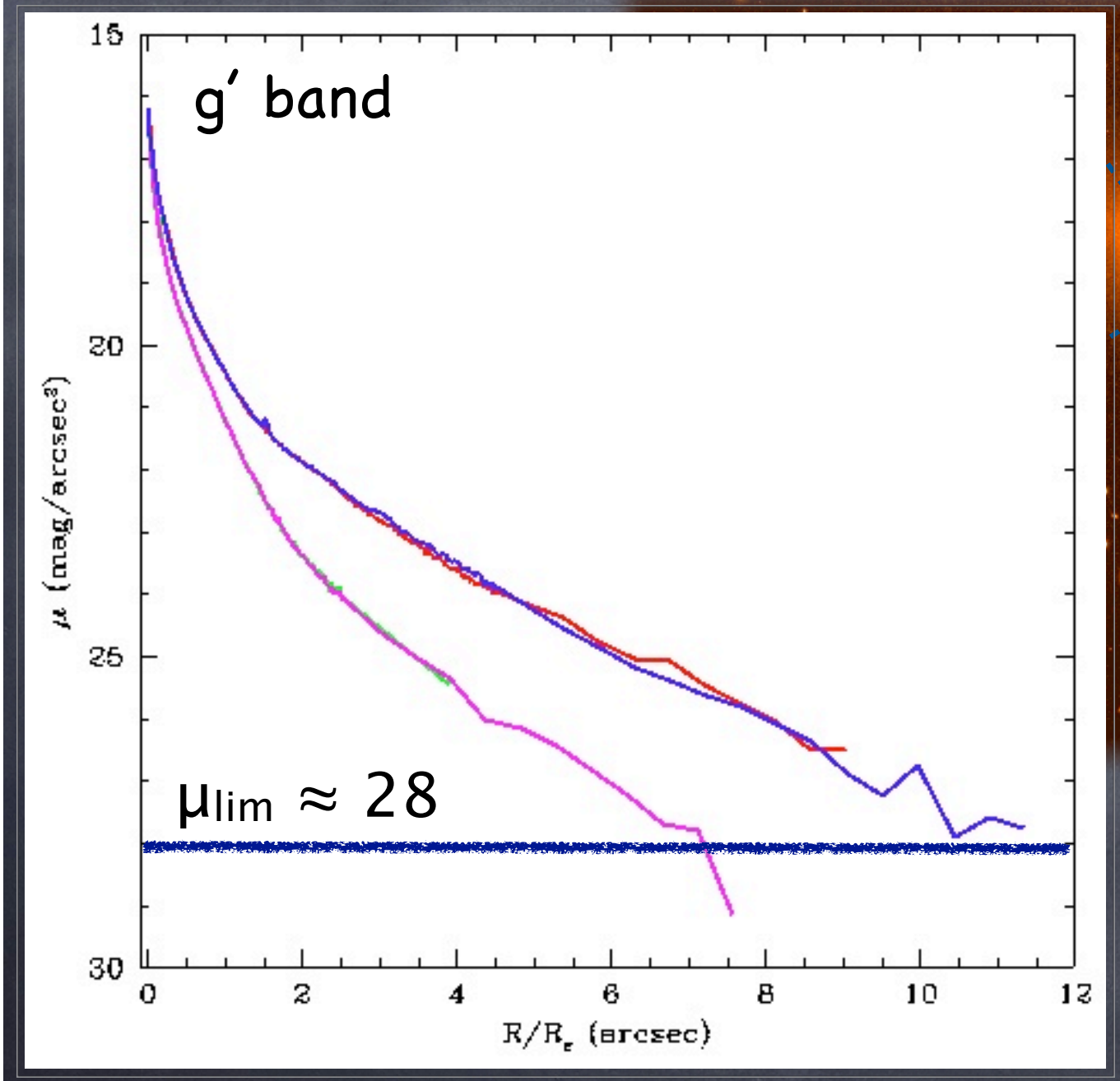


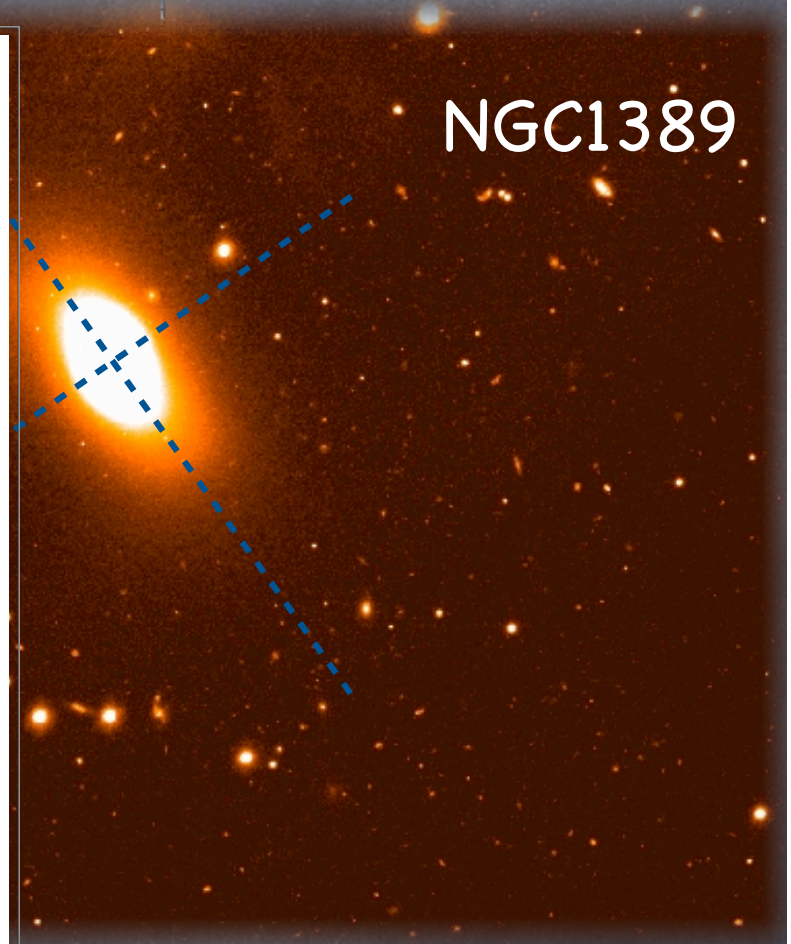
Light profiles along principal axes

NGC1387



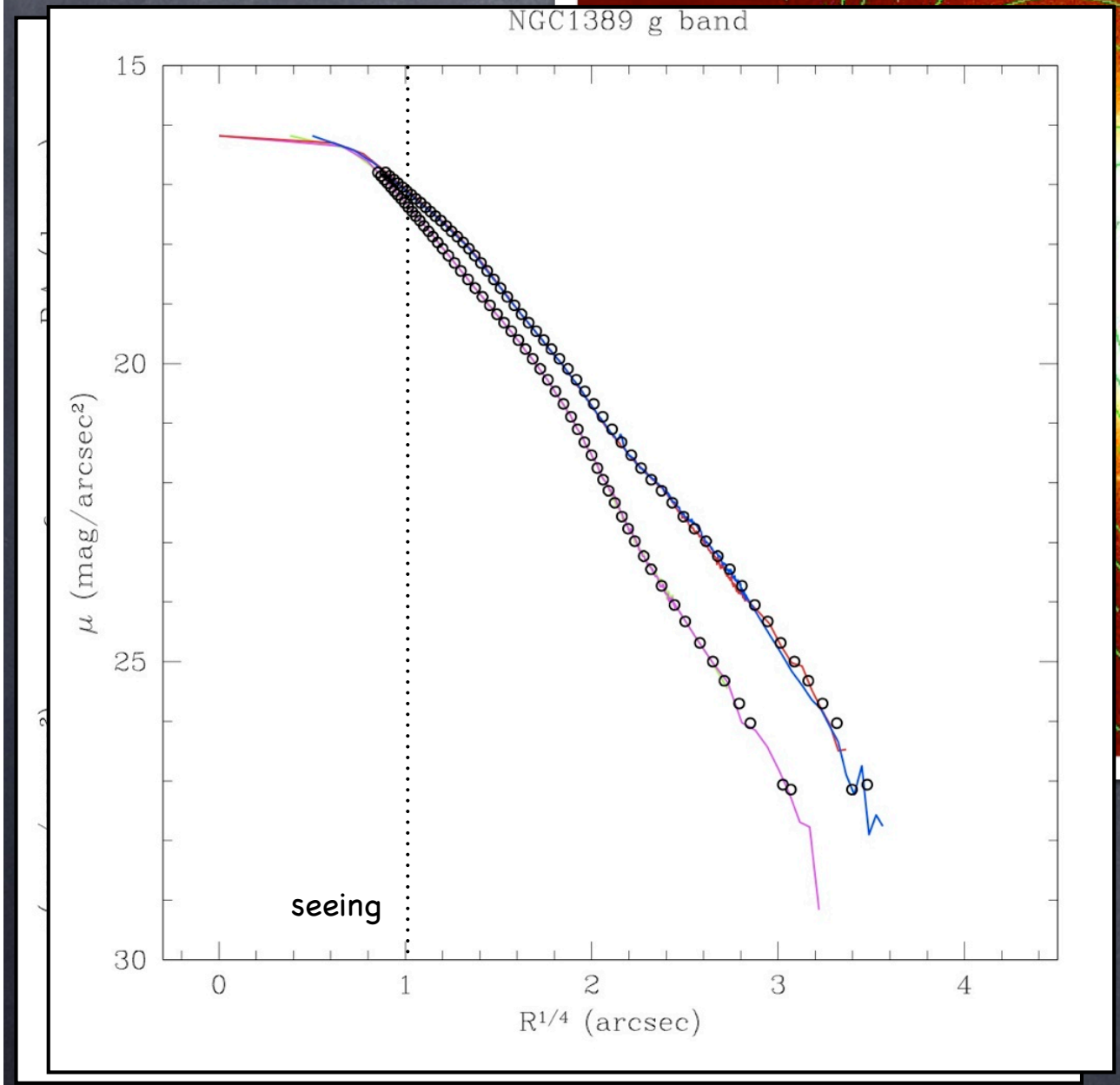
Light profiles along principal axes

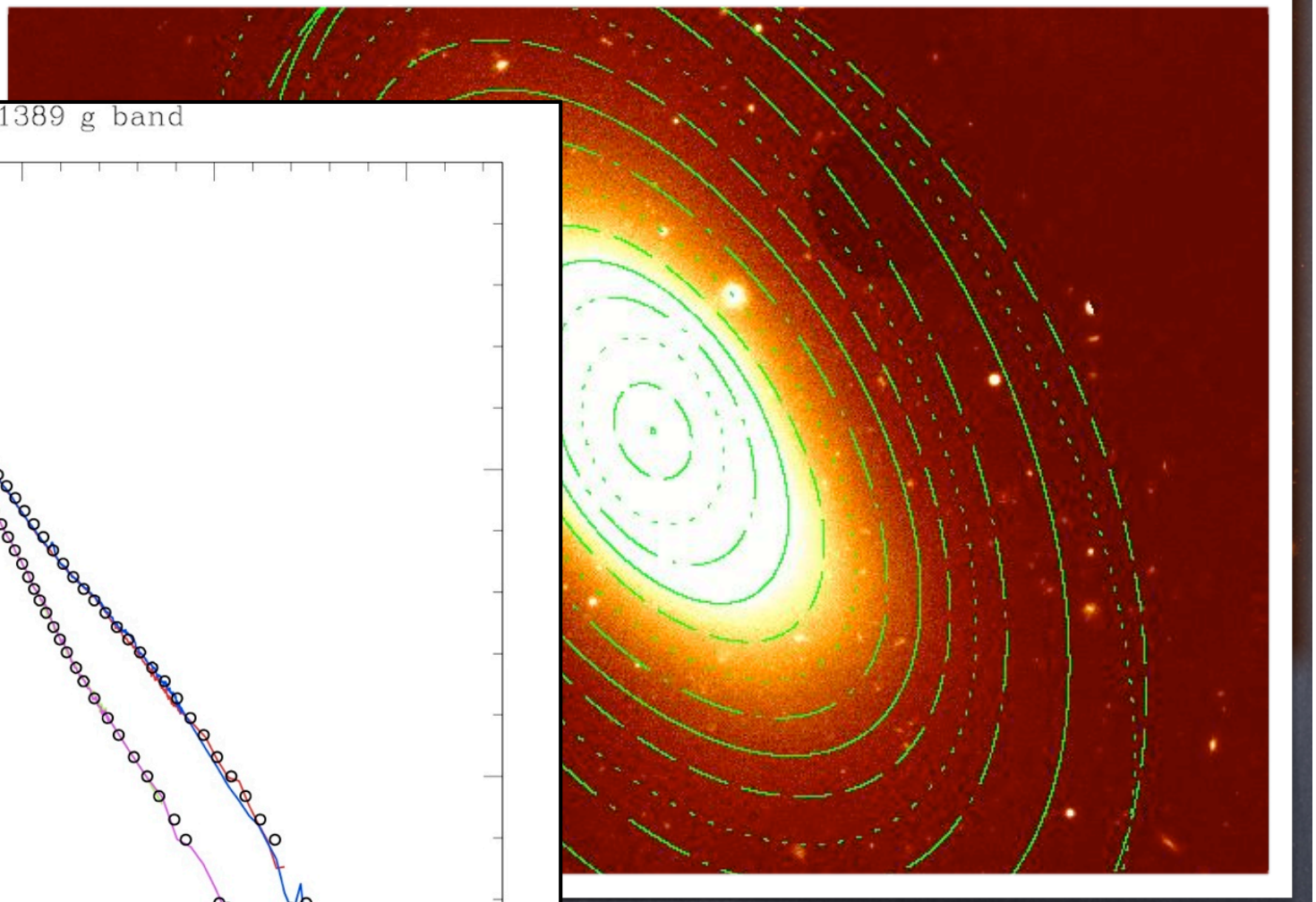




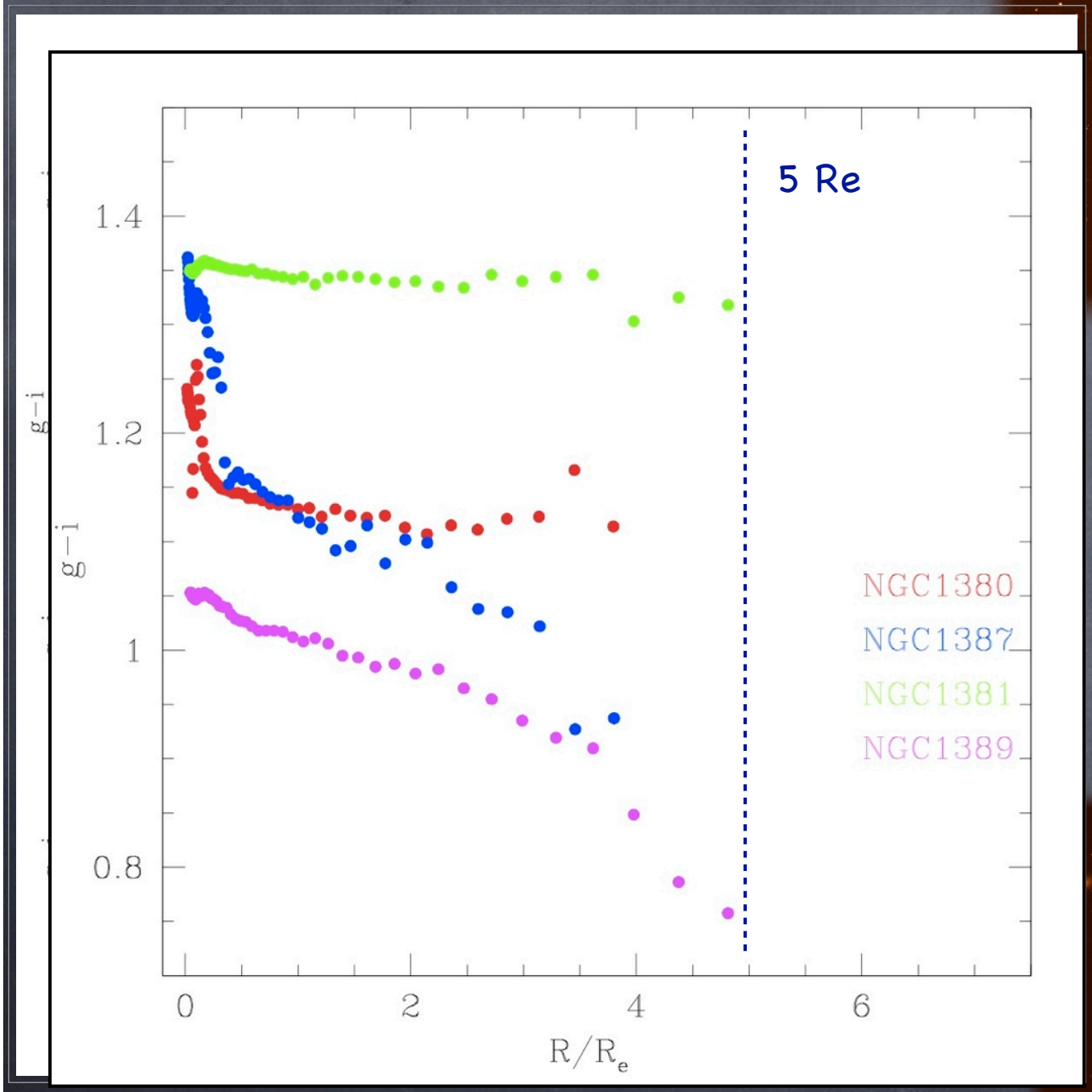
isophote fitting:

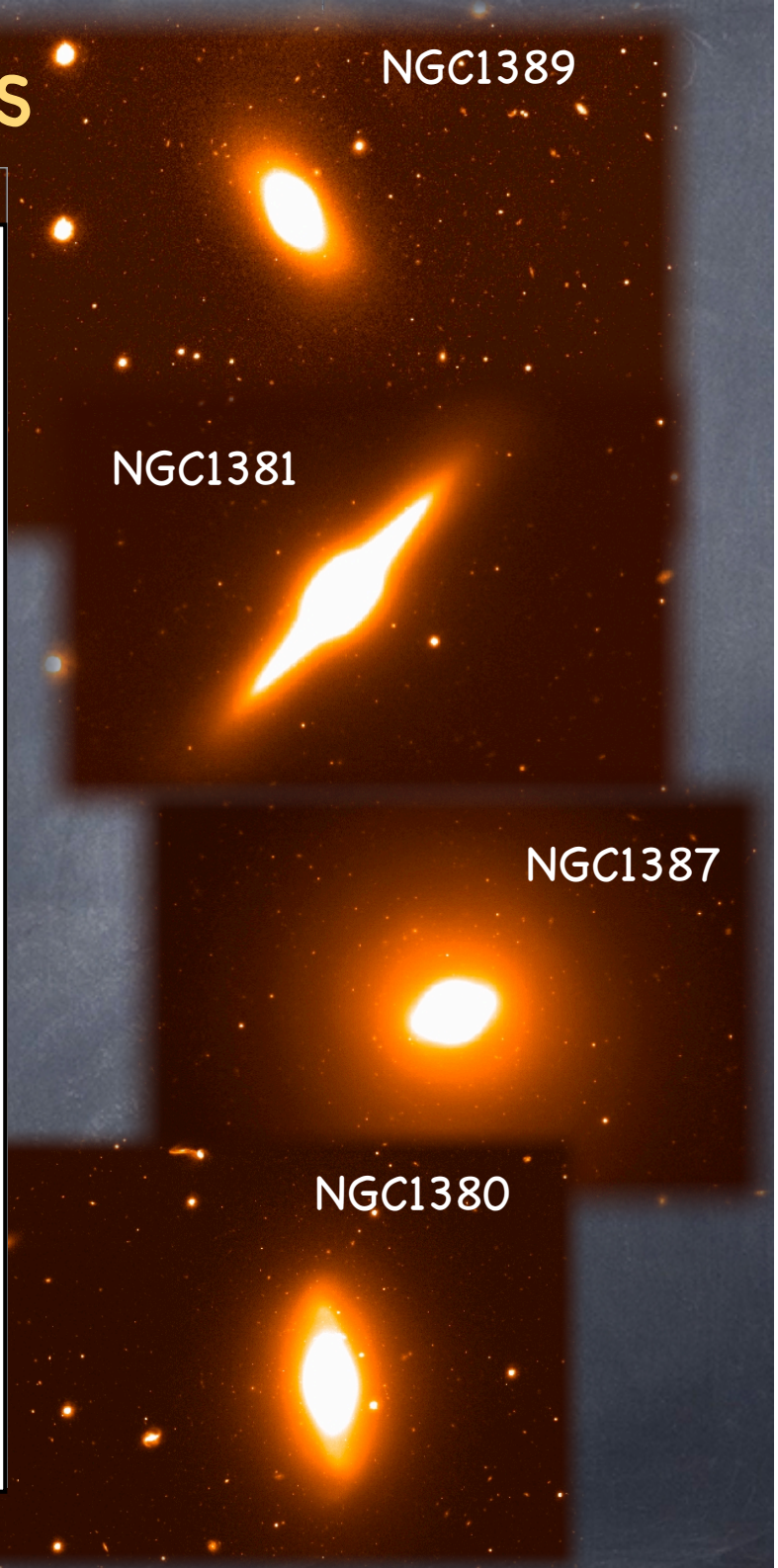
NGC1389



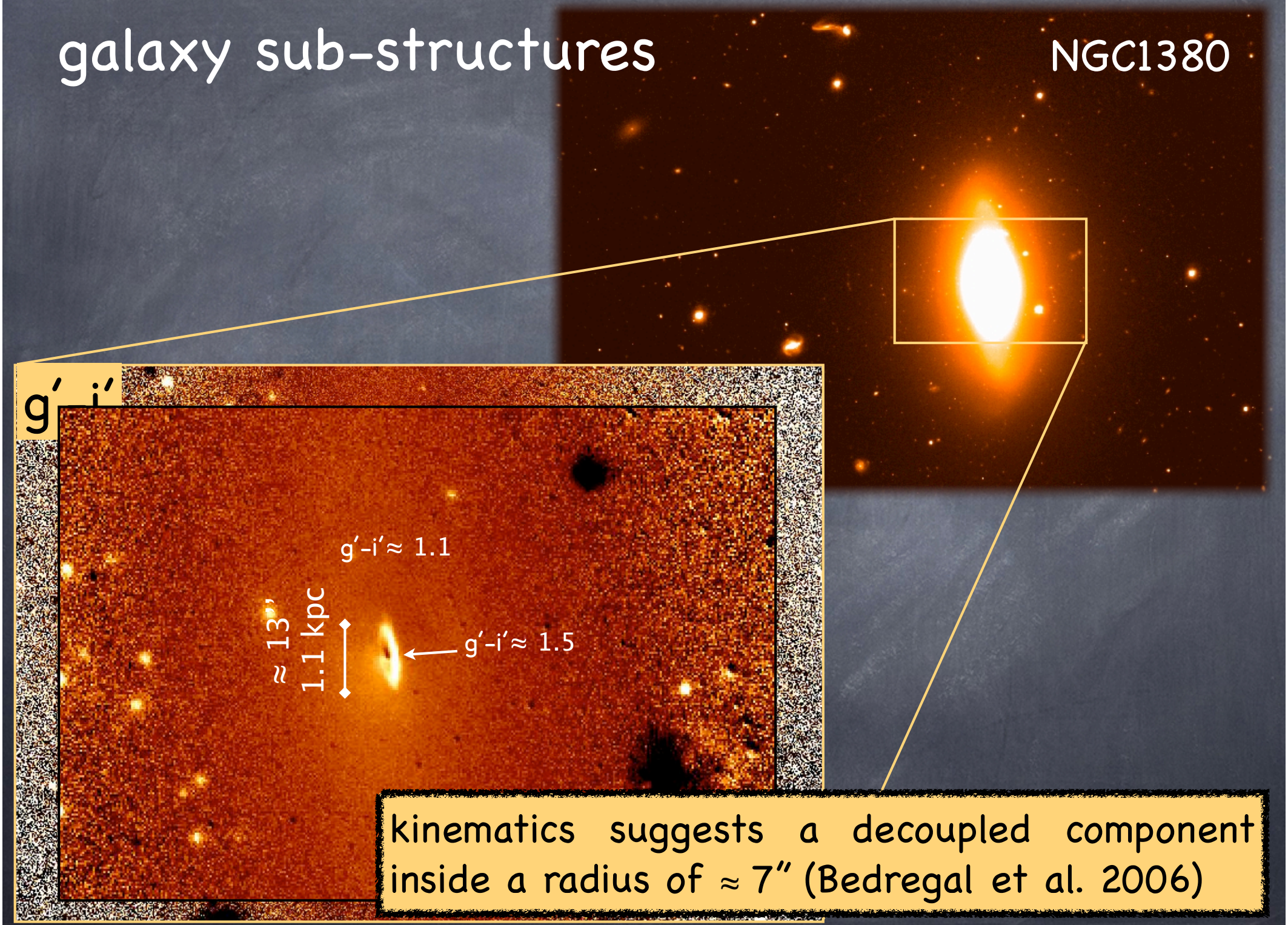


g′–i′ average color profiles





galaxy sub-structures

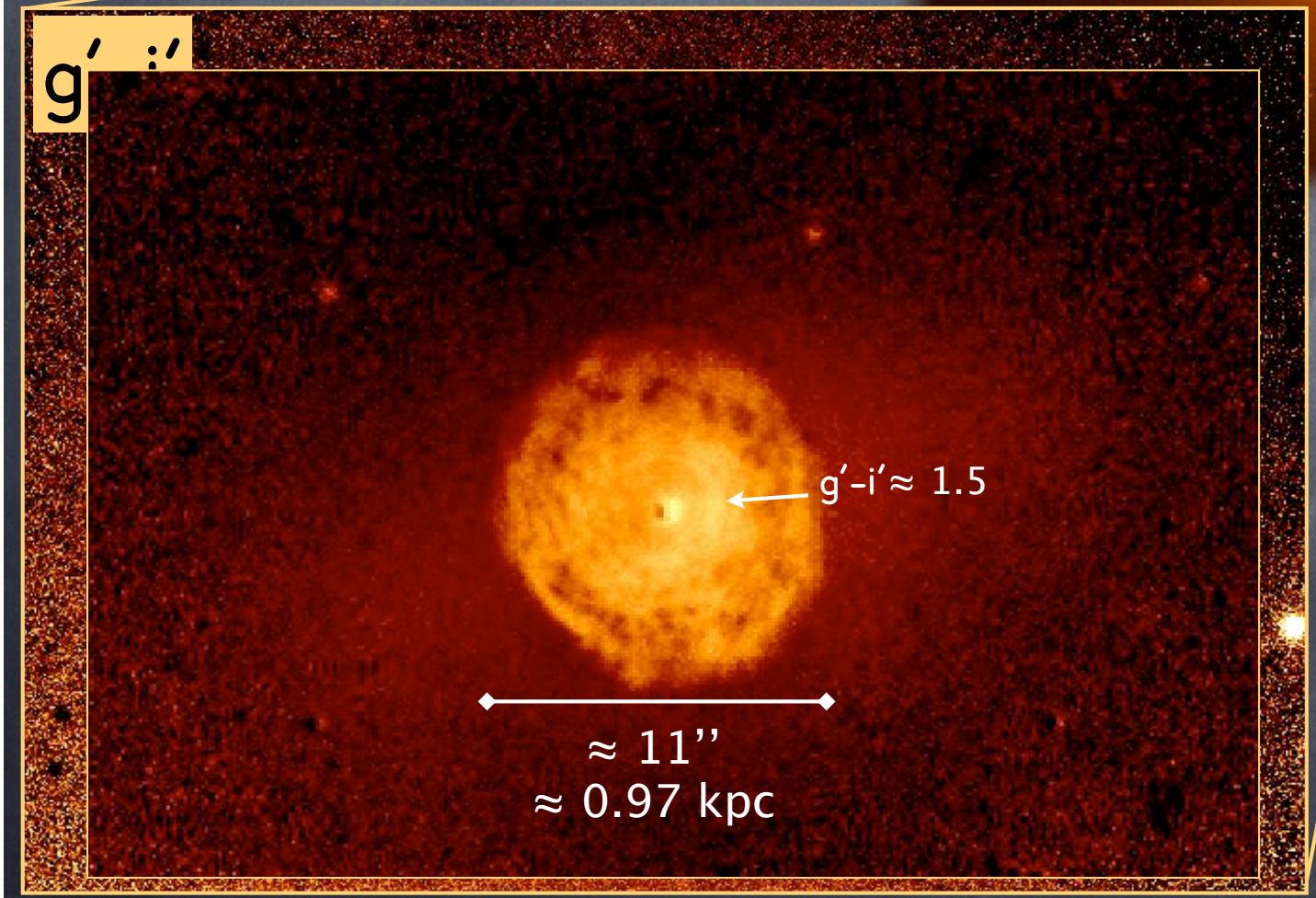


kinematics suggests a decoupled component inside a radius of ≈ 7″ (Bedregal et al. 2006)

galaxy sub-structures

NGC1387

by a 2D galaxy model, a prominent nuclear ring inside a radius of ≈ 6″ has detected by Laurikainen et al. 2006



summary

The first results of the VEGAS survey have tested the value of VST for such a kind of studies

- VST images allow users to study the structure of galaxies with a detail/accuracy comparable to higher class telescopes, i.e. VLT & HST, with the advantage of the large FoV to properly define the BKG

- the high angular resolution --> to unveil sub-structures within the nuclear regions

- the large field of view --> to "correlate" the inner features to the structure of the outer galaxy disk

- the large field of view --> to map SB and colors out to the very faint outskirts to cope with the needs of dynamics (barions vs DM)

- both resolution & large FoV --> GCs, structures, dwarfs

summary

FORNAX field as a pilot project for VEGAS

almost done

- **SB out to 8-10 Re:** physical correlations among structural parameters (total luminosity, Sersic index, Re, ellipticity, boxiness/diskiness);

- **g-r, g-i colour gradients** to unprecedented galactocentric distances and the connection with galaxy formation theories;

- **Globular Clusters:** color and density distribution; luminosity function; comparison of GCs integrated colors to the theoretical models (multiple episodes of formation of GCs);

ongoing

- **SB fluctuations:** for distance and chemical characterization of the stellar population out to 2-3 Re;

- **Stellar M/L:** stellar masses from SP synthesis models, M/L gradients;

- **Long-lived external structures**, ICL, **connection with the environment**

- **Satellites galaxies:** mainly dwarfs

to be done