

Virtual Observations and Data Mining in Astronomy

Future directions in Astronomical data
management

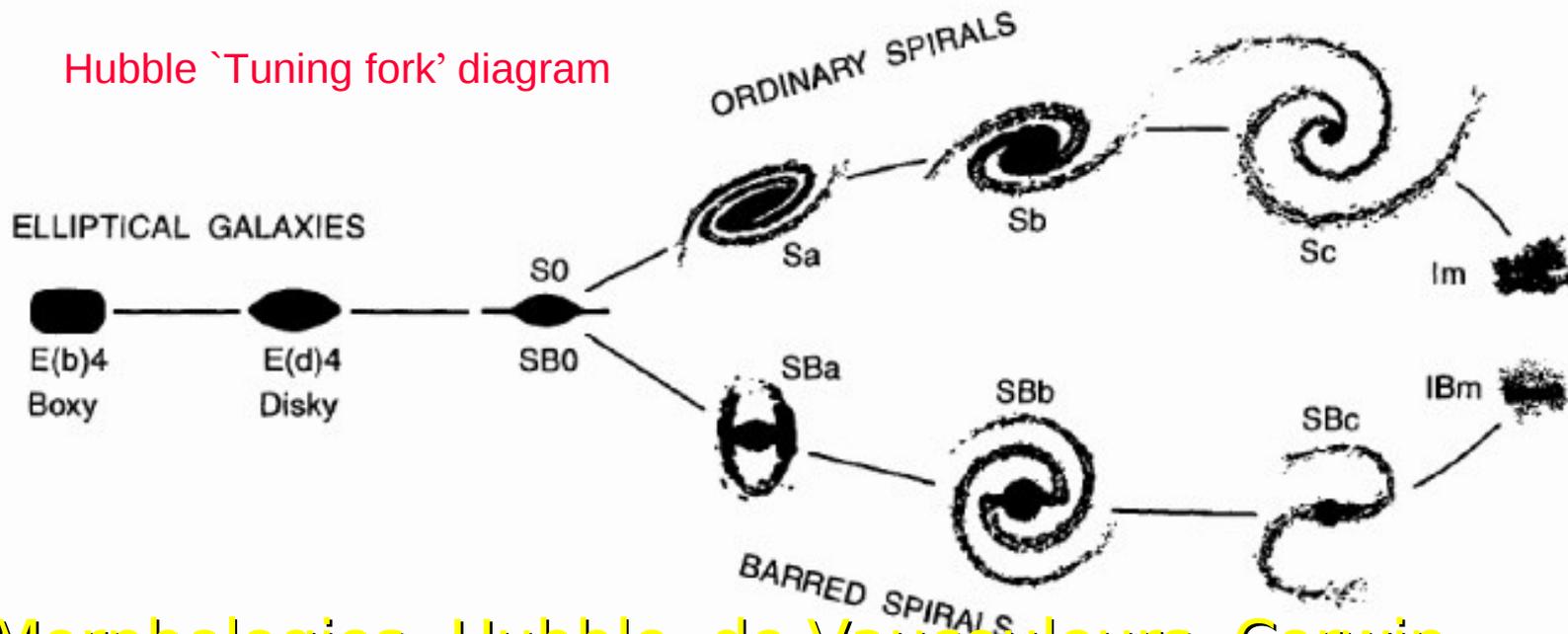
Kapteyn Astronomical Institute
University of Groningen

Edwin A. Valentijn

6 Sept 2010

Case: morphologies parameters vs theory -degeneracy

Hubble 'Tuning fork' diagram



Morphologies- Hubble, de Vaucouleurs, Corwin

- U, B, V, R, I, Z, K
 - m_{tot} , m_{25} , m_{26} , D_{26} , D_{25} , $D_{90\%}$, r_{eff} , sb_0 , sb_{eff}
- Structure/radial
 - a/b , pa , B/D , N , exp scale length, δ (B-R)
- colours
 - Central (B-R), $(B_R)_{tot}$

What characterizes?

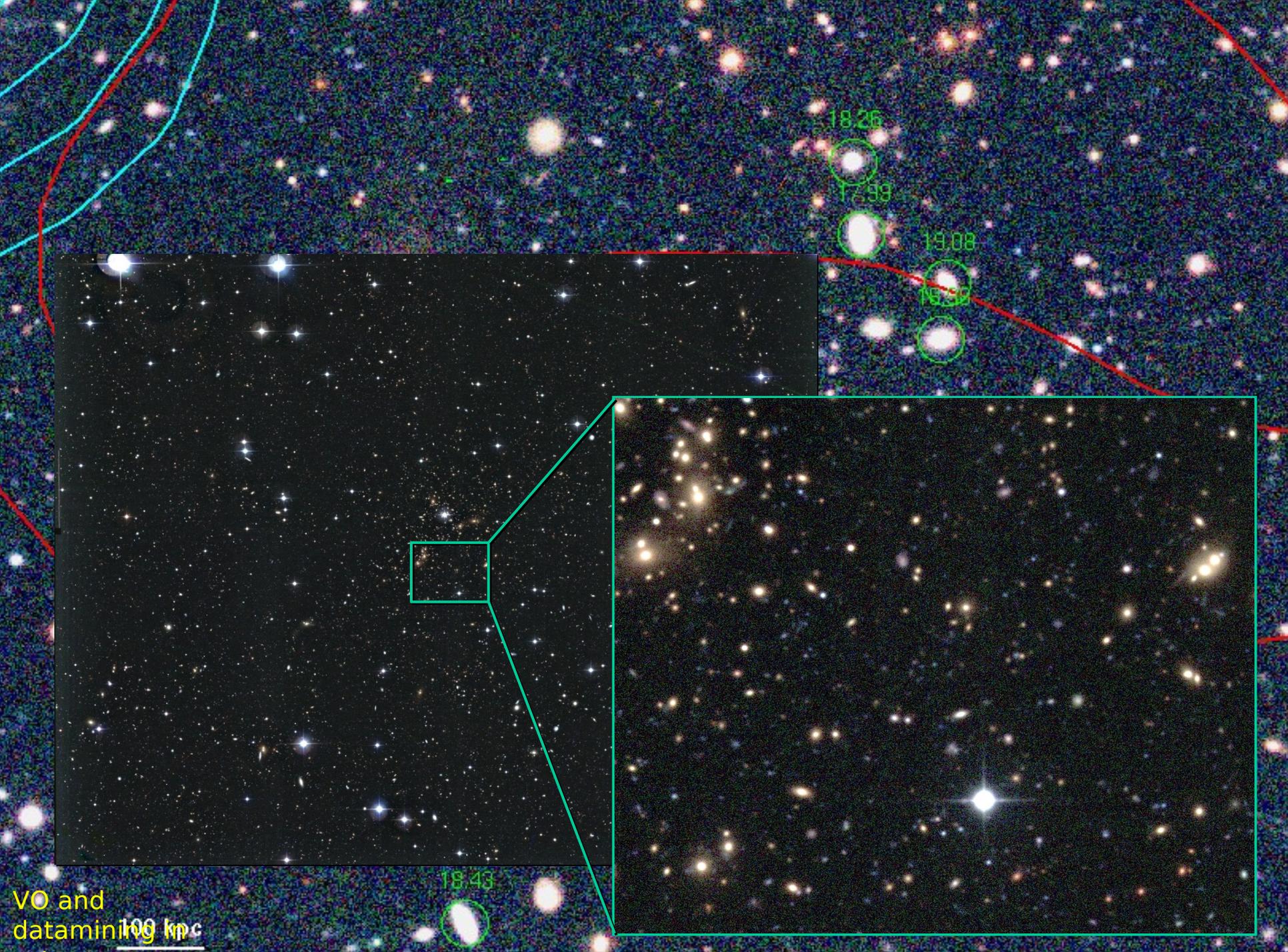
Phenomenology ← understanding → theory

Observations - interpretation

Primary relations - secondary

N parameters N datapoints

Example: *Morphological transitions*

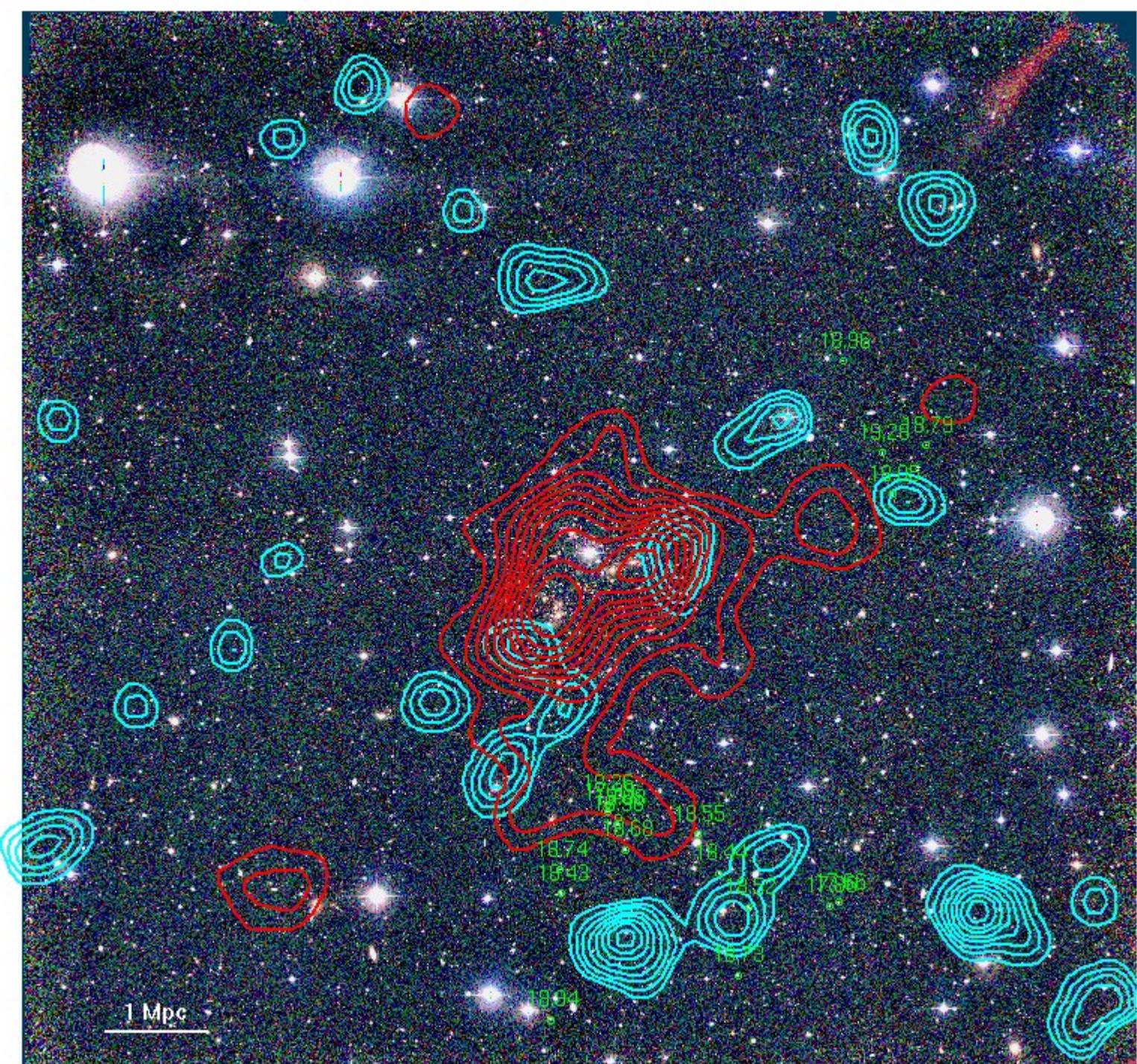


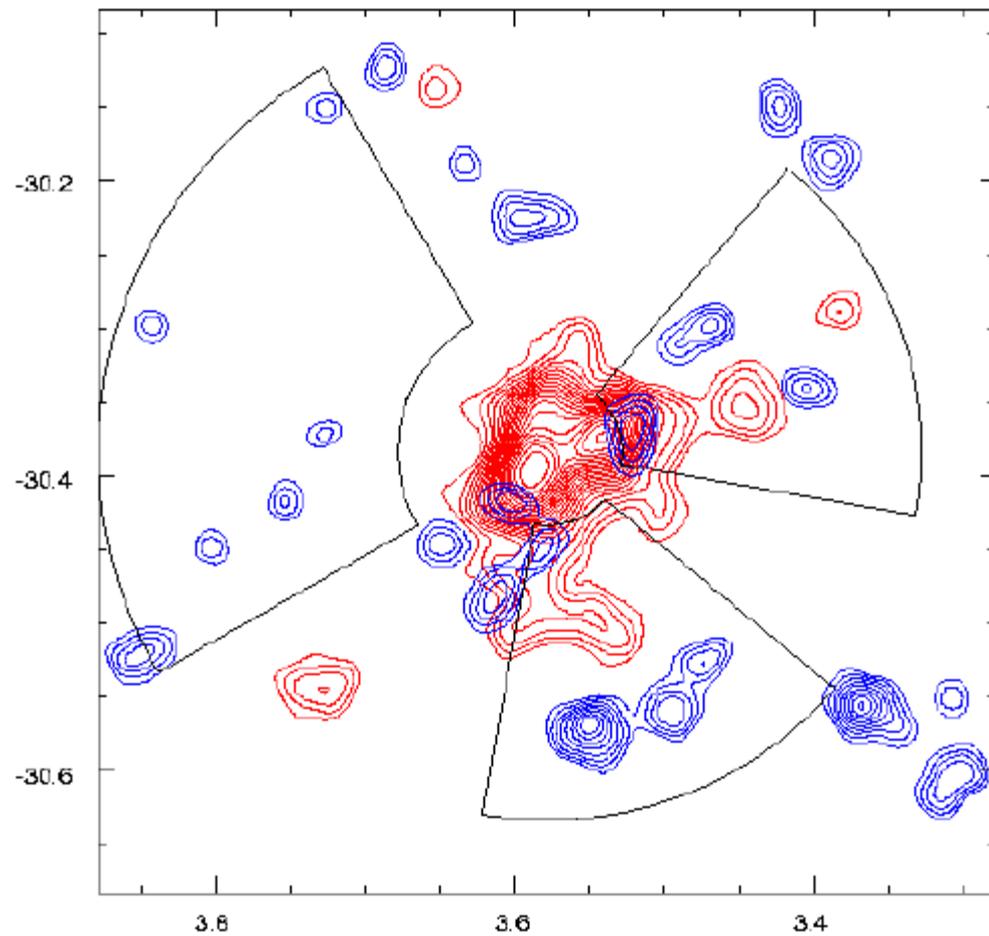
Braglia
Pierini
Bohringer
AA L 2007

A2744
Z~0.3

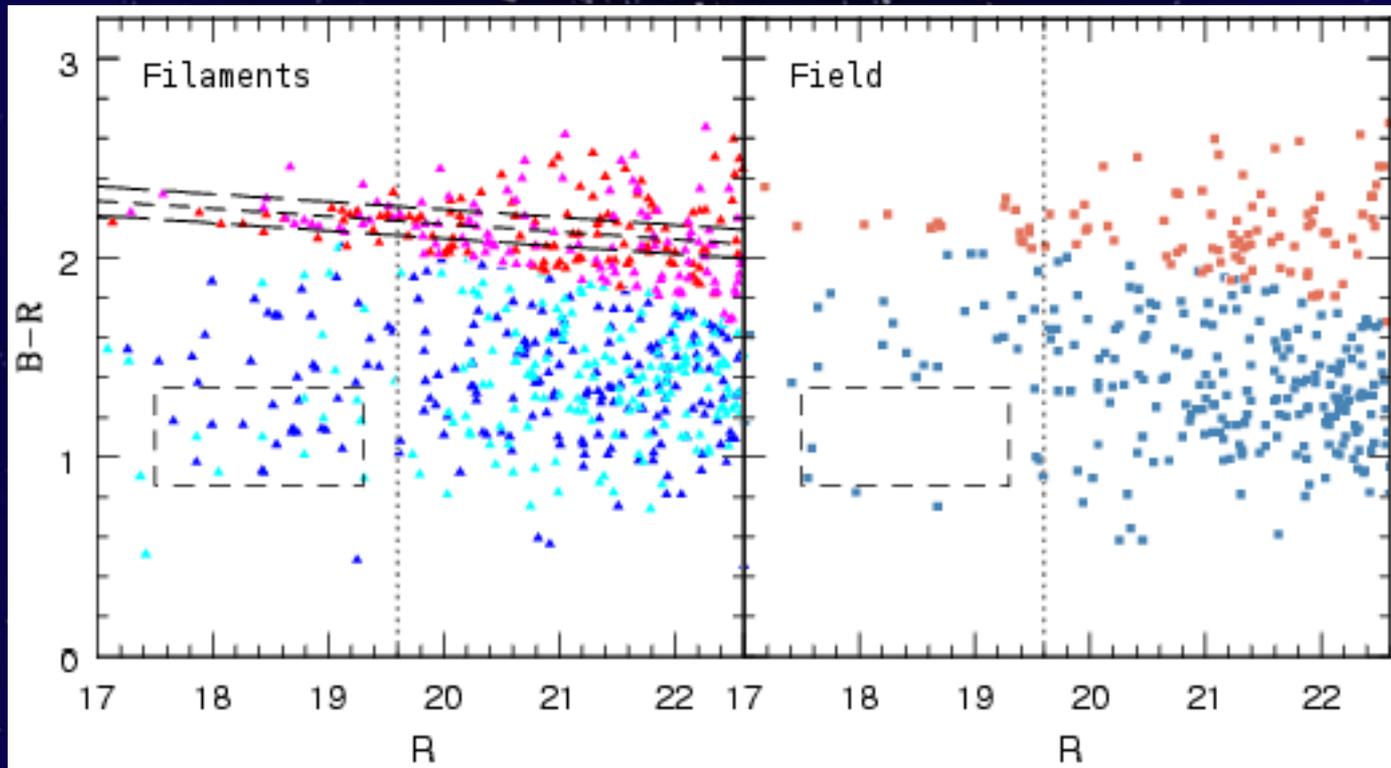
WFI@2.2m

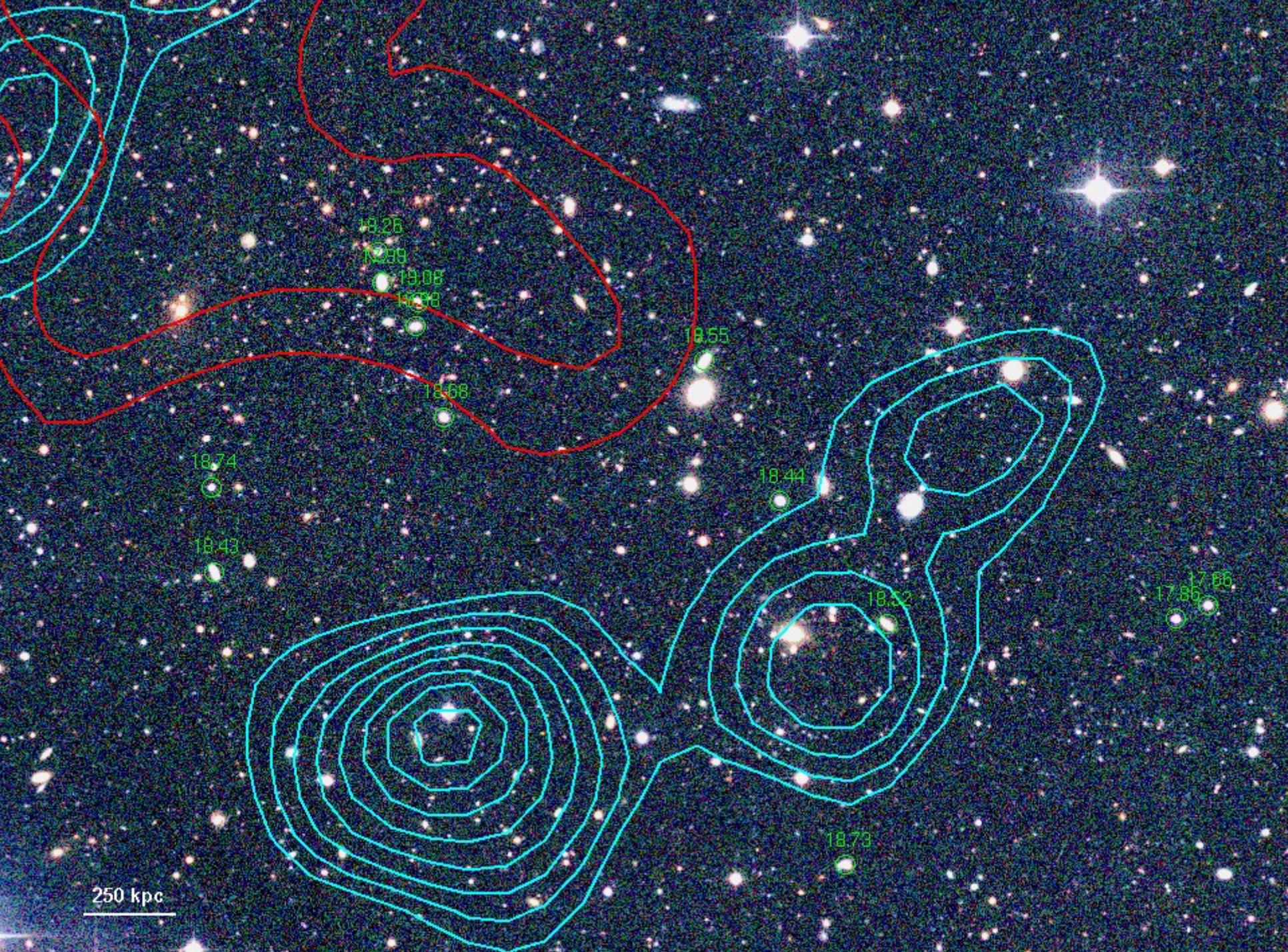
VO and
datam



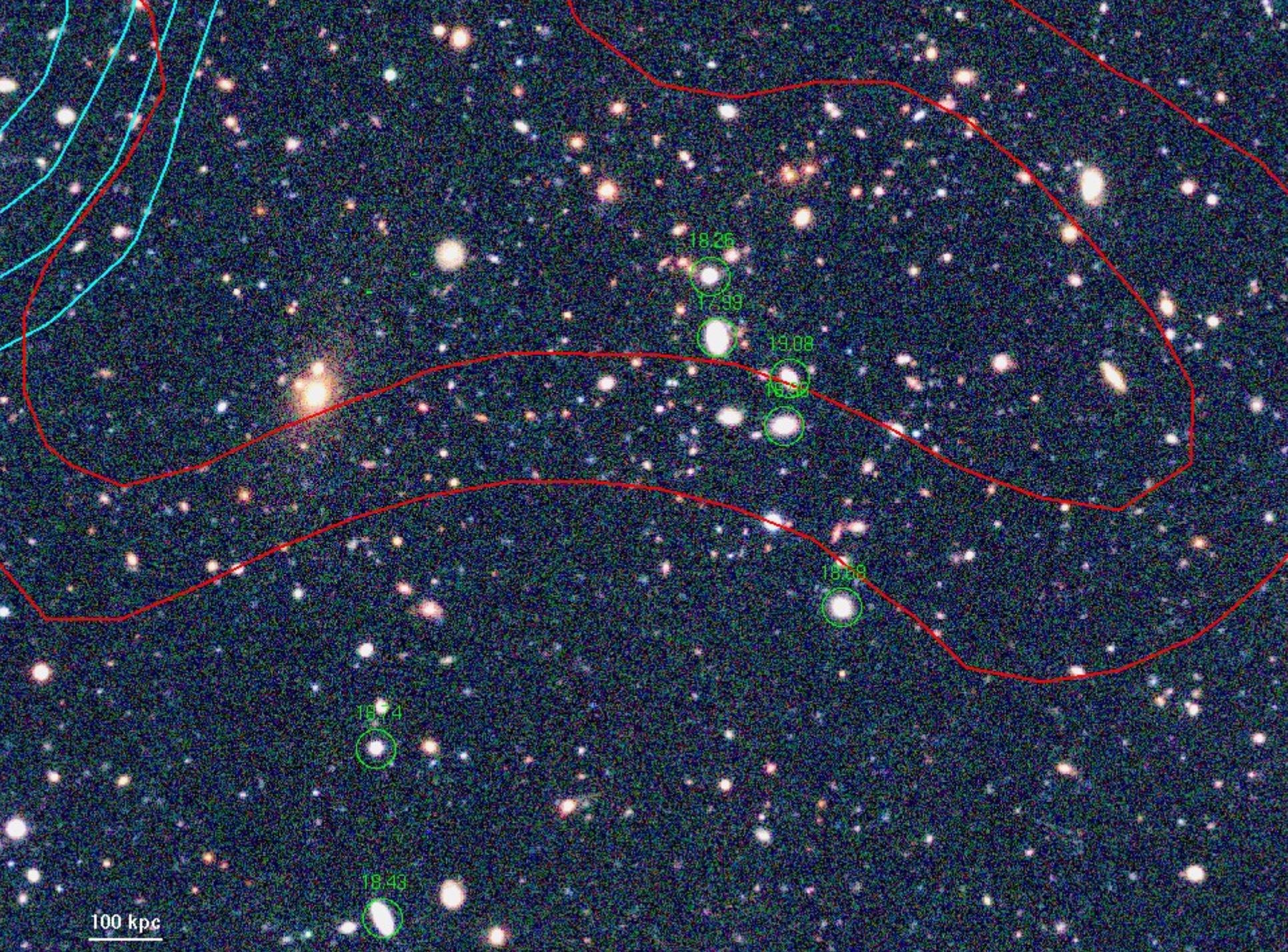


VO and
datamining in





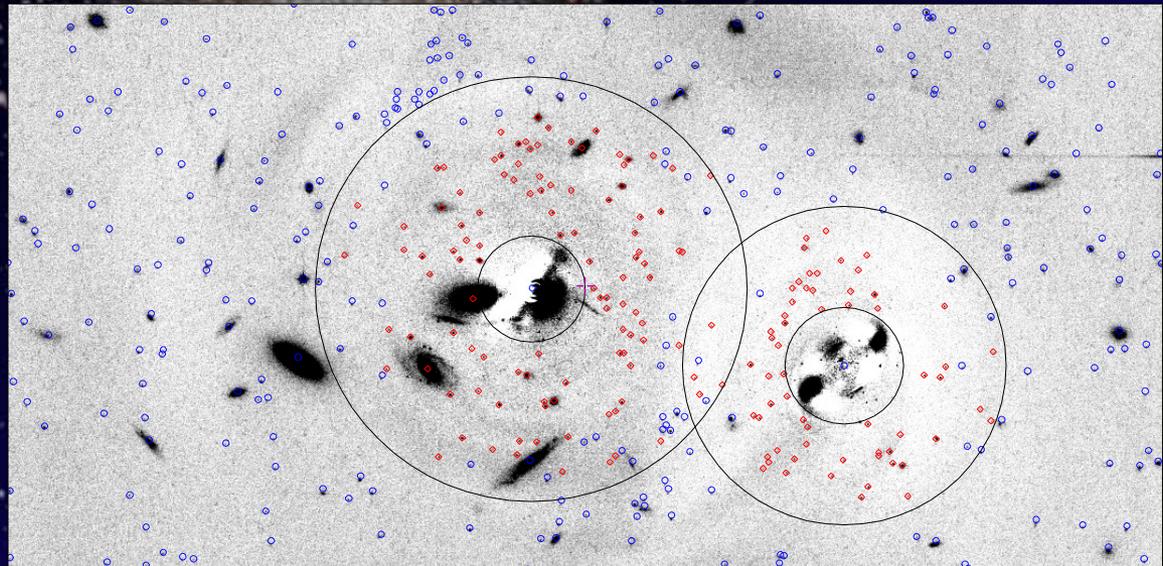
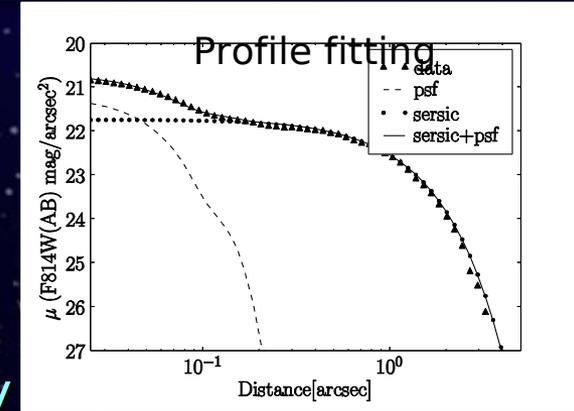
250 kpc

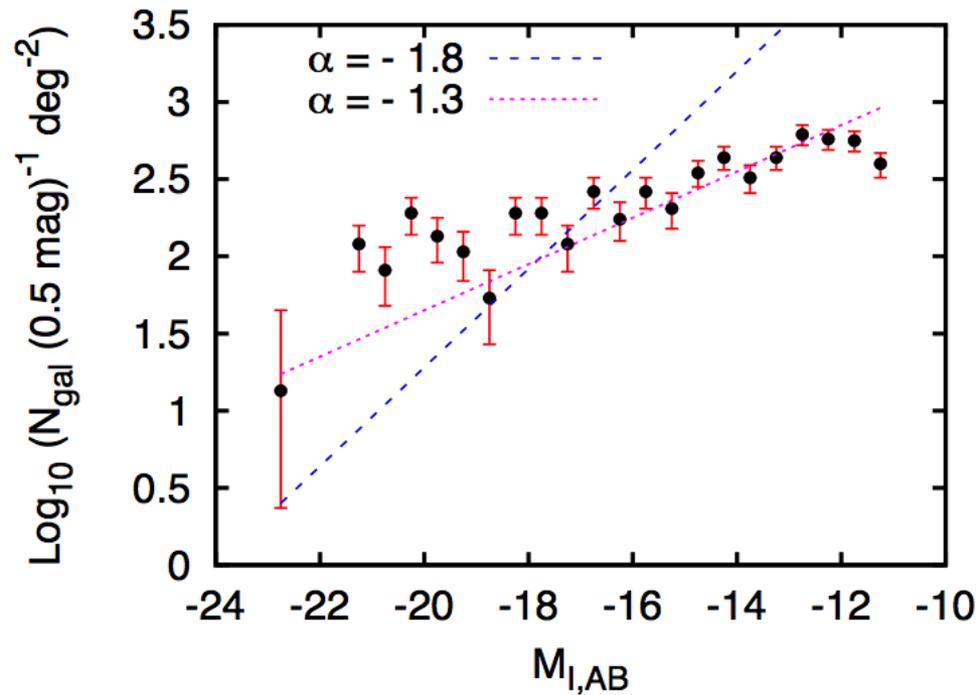
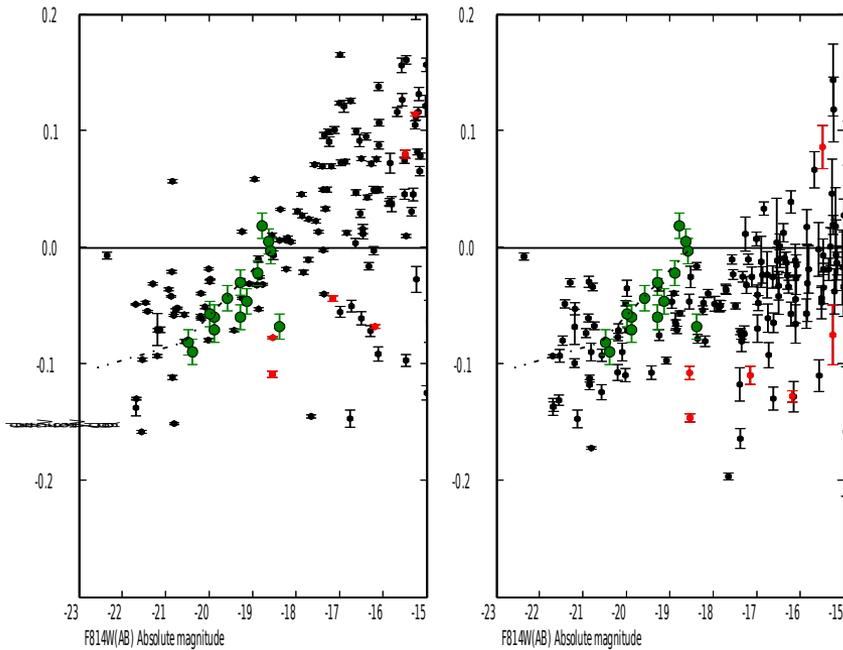


100 kpc

ACS@HST Coma LS

- AstroWise enables COMA LS team
- 10,000 objects via galphot/ galfit parallel processing
 1. Photometric catalog full survey 70,000
 2. Structural parameters catalog full survey





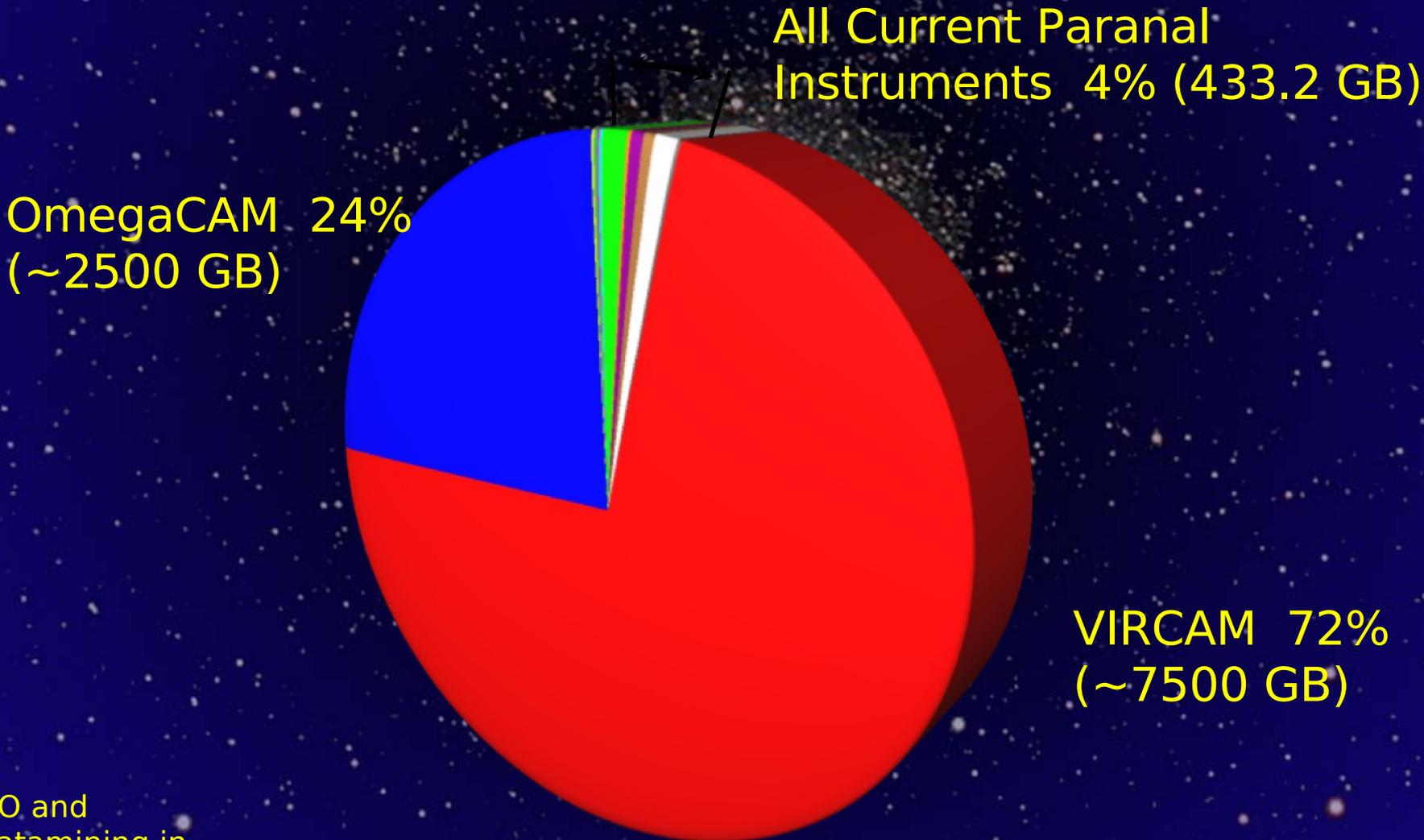
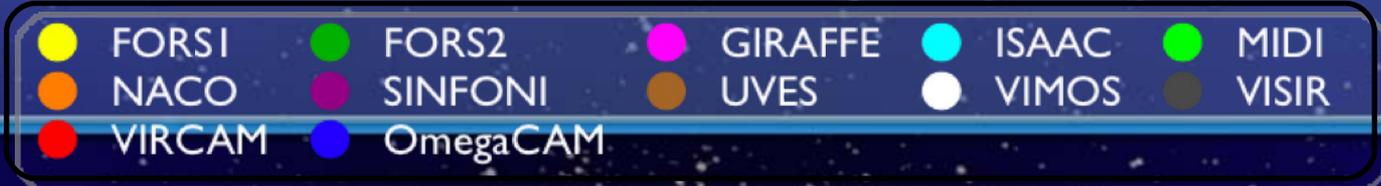
PhD Den Brok 2010

- Extreme faint-end luminosity function Slope $\alpha \approx -1.2$
- Much shallower than Cold dark Matter prediction $\alpha \approx -1.8$
- clean radial colour gradients are much smaller
- Hint of extensive Intracluster globular cluster population

E-science

- Beyond “workstation science” of the 80-90’s
- Distributed services
- Distributed communities
- Distributed archives
- p2p networks – KAZAA- NAPSTAR
 - Share cpu
 - Share storage
 - Share info / meta data /knowledge

Paranal Monthly Data Rates 2007 statistics



future

2010

OmegaCAM- VST

VISTA

LOFAR

>>2010

- GAIA
- ESO- ELT
- LSST
- ESA- EUCLID
- SKA

Basics- different views on

- Surveys
- Templates
- Pipelines
- Virtual Observatories

Basics- Surveys

- Defined area on sky
- Homogeneous
 - Survey limit
 - Flux (magnitude)
 - Size
 - Surface brightness
 - distance
- Quality control

basics- Templates

Standards very important for VO

- Observing templates
 - Astronomical Observing Templates at ESA
 - Templates / Template signature files at ESO

Basics

ESO parse info via headers

Photometry

- **TSF- OCAM_img_obs_stare**

- **TSF- OCAM_img_cal_monit**

Stare observations with $N = 1$, filter=composite

Recipe- PhotCal_Monitoring

```
TPL ID    = OCAM_img_cal_monit
TPL NEXP  = 1
DPR CATG  = 'CALIB'
DPR TYPE  = 'STD, EXTINCTION'
DPR TECH  = 'IMAGE, DIRECT'
OBS STRTG= 'FREQ'
```

-  **TSF- OCAM_img_cal_zp**

Stare observations with $N = 1$, filter=key band

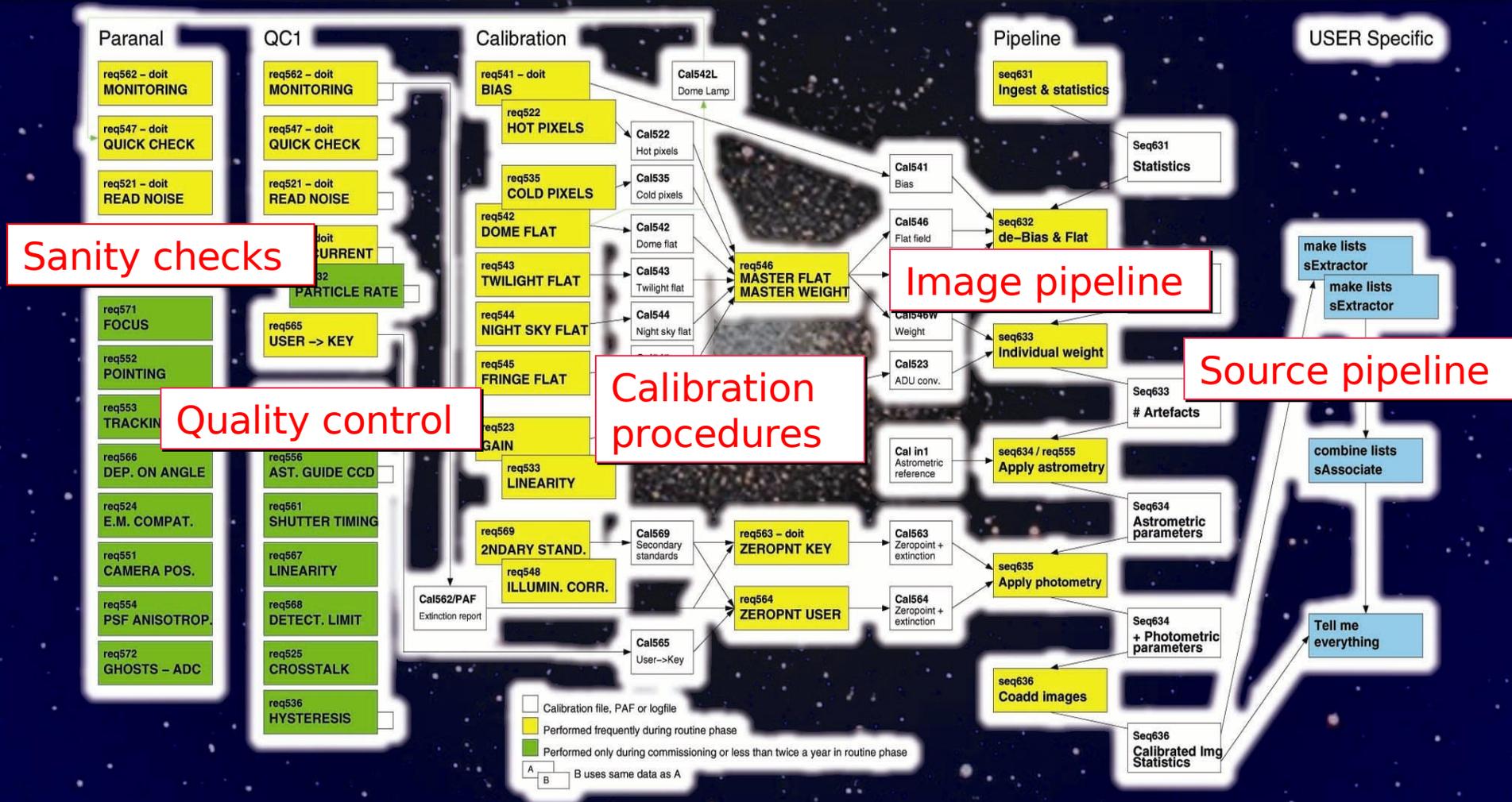
Recipe- PhotCal_Extract_Zeropoint

```
TPL ID    = OCAM_img_cal_zp
TPL NEXP  = 1
DPR CATG  = 'CALIB'
DPR TYPE  = 'STD, ZEROPOINT'
DPR TECH  = 'IMAGE, DIRECT'
OBS STRTG= 'FREQ'
INS FILT1= u',g',r',i',z', composite
```

basics- pipelines

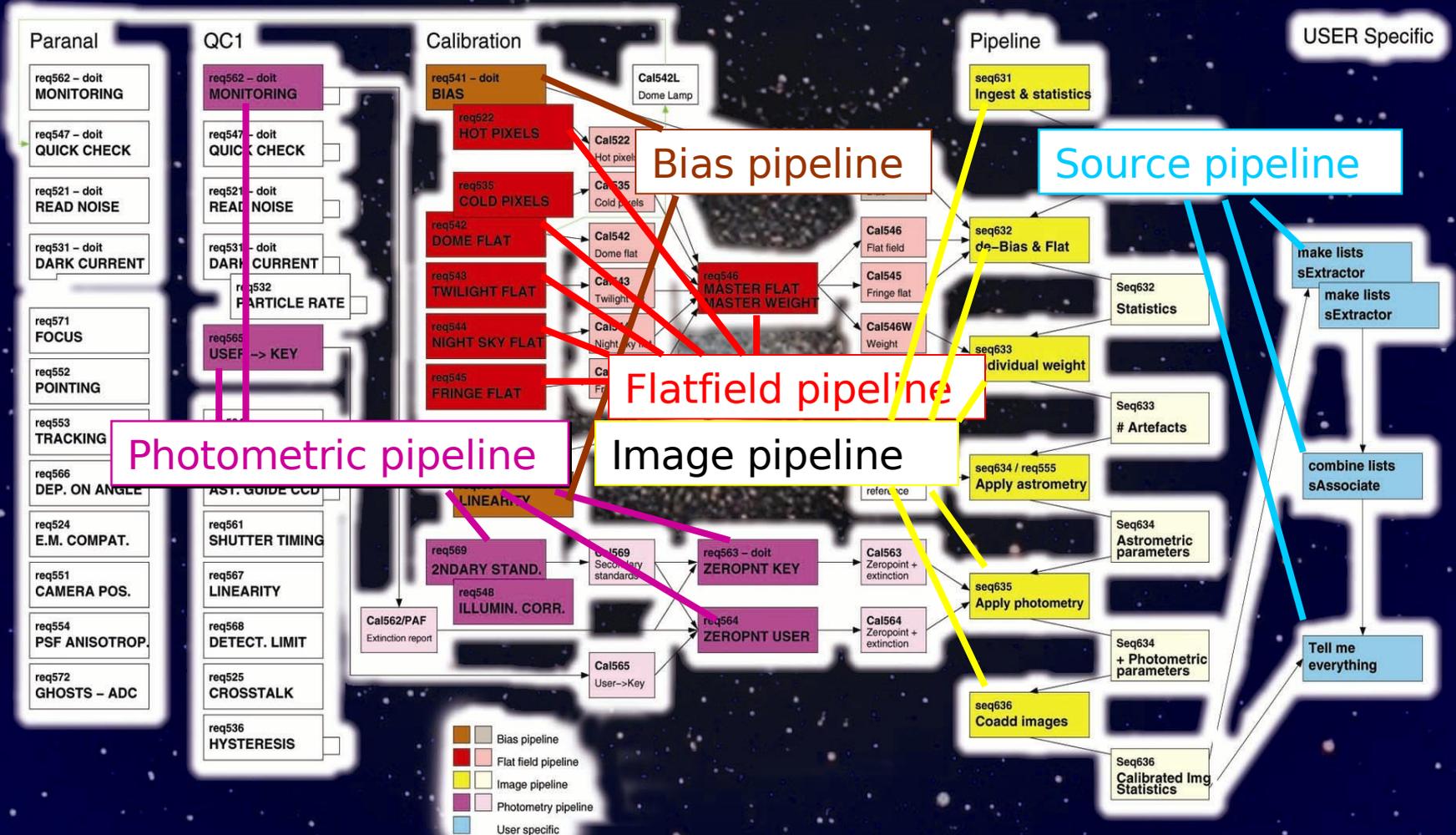
- Workflow
- What triggers a pipeline?
 - Data items
 - Operators
 - users

basics- Data Model / flow



Basics

Astro-Wise Pipelines



Basics

Virtual observatories

- Broad VOs
 - IVOA
 - Euro VO
- EuroVO DataCenter Alliance/ AIDA
- Focussed VOs
 - AstroWise

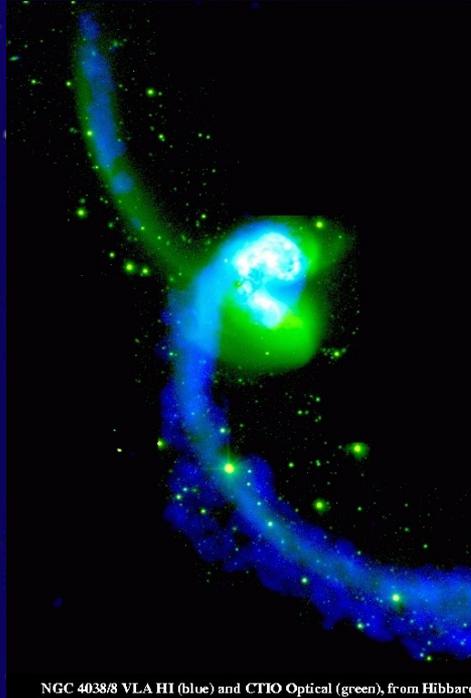


EUROVO



IVO- multi-wavelength view of a galaxy merger

Radio



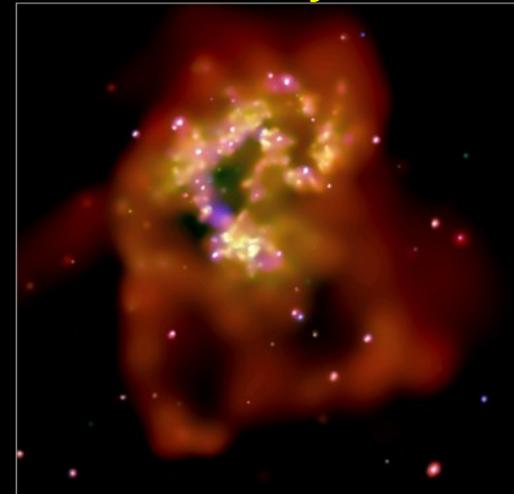
John Hibbard

<http://www.cv.nrao.edu/~jhibbard/n4038/n4038.html>

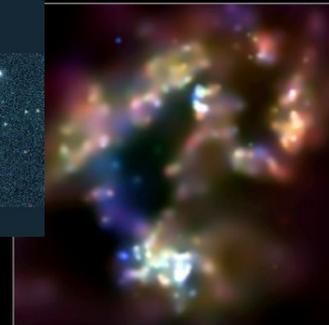
Optical



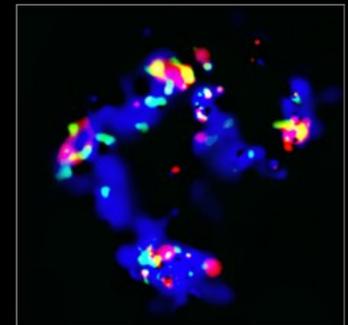
X-Ray



3-COLOR, FULL FIELD



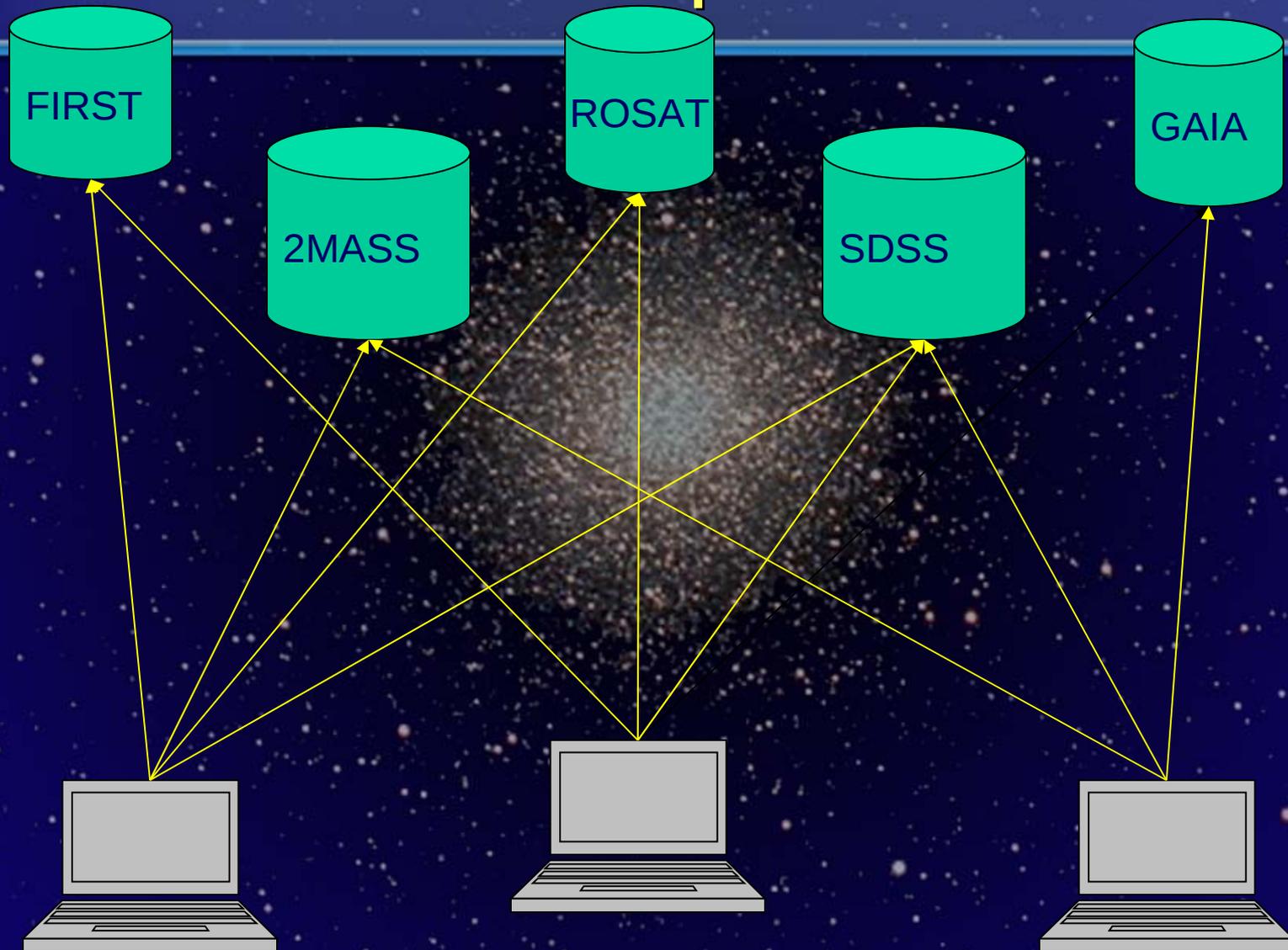
DIFFUSE EMISSION



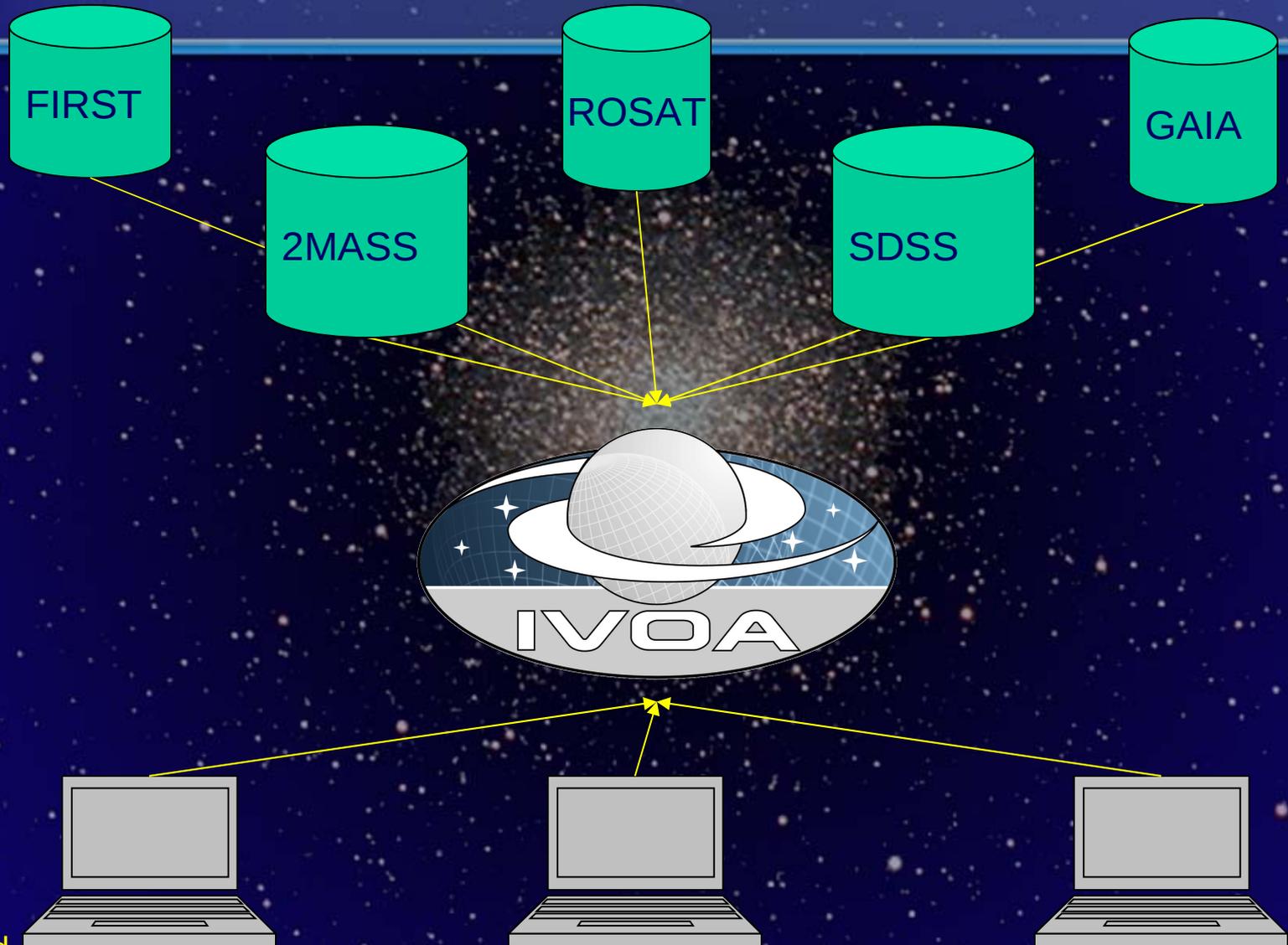
ELEMENT MAP

NASA/CXC/SAO/G. Fabbiano et al.

IVO - the problem



Ivo- work on a solution



Euro-VO

- Standards
 - FITS
 - Universal Content descriptor UCD
 - VO table – VOT
- Communities – workshops/training
- Registry
- Connecting archives
 - Cone search
 - X-match
 - All kinds of tools/ web services
- Relatively static

IVO- standards: Universal content Descriptor - UCD

- <http://www.ivoa.net/Documents/REC/UCD>

Examples of UCD1+ and how they are built:

- *The maximum temperature of an instrument.* This is a *temperature*, so the primary word will be: **phys.temperature**. This temperature is that of an *instrument*, so we specify it next: **phys.temperature;instr**. And finally, we add a third word to indicate that this is the *maximum* value of a **phys.temperature;instr**, giving the final UCD:

phys.temperature;instr;stat.max

- *The error on a magnitude measured in the V band.* The quantity is an *uncertainty*, so the primary word will be **stat.error**. This uncertainty applies to a *magnitude*, so we write **stat.error;phot.mag**. Then, we can specify the photometric band with another word, giving **stat.error;phot.mag;em.opt.V**.

<http://www.ivoa.net/Documents/PR/UCD>

Ivo- Standards: VO table -VOT

- VOtable_SourceList.xml
- <http://www.ivoa.net/twiki/bin/view/IVOA>

Euro-VO Finding information in the VO

Registries are here

- multiple interfaces
 - human readable
 - machine readable
- simple/advanced search

VO and datamining in astronomy

The screenshot shows a Mozilla Firefox browser window displaying the ESA-VO Registry website. The browser's address bar shows the URL <http://esavo.esa.int/registry/>. The website features the ESA-VO logo at the top left, with the text "ESA-VO Registry" below it. A navigation menu includes buttons for "Search Resources", "Insert Resources", and "Update Resources". Below this is a "Registry Quick Search" section with an "Advanced Search" form containing a search input field, a "Go!" button, and radio buttons for "AND" and "OR". The main content area is titled "ESAVO Full Harvestable VO Resource Registry" and contains a welcome message, a link to IVOA Resource Registry specifications, and a list of utilities for handling Registry data: Search Resources, Insert Resources, Update Resources, and Registry Quick Search. Each utility is accompanied by a brief description of its function. At the bottom of the page, there is a copyright notice for 2004 ESA and a navigation bar with links for "HOME", "CONTACT US", and "ADMIN LOGIN".

ESA-VO
Virtual Observatory

ESA-VO
Registry

Search Resources

Insert Resources

Update Resources

Registry Quick Search

Advanced Search

Search Go!

AND OR

ESAVO Full Harvestable VO Resource Registry

Welcome to the ESAVO Full Harvestable VO Resource Registry.

If you want to know more details about what a "VO Registry" is, you can have a look at the [IVOA Resource Registry](#) specifications.

At the left panel, you can find different utilities to handle Registry data:

- Search Resources

Allows to search among the different resource types in the Registry. For example, clicking on the "Simple Image Access" will display all the available Resources of type "Simple Image Access" in the registries around the world.

Due to the fact that the Tabular Sky Service Resource type allows for one entry per table, and that CDS contains thousands of tables, and in order to not clobber the access, we have separated the Tabular Sky Service in CDS and non-CDS searches for commodity.

- Insert Resources

Allows the insertion of a new Resource in the ESAVO Registry.

- Update Resources

Allows the edition of a Resource that resides in the ESAVO Registry. Resources can only be updated in the Registry where they have been introduced, and not in registry that harvest them from other places. Consult the registry specification for more details (see above URL).

- Registry Quick Search

Allows for a quick search on a string. The string introduced is searched in the following Resource Registry fields:

- Title, ShortName, Identifier, ResourceType
- Content -> Description, Subject, Type, ContentLevel

If you have any question regarding the ESAVO Registry, please send a note to our [Registry manager](#)

© Copyright 2004 ESA

HOME CONTACT US ADMIN LOGIN

N params N data back to basics

- Joins – links
- ++ Inheritance – dependencies
- Everything in cs is addresses
memory, ASCII, namespaces,
registry
- Optimize , organize, index
- management

Query driven visualisation

TOPCAT

File Views Graphics Joins Windows YO Interop Help

Table List

- 1: SourceList-135651

Current Table Properties

Label: SourceList-135651
Location: SL-135651-2df_R_17.votable
Name:
Rows: 4787
Columns: 35
Sort Order: \uparrow
Row Subset: All
Activation Action: (no action) Broadcast Row

SAMP

Messages: Clients: AW

60 / 485 M

Aladin v6.0 *** PROTOTYPE VERSION (based on v6.000) ***

File Edit Image Catalog Overlay Tool View Interop Help

Location: ICRS

file:localhost.net:awton.data.users.buddelmeijer@mp.sci-6.nl:KEM

2 superimposed objects

BackGr	ERRA_IMAGE	SID	MAGERR_IS
5.44149848878E-13	8678.15332031	2521	1202.79
3.09843269748E-13	9033.68652344	2550	1760.59
1.46398917295E-11	16169.5732422	2604	853.52
1.96915183812E-13	4169.22070312	2740	1987.10
2.30313733579E-13	7846.08886719	2828	1228.89

TIP: Write a script command directly into the "Command/Location" field

33 sel / 4787 src 112Mb

Scatter Plot

File Export Plot Axes Subsets Errors Marker Style Error Style Help

FLUXERR_ISO (x10⁻³)

MAG_ISO

Legend: All (red dot), bright (blue dot)

Main

Data

Table: 1: SourceList-135651

X Axis: MAG_ISO

Y Axis: FLUXERR_ISO

Row Subsets: All, bright

Potential: 4,787 Included: 4,787 Visible: 4,787 Position:

SAMP Control

File Connect Help

Sent Messages

Received Messages

Clients

- Aladin
- Hub
- topcat
- Astro-WISE

Current profile:

- username : AWHBUDELMEIJER
- database : db.astro.rug.astro-wise.org
- project : ALL
- current privileges : 1 (MyDB)

```
awe> sl = (SourceList.SLID == 135651)[0]
awe> from astro.services.samp.Samp import Samp
awe> samp = Samp()
awe> samp.broadcast(sl.frame)
awe> samp.broadcast(sl)
awe> s.highlighted(sl)
2474
awe>
```

Extreme data lineage

	RawFrame	ReducedFrame	RegriddedFrame	CoaddedRegriddedFrame	BiasFrame	ColdPixelMap	MasterFlatFrame	FringeFrame	HotPixelMap	Illumination Correcti
SLID=4147 SID=0 RA=11.3289 DEC=-29.3984 X=1765 Y=84										
SLID=136151 SID=27 RA=9.5151 DEC=-28.9031 X=883 Y=45								None		
SLID=136151 SID=29 RA=9.6949 DEC=-28.9023 X=538 Y=126								None		
SLID=136151 SID=28 RA=9.8784 DEC=-28.9041 X=247 Y=96								None		
SLID=4147 SID=40 RA=11.4650 DEC=-29.3785 X=284 Y=187										

Comp. science journal PhD Mwebaze

Drop-outs

PhD Bout

VO and datamining in astronomy

