From Radio to X-ray Galaxy-Cluster-Galaxy

- From 1973 →

  Lectures

  Ph D. thesis Radio Investigations of Cluster of Galaxies 1976 - 1979

Notion:

"reality is the scientific system we operate"

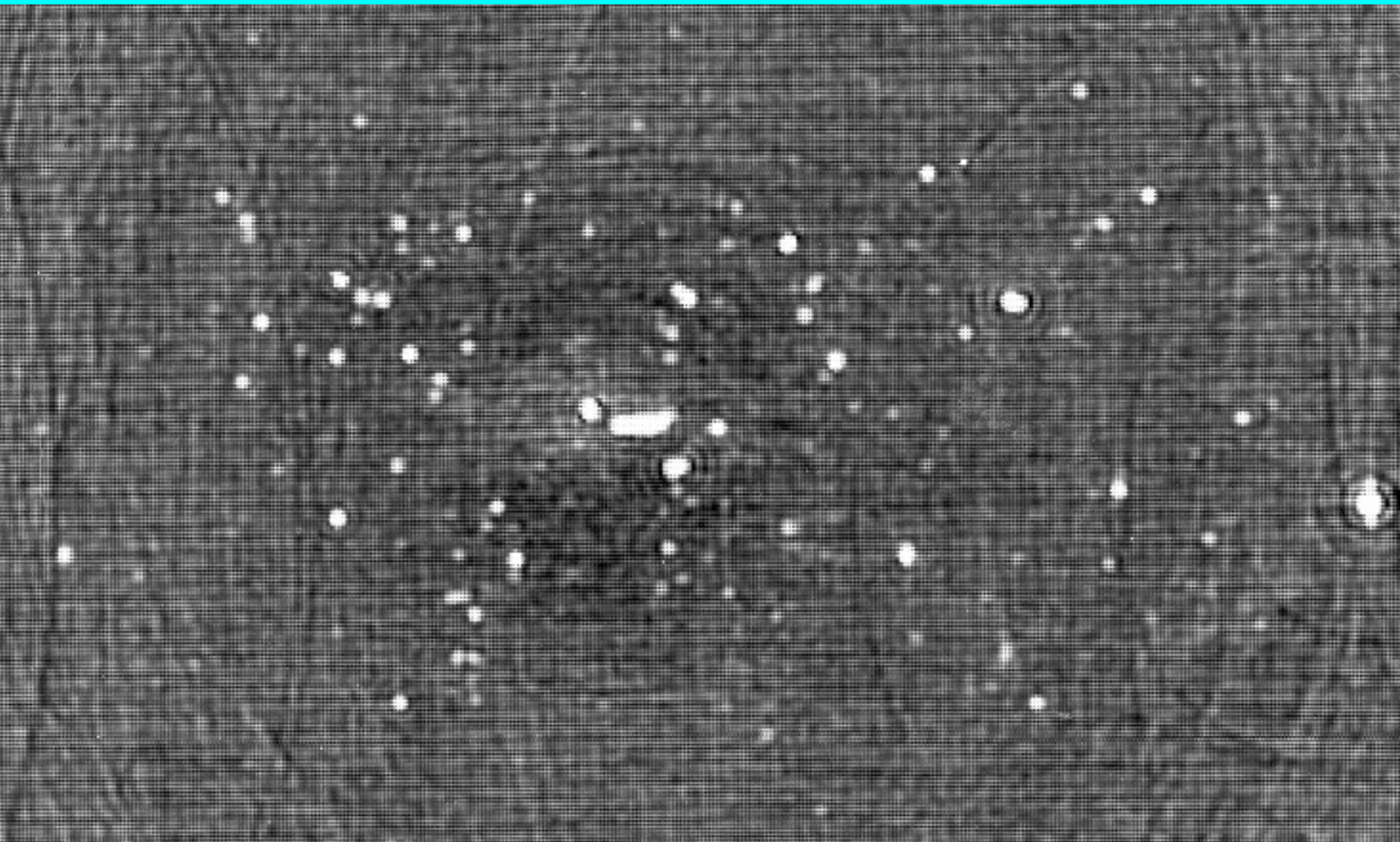
Die Phänomenologie des Geistes

Hegel 1807:

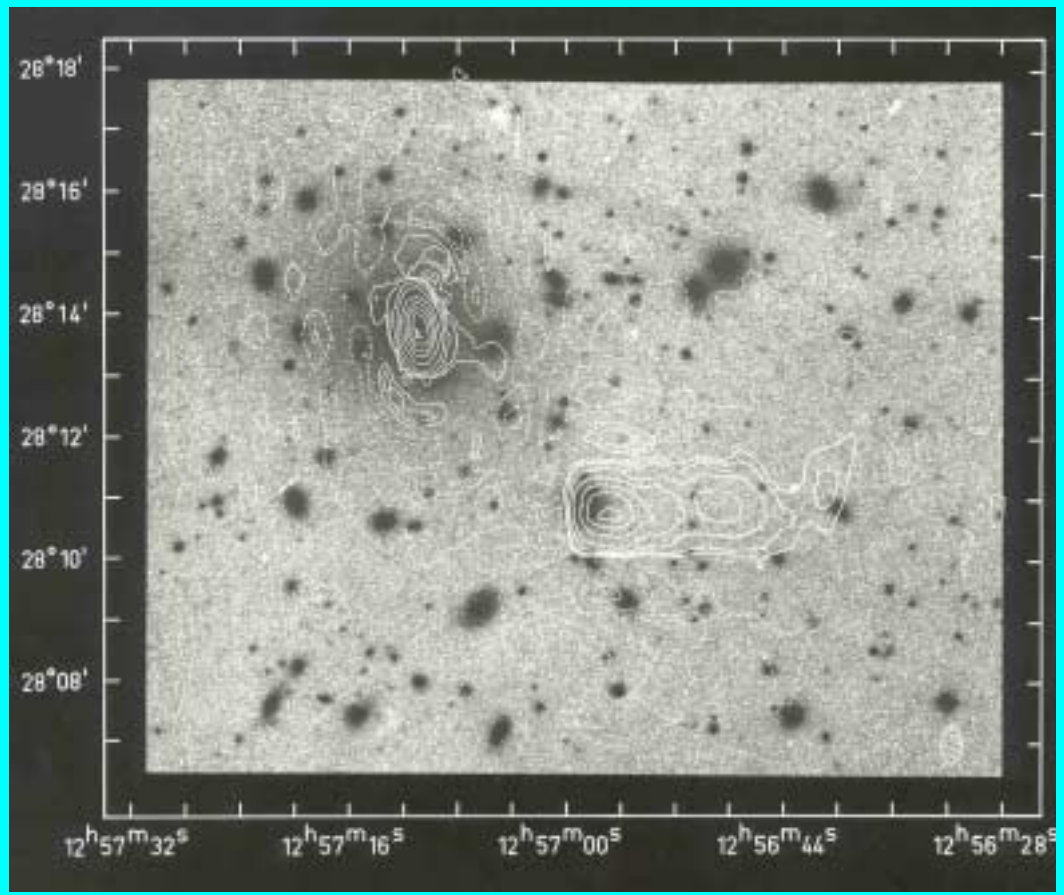
“ The true form in which reality exists can only be the scientific system of the reality”

Let us now focus on the system

1976:Coma Cluster 610 MHz

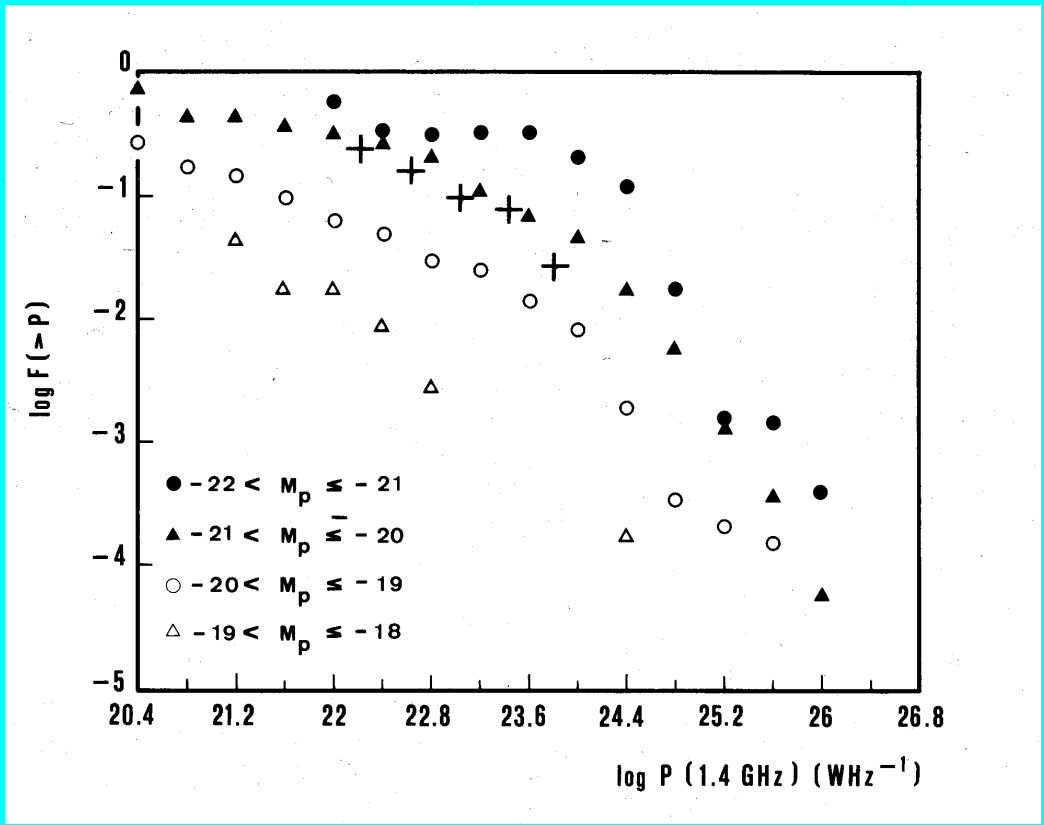


COMA CLUSTER 1415 MHz



- Giant ellipticals
- Head-tail
- moving
- Confinement ICM
- Energy losses
  Diffusion
- Static thermal press.
  ρT 10^{-3} 10^{+8}
- match X-ray

cluster radio galaxies -RLF



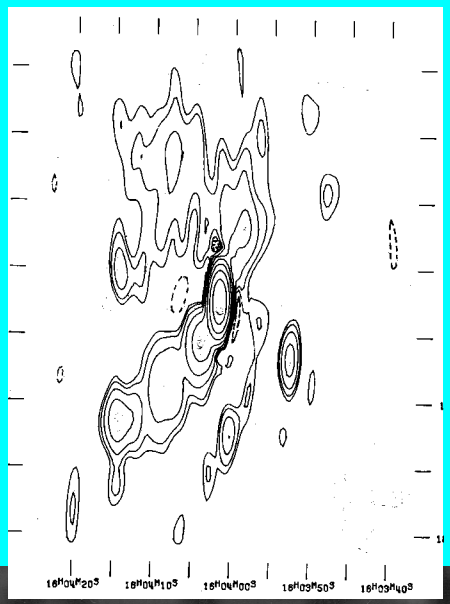
radio galaxies

RLF Jaffe,Perola

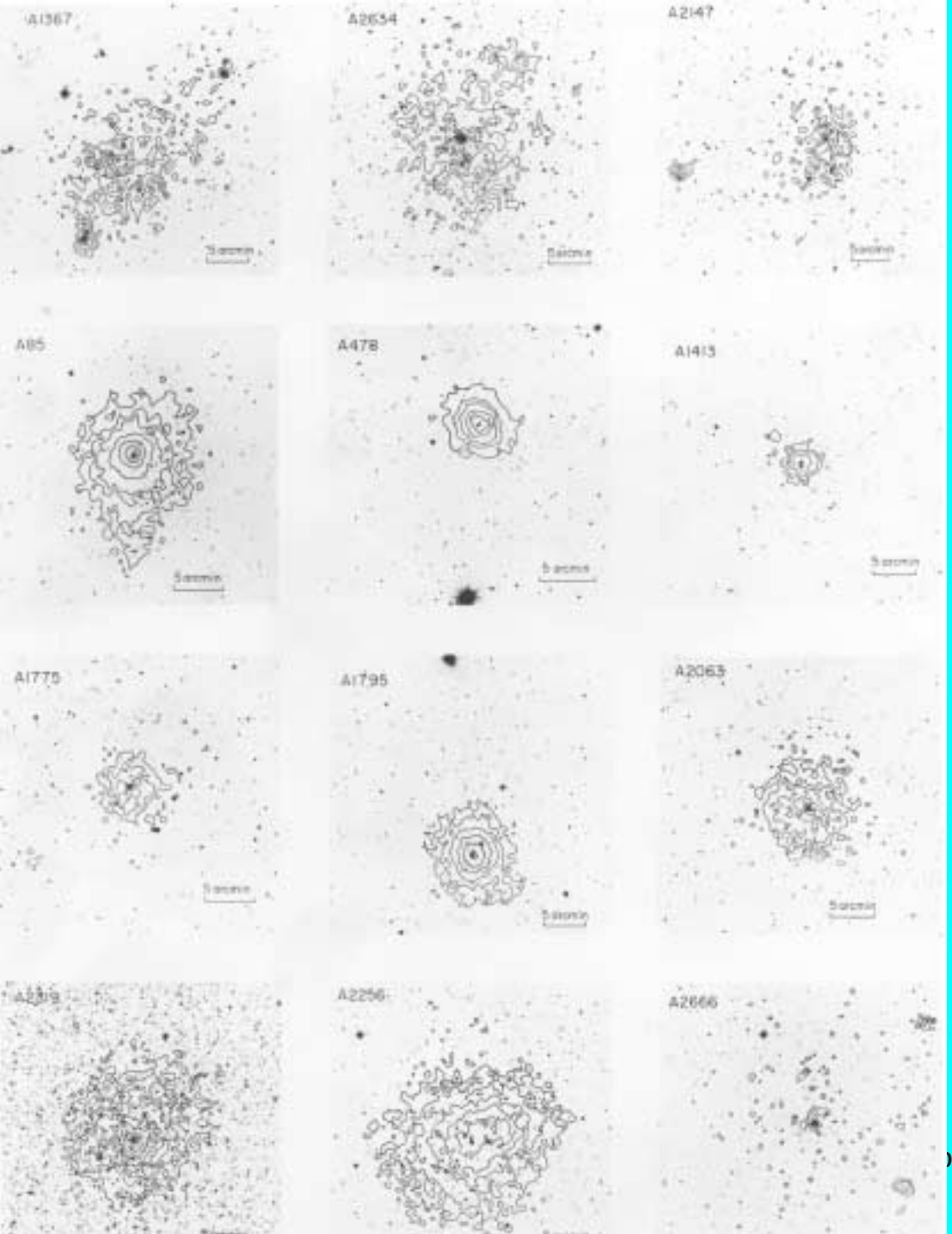
- dependency optical
- fractions –chance
- On-off
- all are radio
- identical environment

HERCULES SUPERCLUSTER

1978

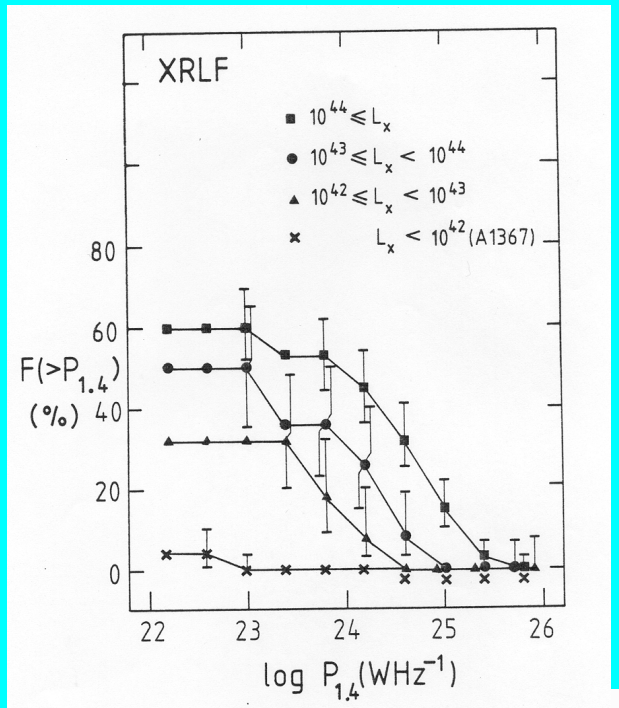


Laan



1981 EINSTEIN X-ray

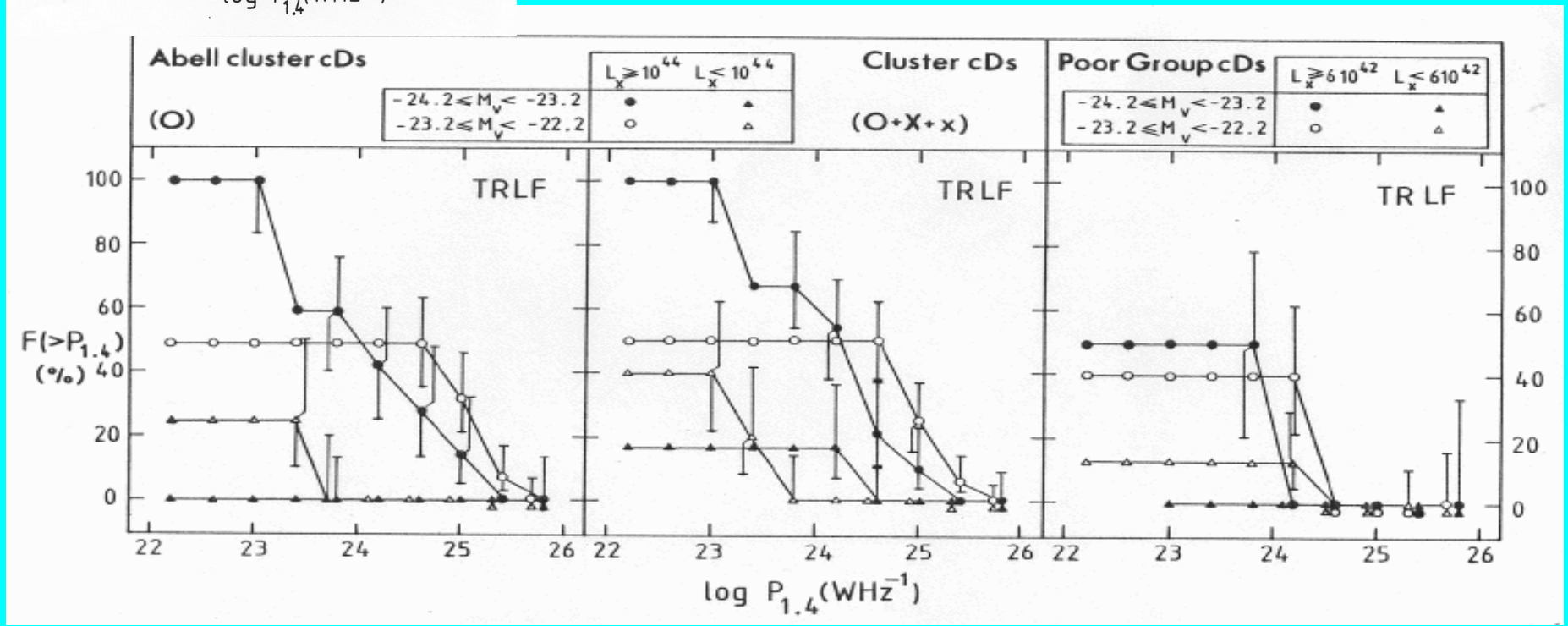
- HvdL: NL input
- Haloes cD Galaxies
- Cooling flows
- Pressure driven
- Bondi- gravitational accretion



Trivariate LF

W. Bijleveld

cDs- rich clusters - groups



Search for condensations

1984 La Palma:

Optical filaments

Dumbbell galaxies

mass 10 - 50 kpc

relative velocities

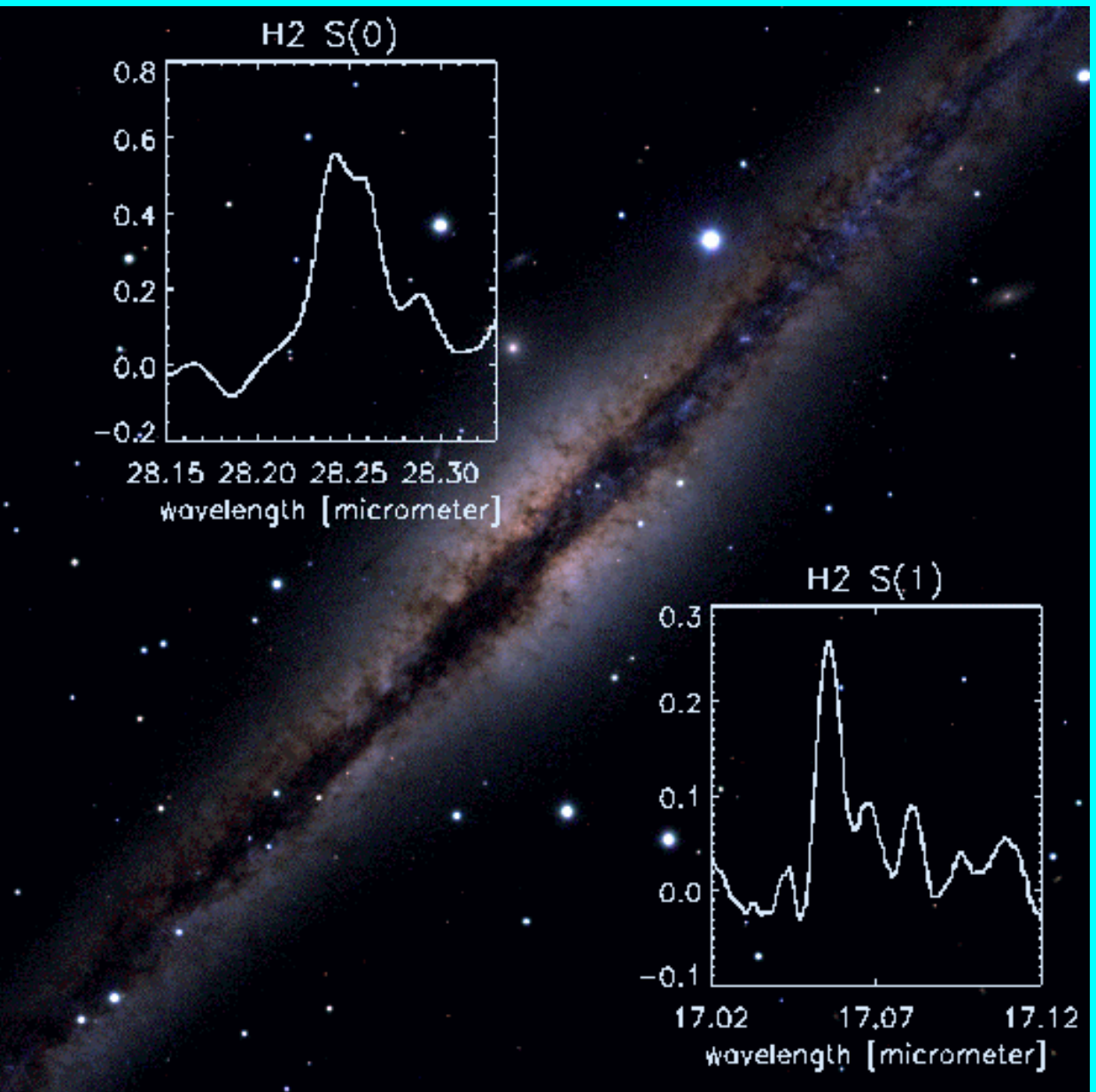
1985: Inauguracion de los Observatorios Astrofisicos de Canarias

1985: Inauguracion de los Observatorios Astrofisicos de Canarias

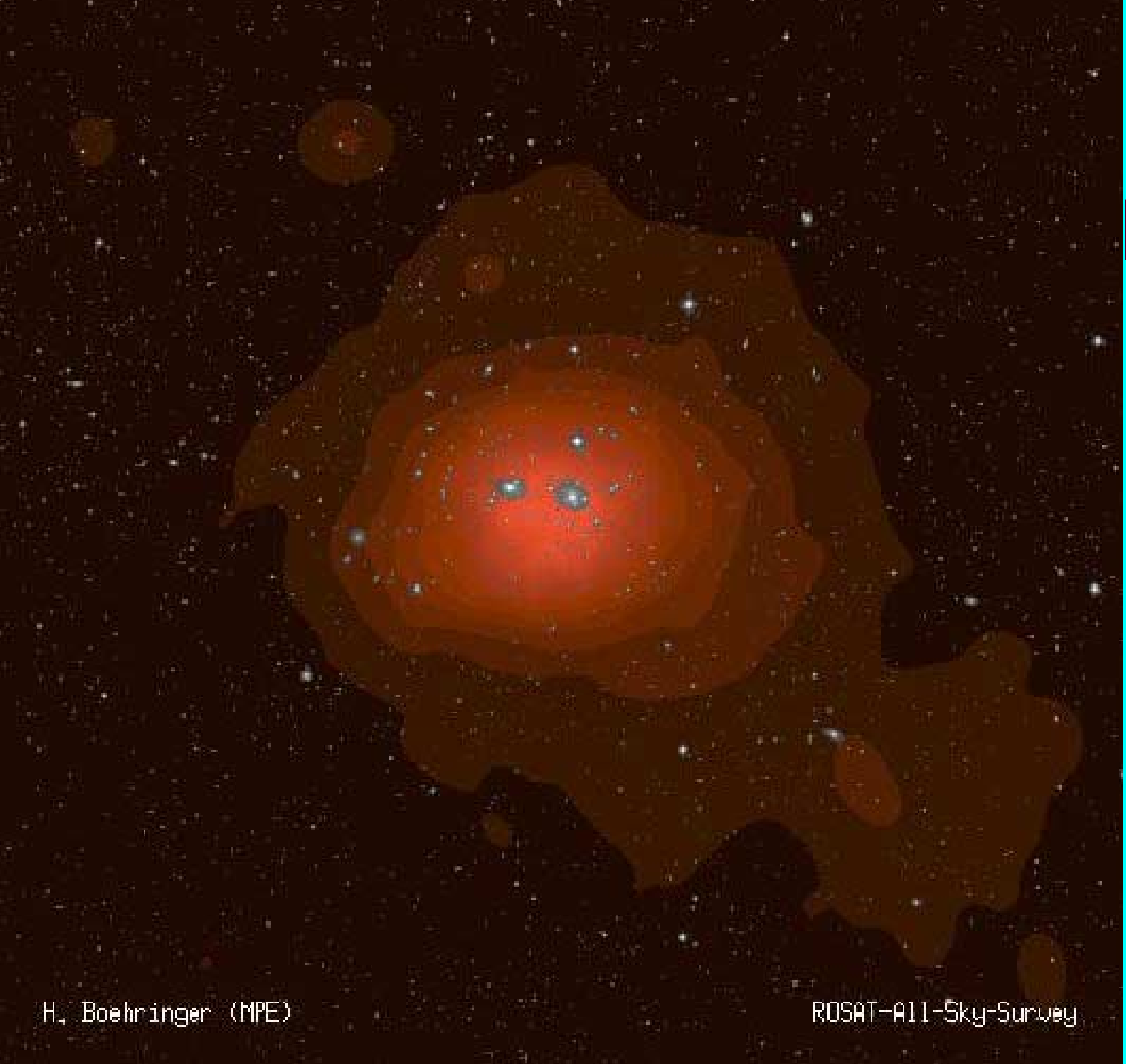
El Rey D. Juan Carlos I :

“ The prayer is that each man and each society must renounce interests that divide us and come together in others which, by overcoming difficulties, will make us greater and better day by day, linked in brotherhood beneath the same skies, conscious of the harmony of the peace of the galaxies”

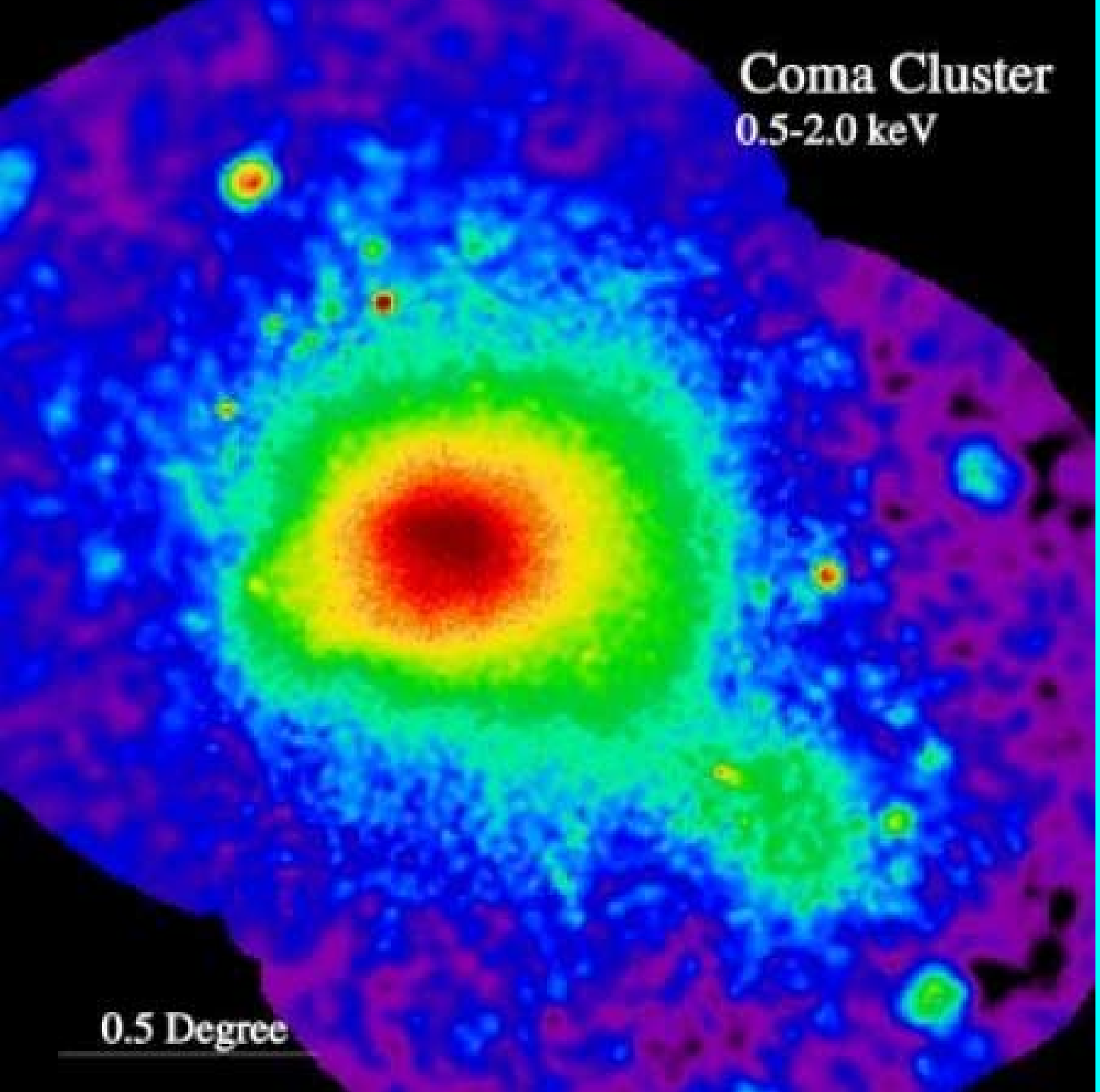
1989 ESO – LV support by HvdL



- 16.000 galaxy catalogue
- only few % E
- 1990: spirals much more extinction
- 1998: ISO- SWS much more H_2 NGC 891
- 80K
- 10^{23} cm^{-2}



ROSAT
COMA

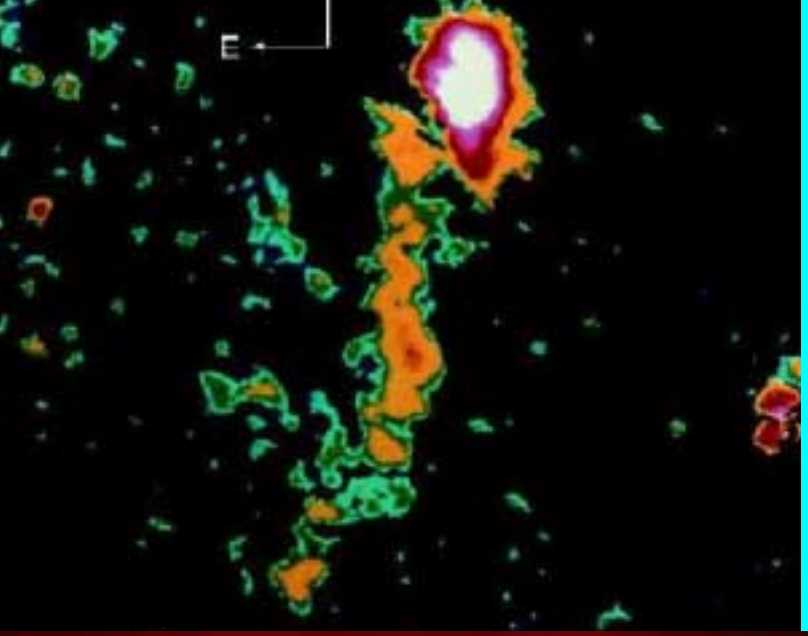


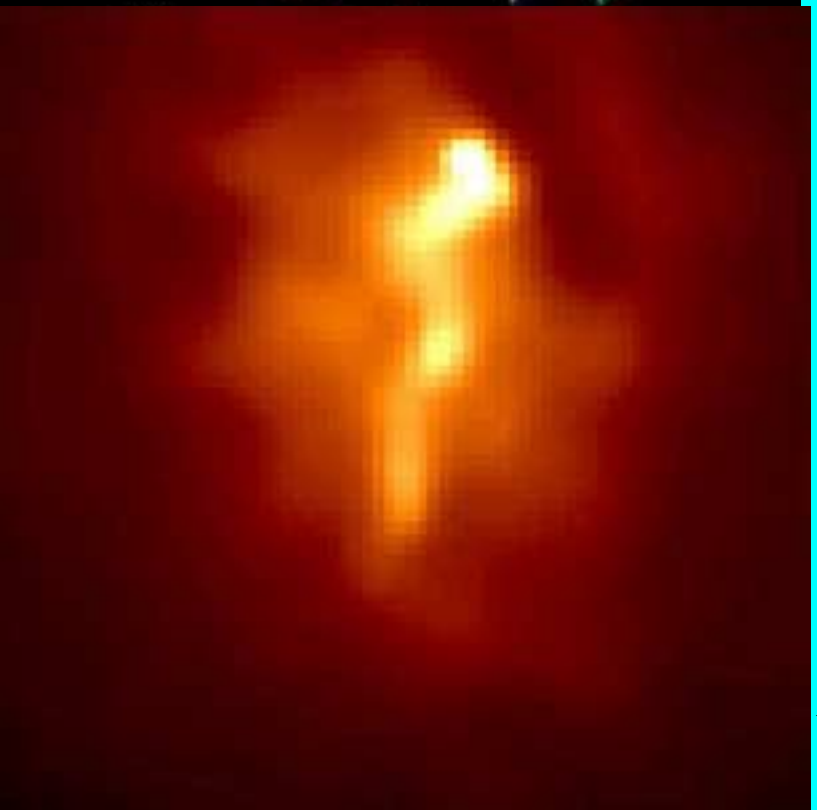
XMM-Newton

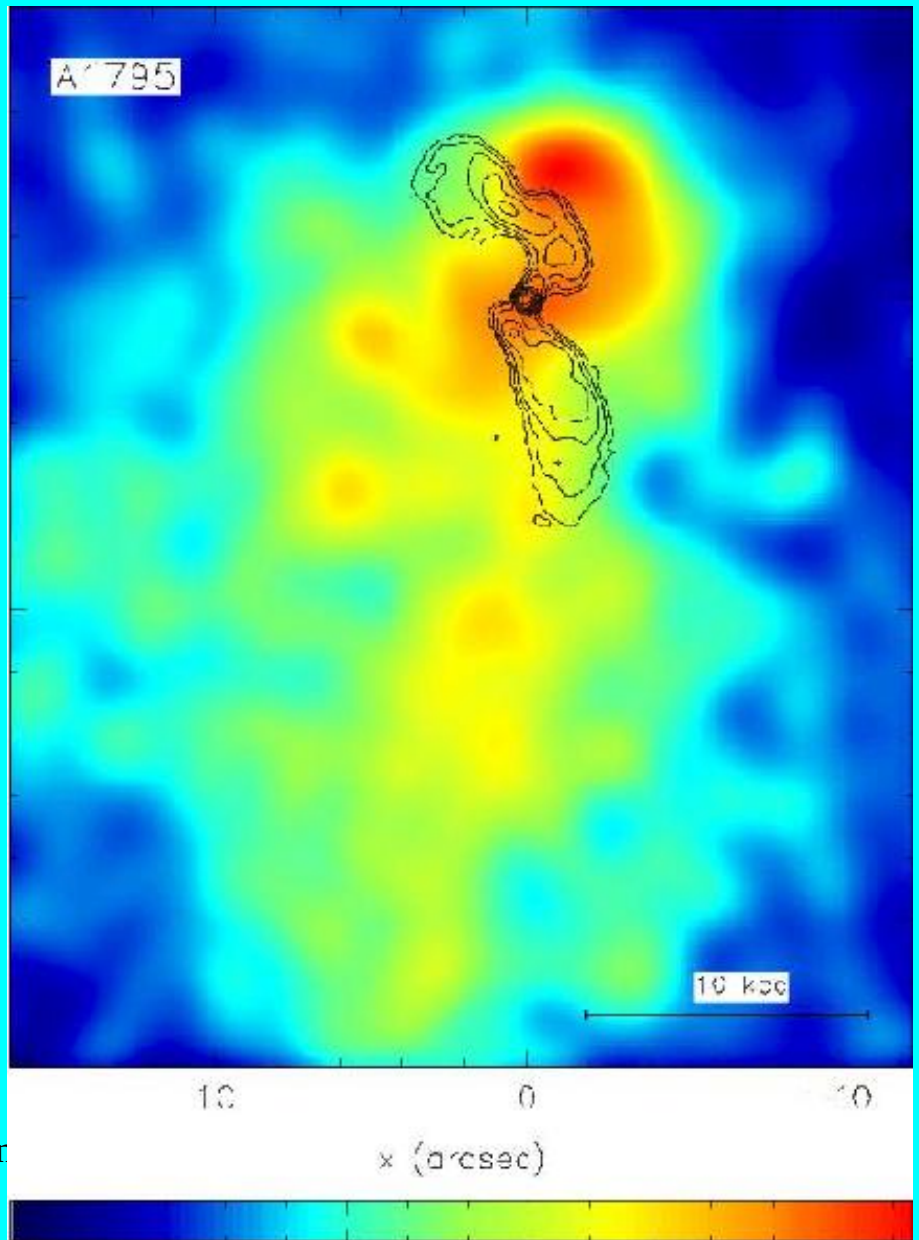
mosaic EPIC-pn camera

5 arcsec

Abell 1795 cD

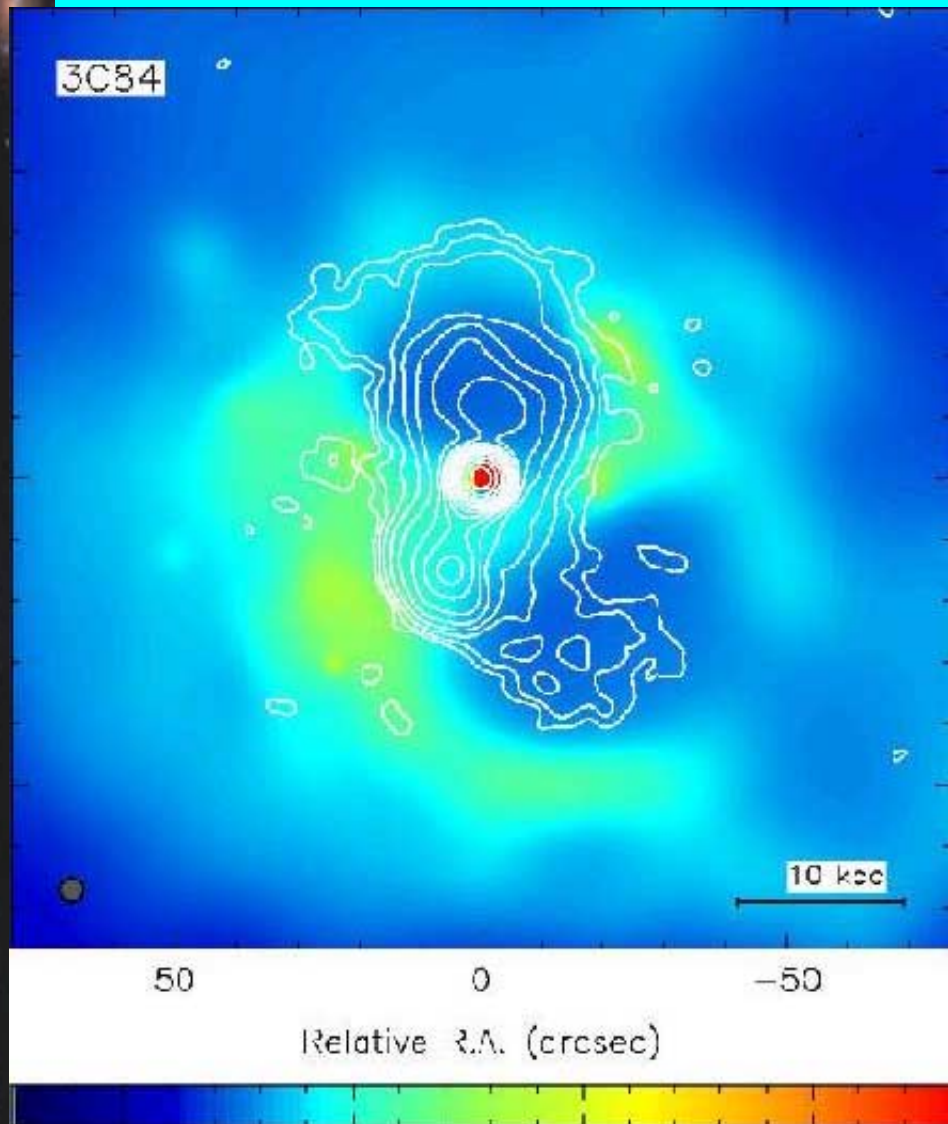






var

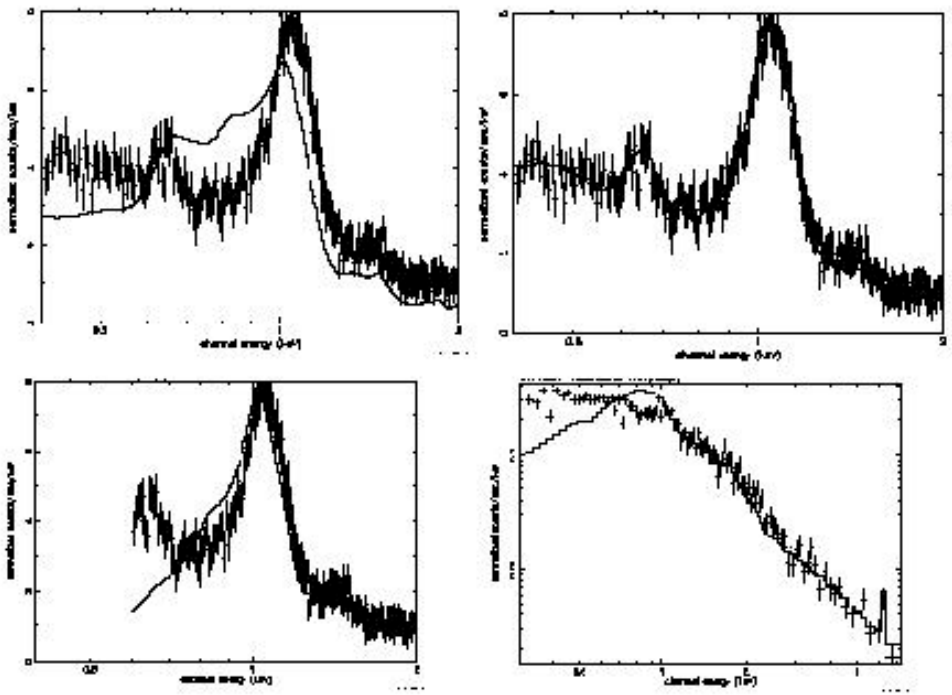
NGC 1275 -Hubble



2001: XMM- M87 N1275 A1795

Böhringer et al- spectroscopy

Fe L shell lines 1keV 1-2’ halo M87



- Isothermal
- No HI columns
- Low mass deposition rate in the centres
- Heating by AGN $10^{44\text{-}45}$ ergs/s
- Bondi accretion
- Self-regulating

rs on- accretion off

rs off- accretion on

Kurk

Miley

Röttgering

Venemans

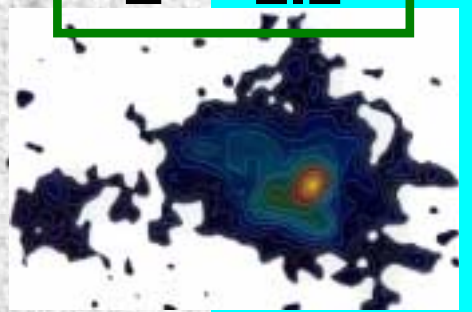
VLT ANTU
ISAAC

Narrow-band
~1% 2.07 mm
EW > 50 A

Confirming spectra needed

Forming CD?

ALL SIGNS OF PROTO-CLUSTER Z ~ 2.2



160 kpc Ly α

ESO
scaling
kurk/Skycat

nb41568.fits
11:40:48.248 −26:29:17.20 J2000
Feb 22, 2001 at 15:49:05

1338-19 at z ~ 4.1Venemans et al.

Most distant structure of galaxies known

Ancestor of rich cluster?

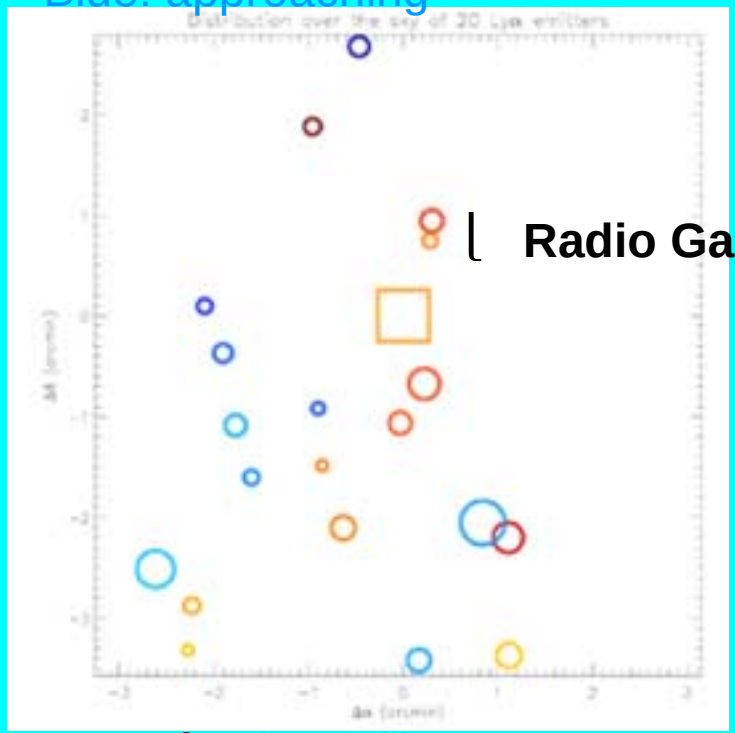
7’ x 7’ VLT/FORS FIELD

Red: receding

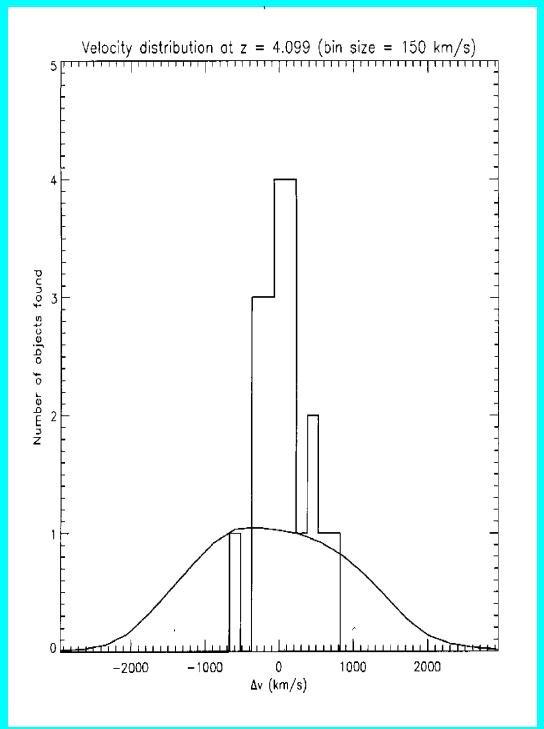
Blue: approaching

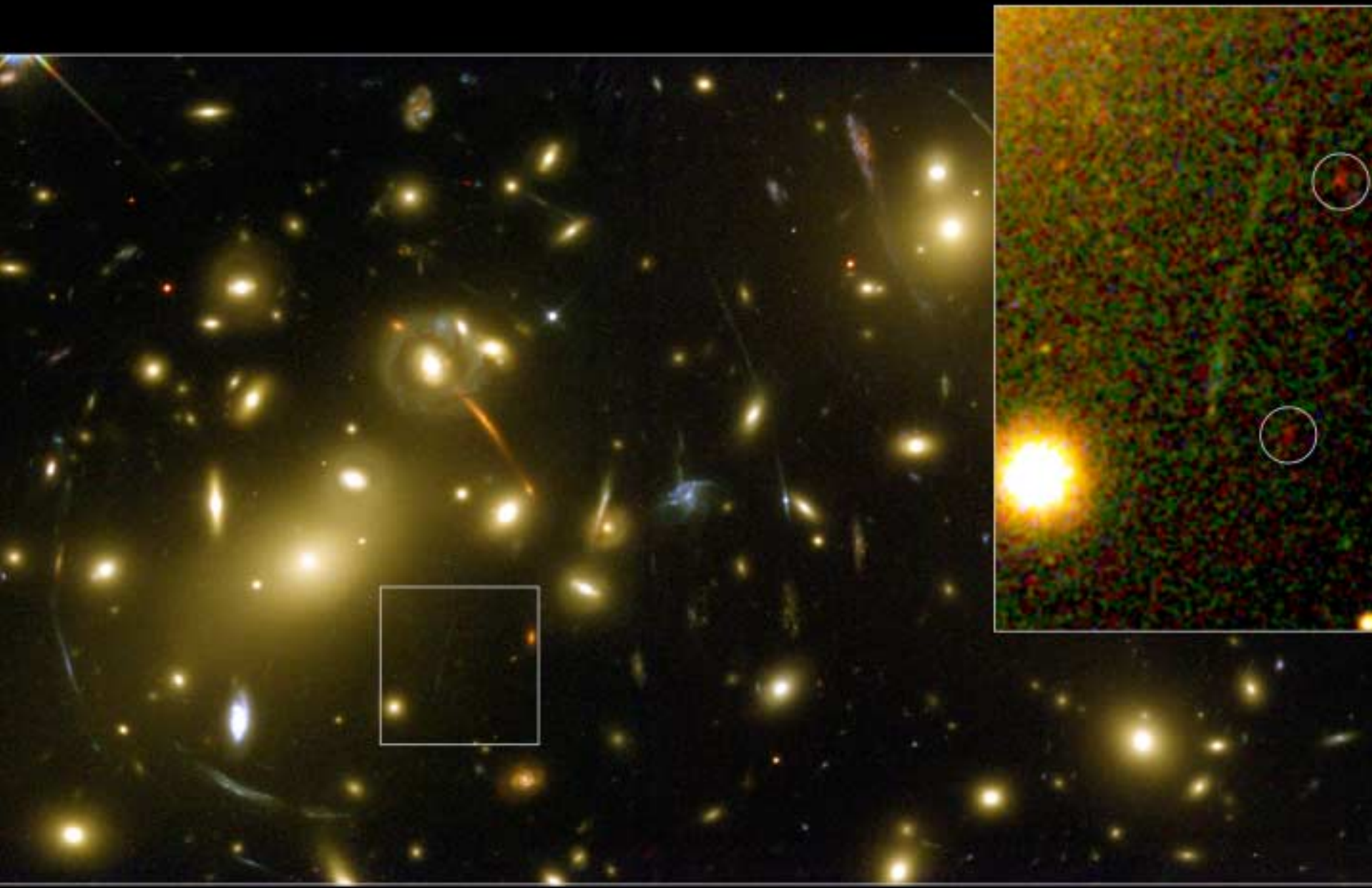
21 Ly ∀ Emitters

)v ~ 400 km/s



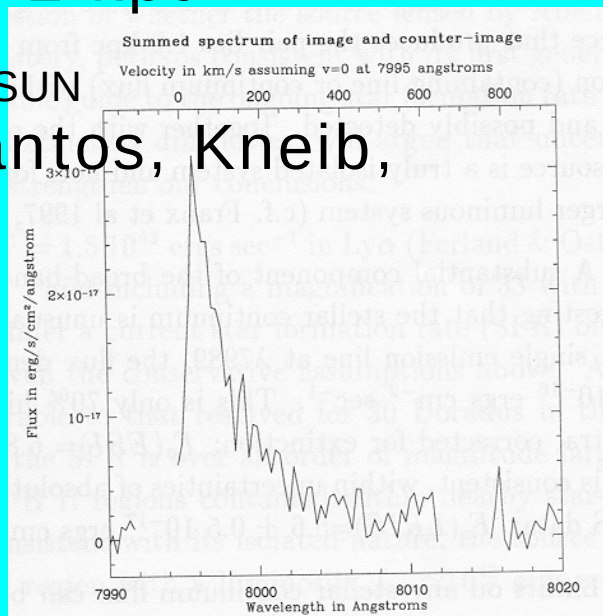
Radio Galaxy





Z= 5.576 galaxy lensed by A2218 at z=0.18

- Keck II spectroscopy
- Ly- alpha emitting
- I ~ 30 (unlensed)
- Magnification ~30
- Size ~0.2 kpc
- ~10^6 M_{SUN}
- Ellis, Santos, Kneib, Kuijken

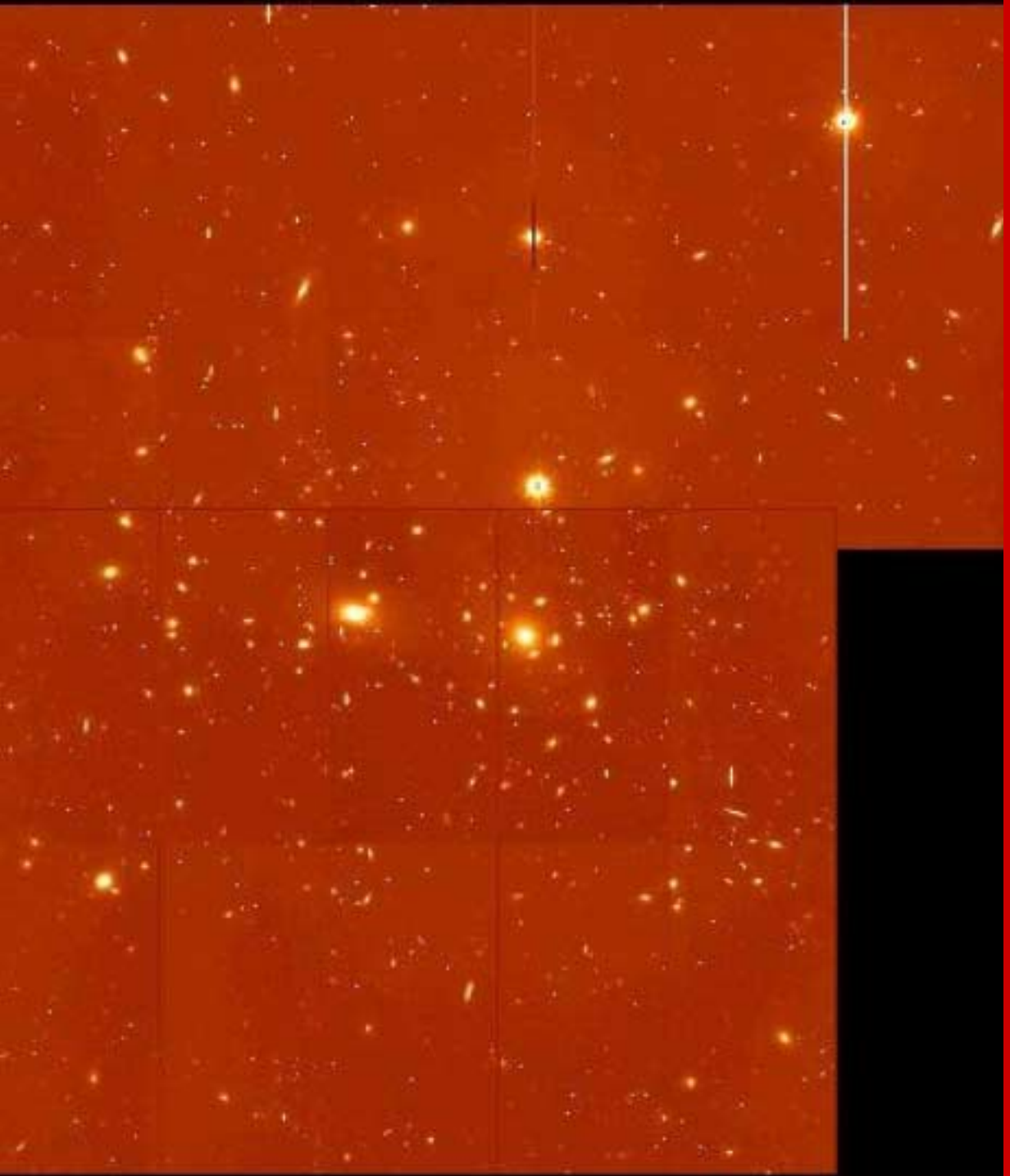


Wholeness and the implicate order

- The streaming river of developing knowledge

David Bohm 1980:

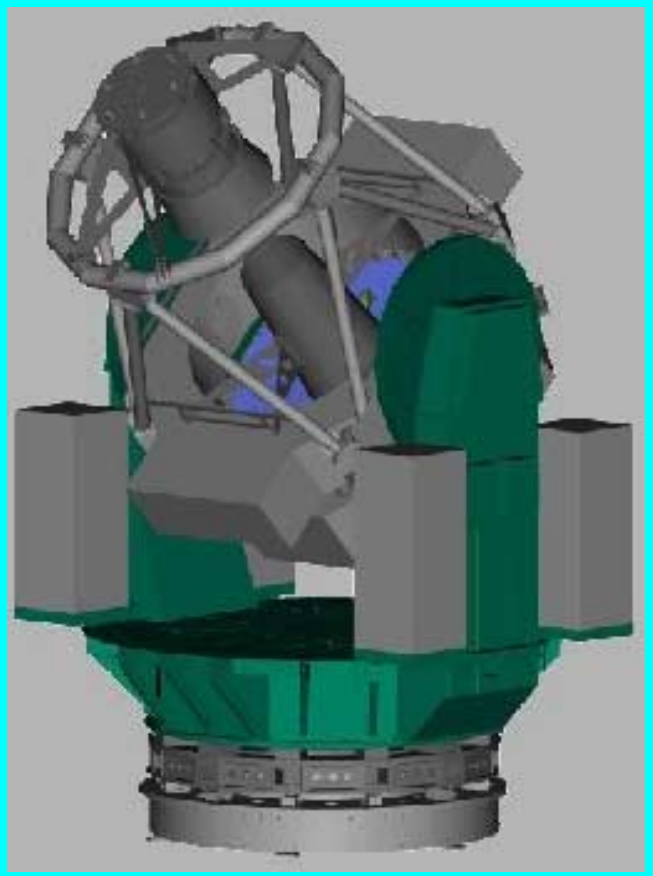
“ So, instead of supposing that older theories are falsified at a certain point in time, we merely say that man is continually developing new forms of insight, which are clear up to a point and then tend to become unclear. In this activity, there is evidently no reason to suppose that there is a or will be a final insight (corresponding to truth) or even a steady series of approximations to this”



CFHT 12 K

COMA
cluster

The future - ASTRO-WISE



- Large scale structure
- Superclusters
- Cosmic shear
- 10’s Terabytes of galaxy data
- Stop copying the Universe
- Static catalogues → Dynamic
- AVO
- System determines knowledge and reality

VLT-Survey Telescope VST