
The First International eROSITA Conference
-157 Registered Participants
- ~60% from German/Russian eROSITA institutes (26 talks)
- ~40% from outside Germany and Russia (38 talks)

How can you work with eROSITA-Germany ?

1. Survey Data will go public incrementally, after a maximum 2 years proprietary period. For the pointed phase, everyone can apply through AO
2. Access to the proprietary eROSITA data is via the eROSITA Working Groups, which currently comprise members of the collaborating German institutions. **"External collaborators"** can propose to work on a specific project/paper using the proprietary data by contacting and working together with a member of the working group, who will seek the necessary approval from the eROSITA project.
3. Members of large collaborations with broad synergies with eROSITA (e.g. very wide area follow-up etc.) can gain access to the proprietary eROSITA data for joint projects, in return for access to proprietary data from the complementary survey. Case by case negotiations will take place at project level
4. External scientists may become **"Associate Members"** of an eROSITA WG. Rights and responsibilities of Associate members are still under discussions, as is the mechanism for their appointment (e.g. via invitation, AO, etc.)

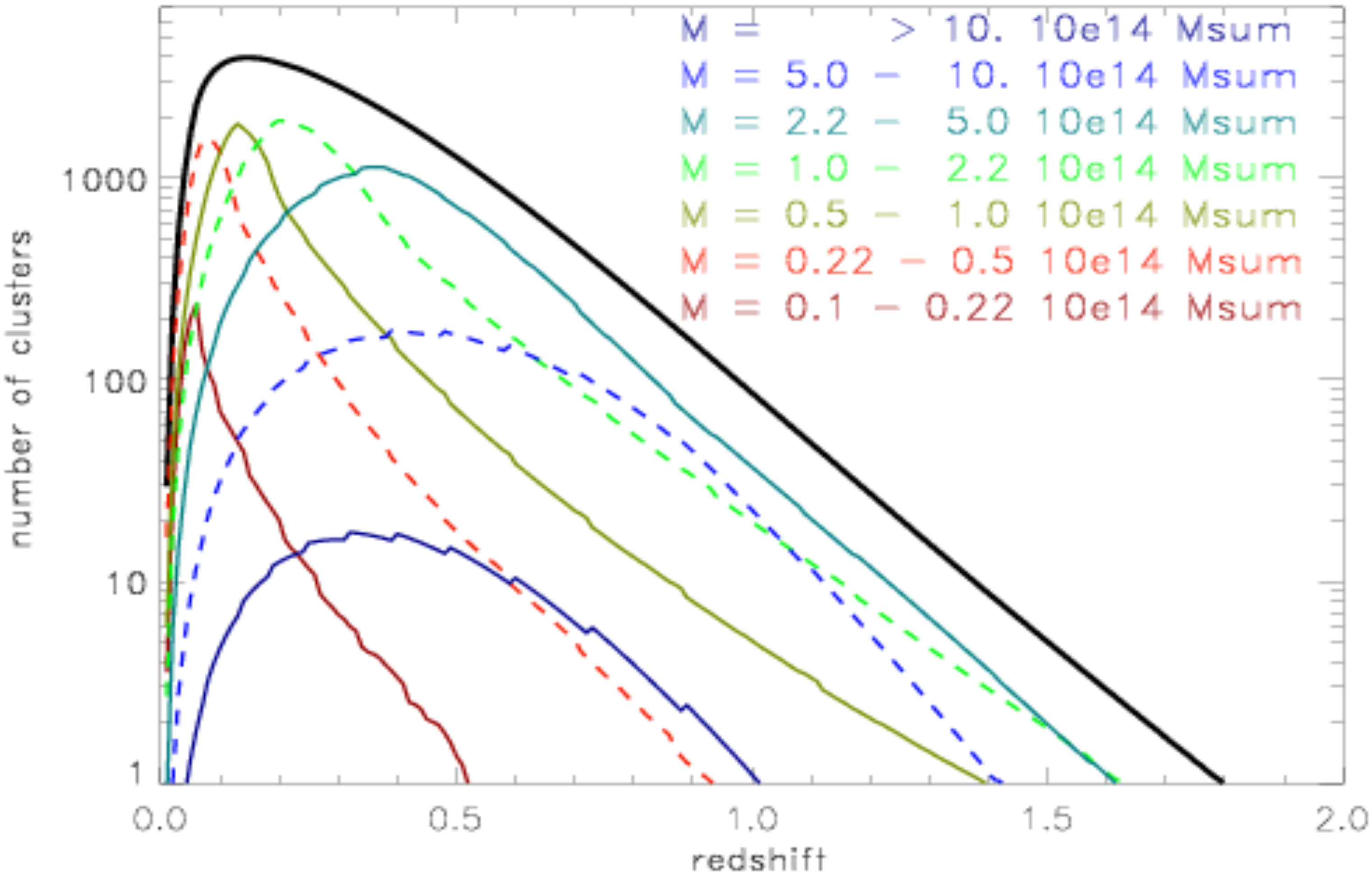
eROSITA Working Groups in Germany

Science
Clusters and Cosmology H. Böhringer (MPE, chair); J. Mohr (USM, co-chair); T. Reiprich (Bonn,co-chair)
AGN, Blazars K. Nandra (MPE)
Normal Galaxies F. Haberl (MPE)
Compact Objects A. Schwope (AIP); A. Santangelo (IAAT)
Stars J. Schmitt; J. Robrade (Hamburg)
Solar System K. Dennerl (MPE)
SNR, diffuse emission W. Becker; M. Freyberg (MPE); M. Sasaki (IAAT)

Infrastructure
Time domain astrophysics J. Wilms; I. Kreykenbohm (Bamberg)
Data analysis, source extraction, catalogs H. Brunner (MPE)
Multi-wavelegth coverage and follow-up, ID J. Mohr (USM)
Calibration & Background K. Dennerl; M. Freyberg (MPE)

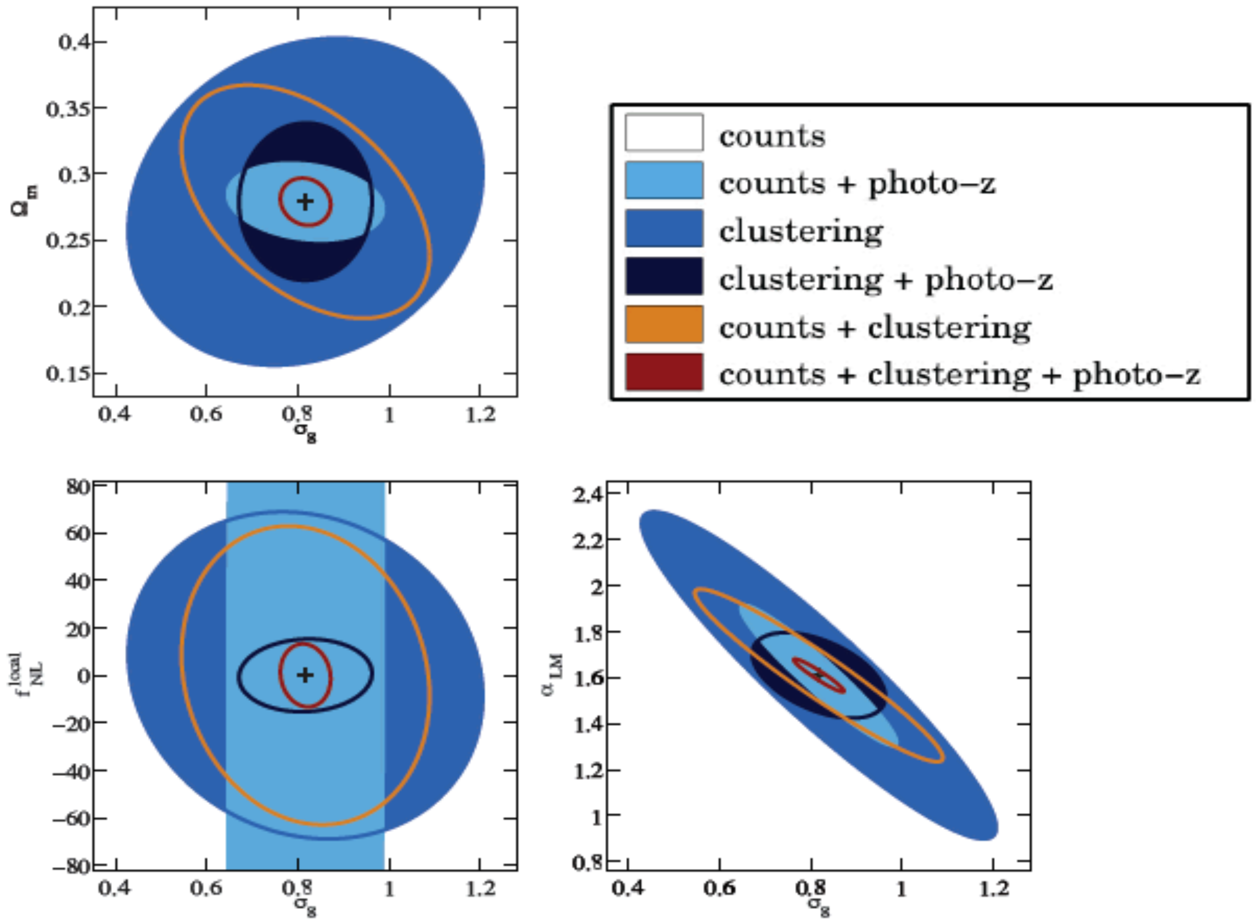

1. CLUSTERS AND COSMOLOGY
2. DIFFUSE EMISSION FROM ICM, ISM, SNR
3. MULTIWAVELENGTH WIDE AREA SURVEYS

Mass and Redshift Distribution of the Clusters



H. Boehringer (MPE)

Results with eROSITA: self-calibration

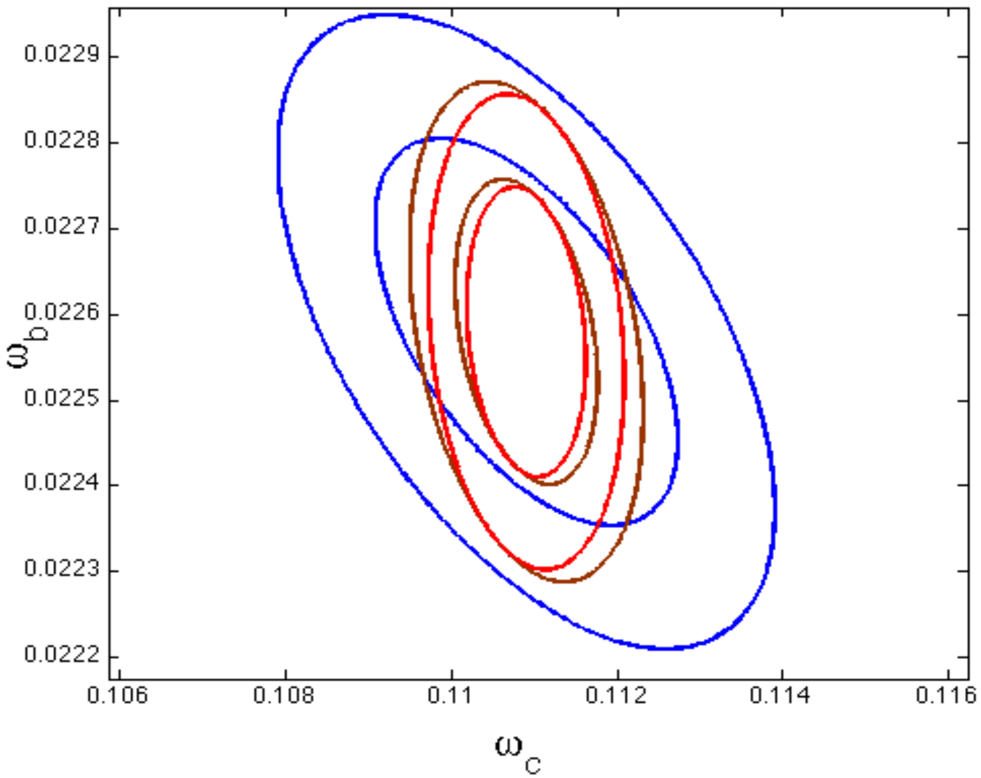


A. Pillepich (UCO/Lick)

eROSITA helps tighten constraints from Planck…

Planck is the built for precision cosmology and it is hard to compete with its power to constrain cosmological parameters.

Adding eROSITA still helps a lot !



Improvement by factor of 1.5

Improvement by factor of 2.5

S. Majumdar (TIFR)

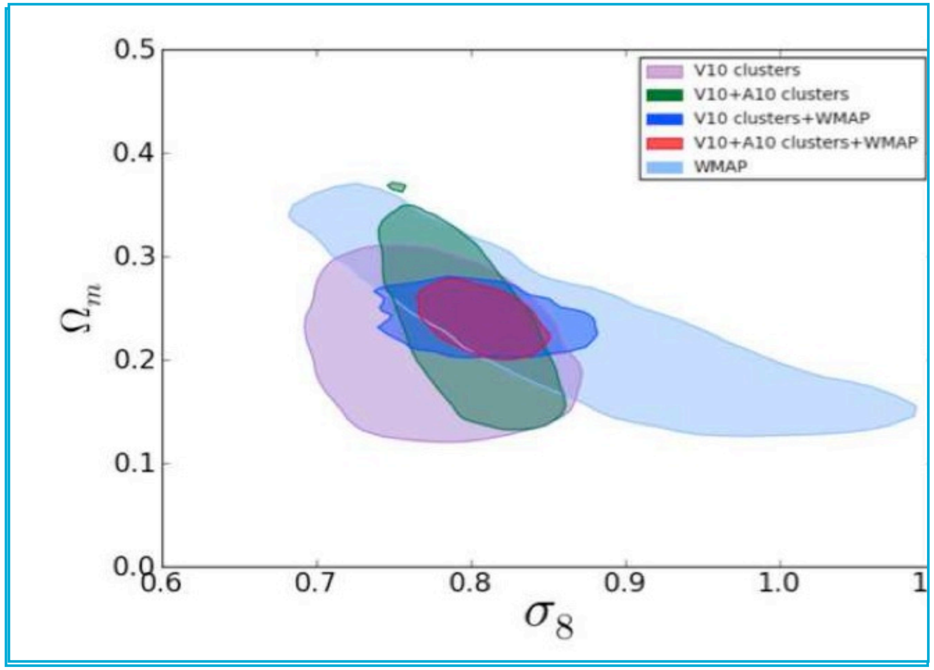
SPT: Preliminary Cosmology Results
(including X-ray Mass Calibration)

- Using A11 mass calibration, Benson et al reanalyze sample of 21 clusters within initial 178deg^2 survey

- Initial X-ray mass cal tightens constraints (need 5% fpr Cosmology)

- Results in good agreement with previous cluster constraints

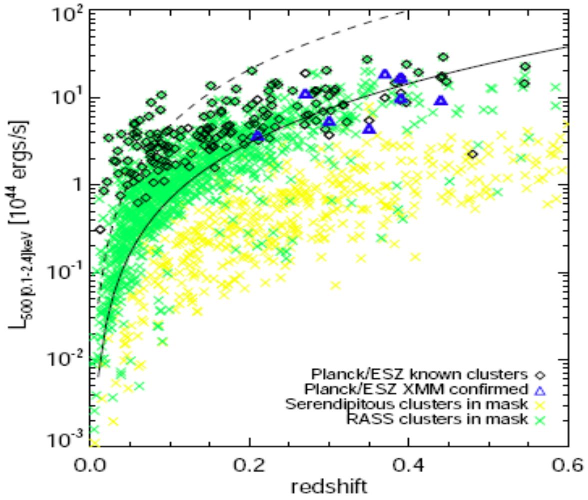
Benson et al 2011



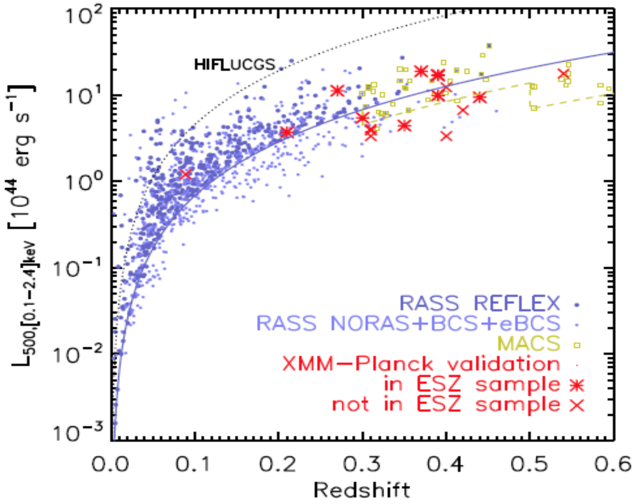
J. Mohr (USM)

ESZ sample vs other surveys

Planck ESZ clusters (black & blue)



All new Planck clusters red/orange

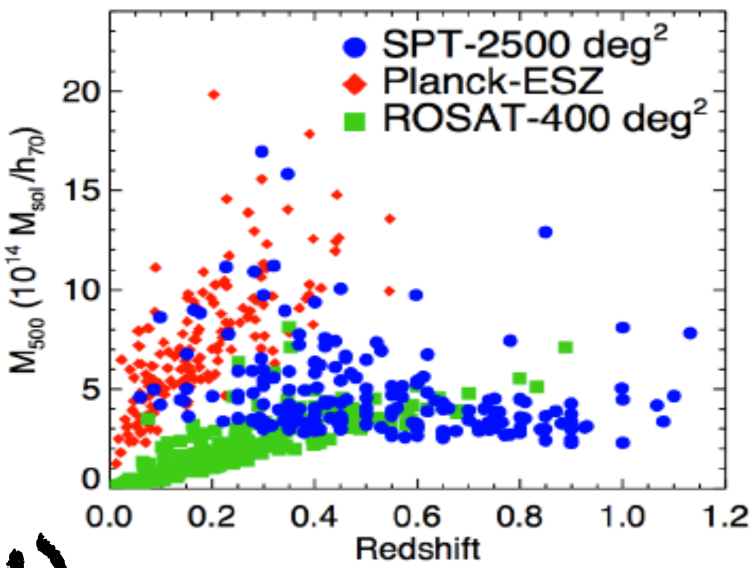


- ESZ completes the high M-z region sparsely-populated by RASS clusters (massive dynamically perturbed systems)

Planck has the unique capability to detect the most massive clusters over the whole sky

- ESZ reference sample for z<0.5 massive clusters complementary to high-z SPT sample

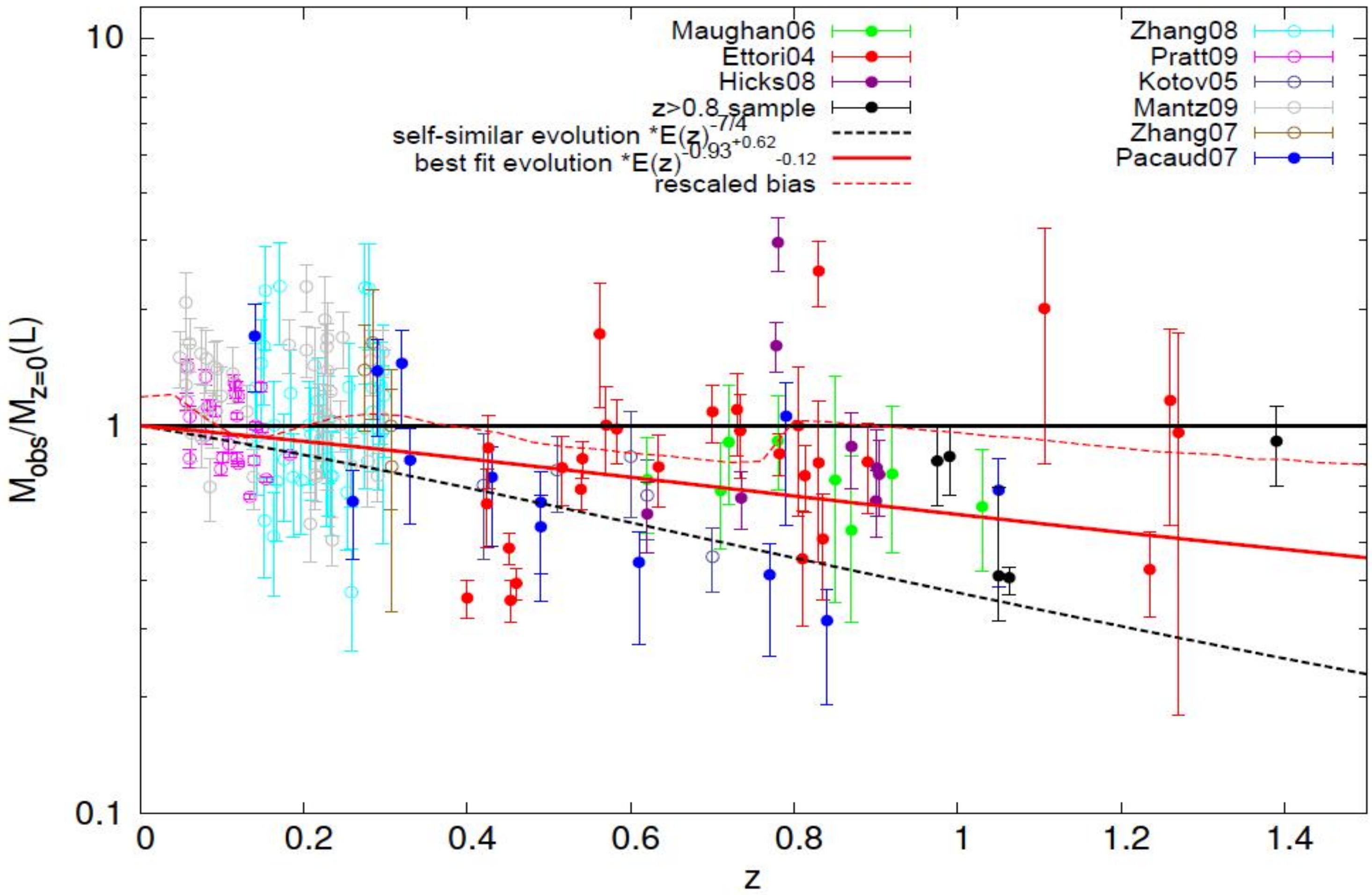
SZ Mass vs Redshift



Courtesy, B. Benson & G. Holder

N. Aghanim (IAS) J. Mohr (USM)

Observed Evolution of the M - L Relation



good L_X measurements currently allow mass estimates with ±30% uncertainty (using the local intrinsic scatter)

to be improved for eROSITA applications

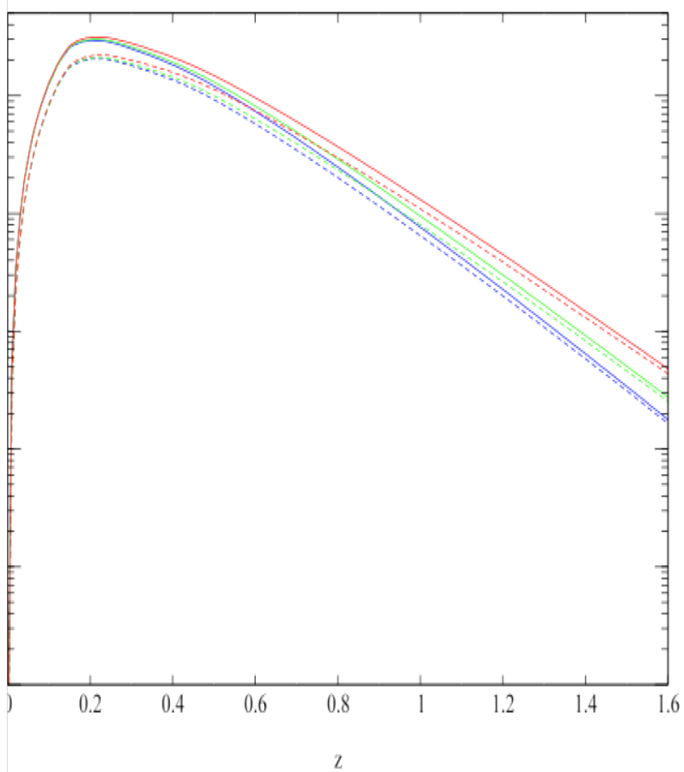
X-ray luminosity for given cluster mass does not increase as fast with redshift as assumed in self-similar models !

H. Boehringer, R. Fassbender (MPE)

Change of Number of Predicted Distant X-ray Cluster Number Counts

Ratio of clusters above redshift 1 seen by eROSITA:

	ratio to self-similar
Self-similar:	1
no L-T rel. evol.:	0.55
New relation:	0.27



Reichert, Böhringer et al. 2011

H. Boehringer (MPE)

Task	Challenge	Challenge Level (1-5)
source detection of extended sources	need purity levels >99%, every 1% impurity yields ~1000 spurious sources	+++++
optical and NIR imaging follow-up with 4m+ telescopes	deep, efficient data acquisition and reduct. with accurate color-based z-estimates out to z~1.6 for several 1000 sources	+++
spectroscopic follow-up (8m+ tel.)	redshift measurements for hundreds of clusters up to z~1.6	+++
mass estimates from M-L_X scaling relation	availability of an accurately calibrated M-L_X relation up to z~1.6	++
completeness, contamination & bias evaluation	characterization of AGN contamination effects on detection efficiency and L_X and T_X biases	+++
deep X-ray follow-up observations	deep (Chandra) X-ray data for a suffici-ently large sub-sample to allow a detailed characterization of z>1 eROSITA clusters	++++

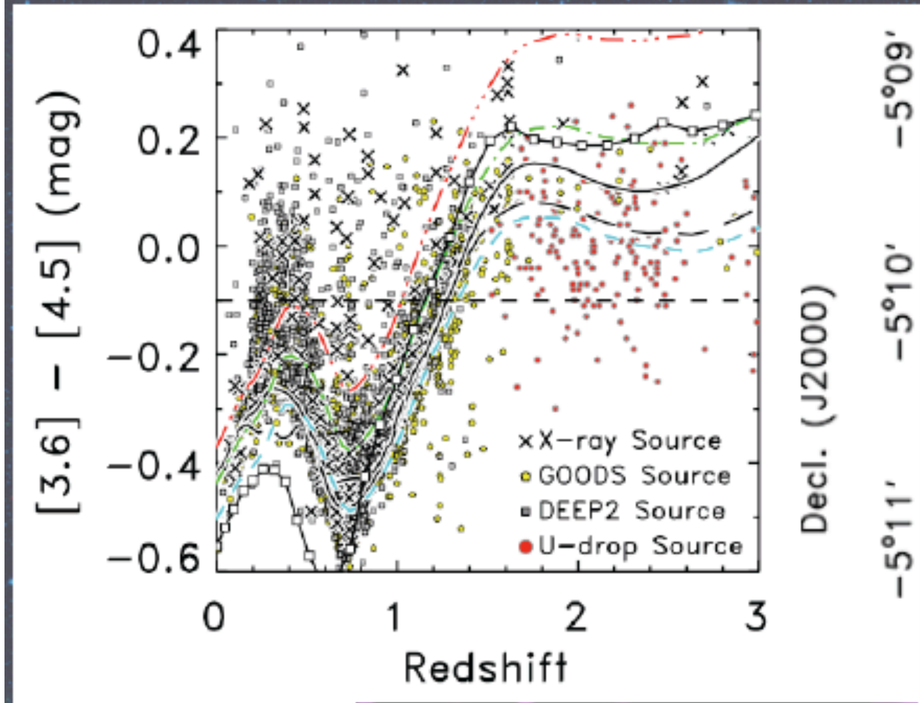
R. Fassbender (MPE)

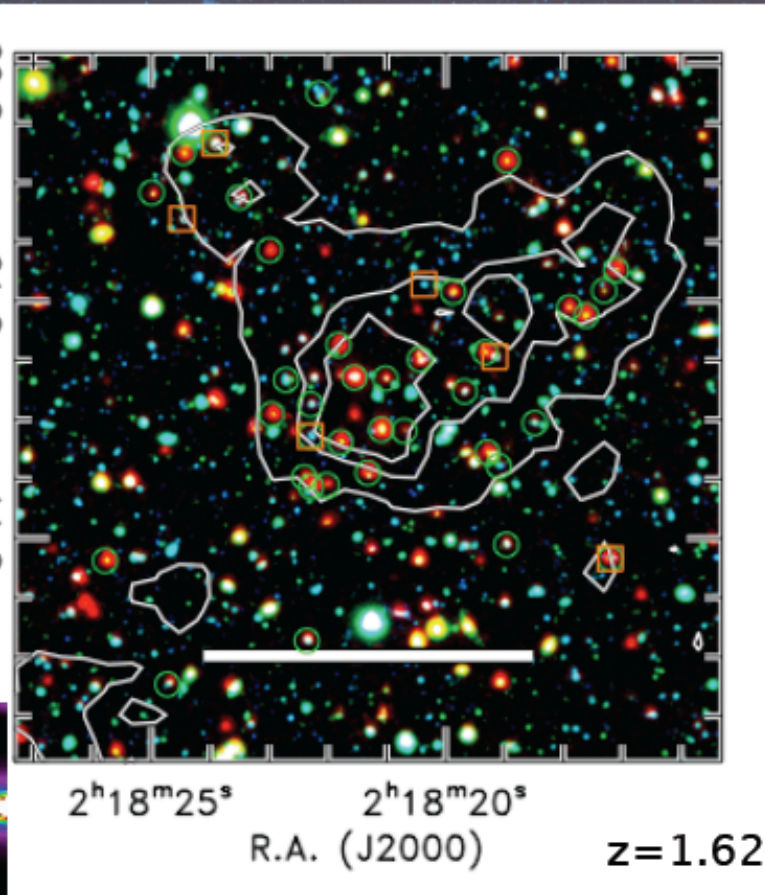
A lot of crucial “support” work

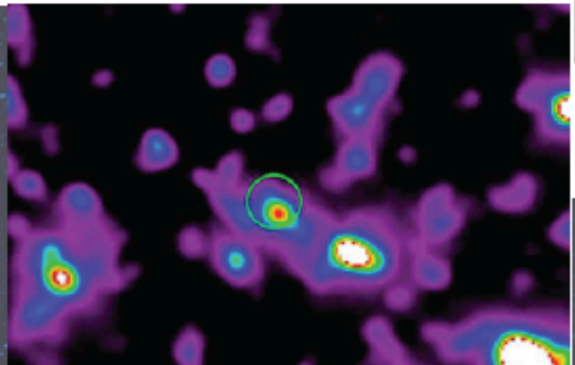
- Need survey-specific simulations
- For precision Cosmology, we are systematics limited already now
    - Mass is hardly an observable
    - “The Universe is a big place” - Distortions along l.o.s.
    - 17% of baryons are dynamically complex and relevant on Mpc scale
- The benefits of large overlapping cluster samples

G. Evrard (Michigan), S. White (MPA)

SWIRE Clusters: Papovich







C. Lonsdale (NRAO)

A lot of crucial "support" work

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- For precision Cosmology, we are systematics limited already now
    - Mass is hardly an observable
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    - 17% of baryons are dynamically complex and relevant on Mpc scale
- The benefits of large overlapping cluster samples
- Precision Cosmology with Clusters require calibration strategies that fully account for scatter in all relations between observables

G. Evrard (Michigan), S. White (MPA)

Aim of Magneticum Pathfinder

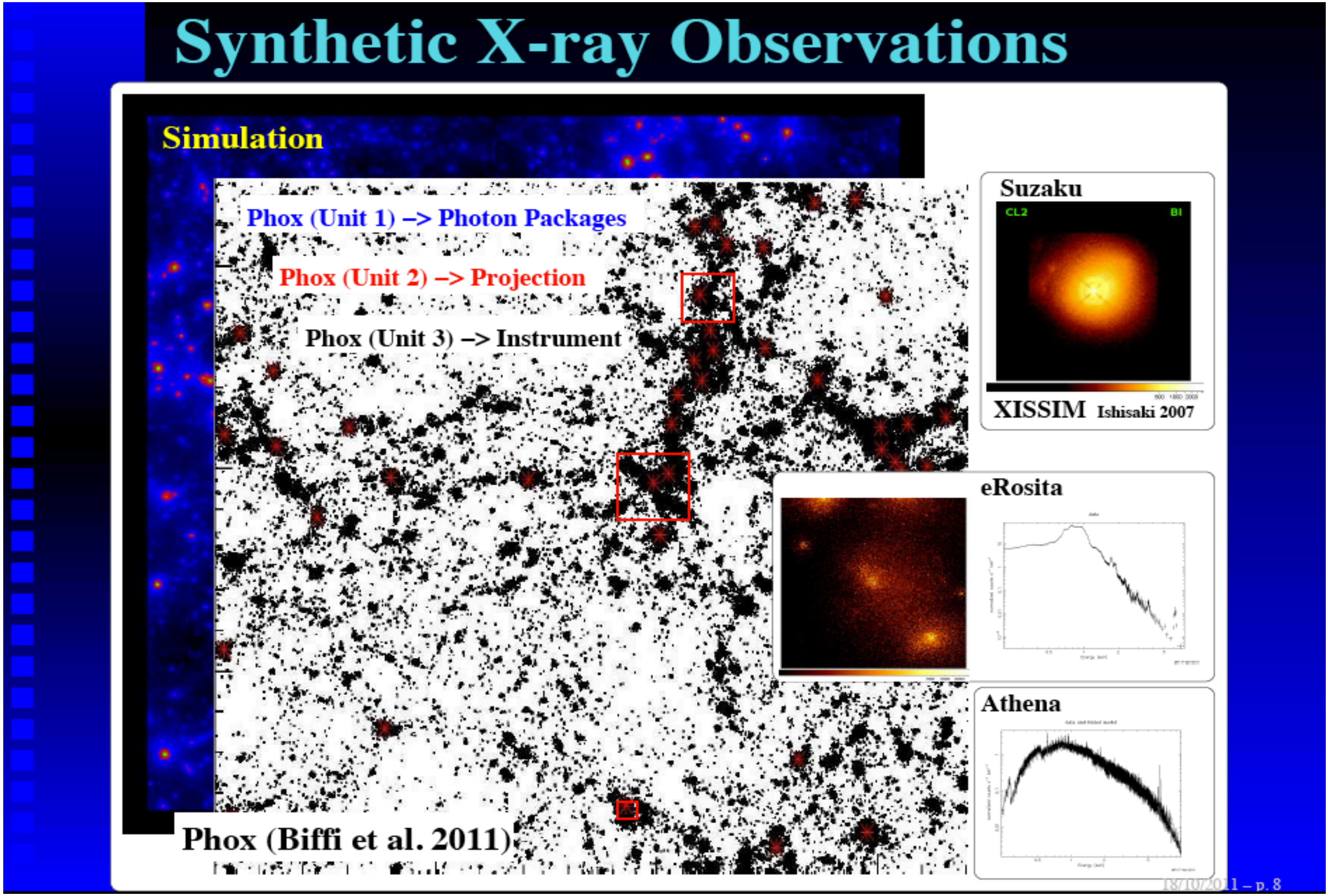
Physics to be included:

- cooling + star formation + winds Springel & Hernquist 2002/2003
- Metals, Stellar population and chemical enrichment, SN-Ia, SN-II, AGB Tornatore et al. 2003/2006
  + new cooling tables Wiersma et al. 2009
- BH and AGN feedback Springel & Di Matteo 2006, Fabjan et al. 2010
  + various modifications
- Low viscosity scheme to track turbulence Dolag et al. 2005
- Magnetic Fields (passive) Dolag & Stasyszyn 2009

Add ons:

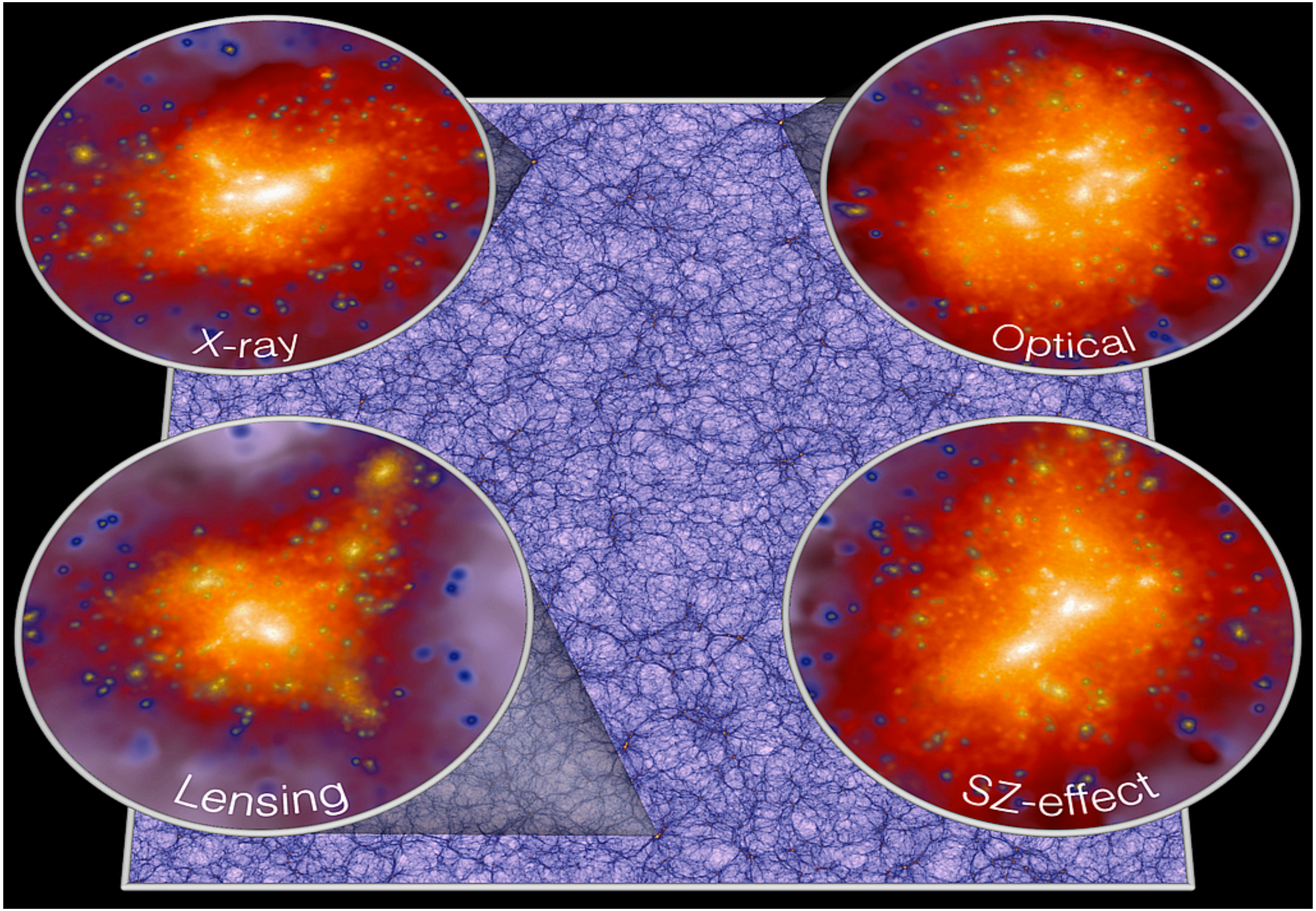
- On the fly Sub-Find Springel et al. 2001/2010, Dolag et al. 2009
- Photometric code to assign optical/near-IR luminosities to galaxies (u,V,G,r,i,z,Y,J,H,K,L,M) Saro et al. 2006, Nuzza et al. 2010
- On the fly Cluster/Groups properties
- Novel sub-data access scheme allowing an efficient read-out of particles belonging to a galaxy cluster

K. Dolag (USM)



Synthetic X-ray Observations
Simulation
Phox (Unit 1) –> Photon Packages
Phox (Unit 2) –> Projection
Phox (Unit 3) –> Instrument
Phox (Biffi et al. 2011)
Suzaku
CL2
BI
XISSIM Ishisaki 2007
eRosita
Athena
18/10/2011 – p. 8

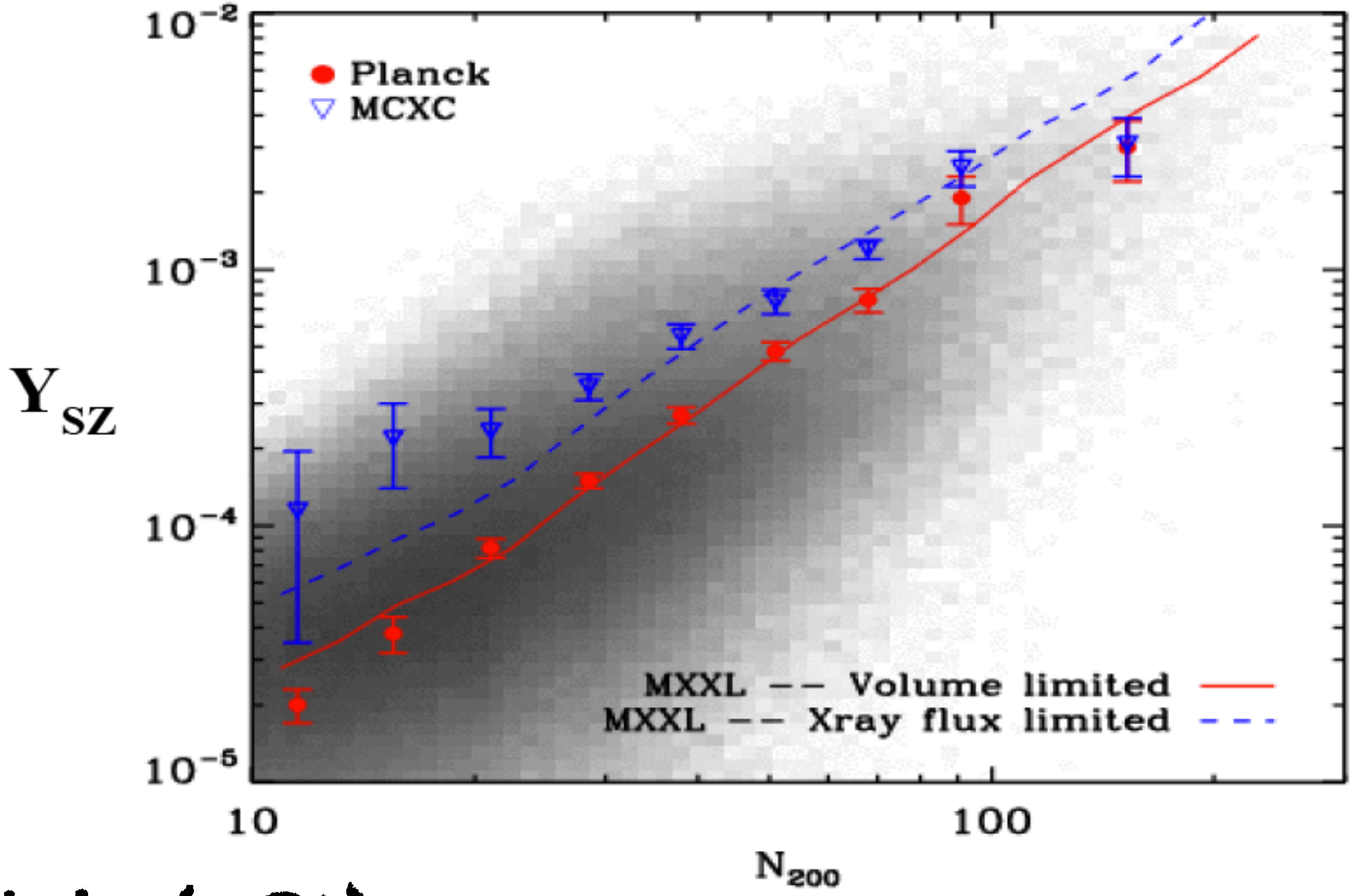
K. Dolag (USM)



S. White (MPA)

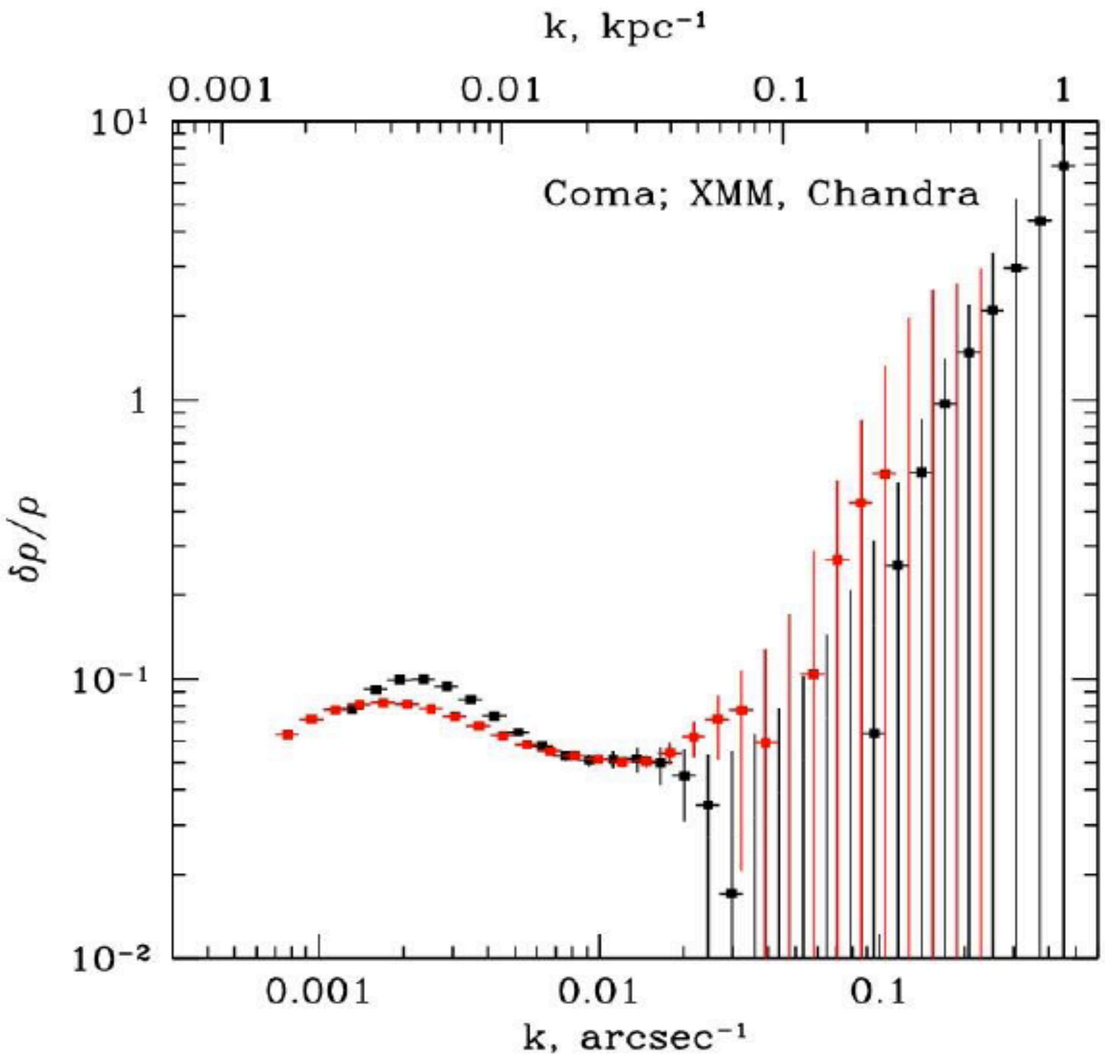
Stacked Y_{SZ} as a function of maxBCG richness

Angulo et al 2011



S. White (MPA)

3D gas density perturbations in Coma

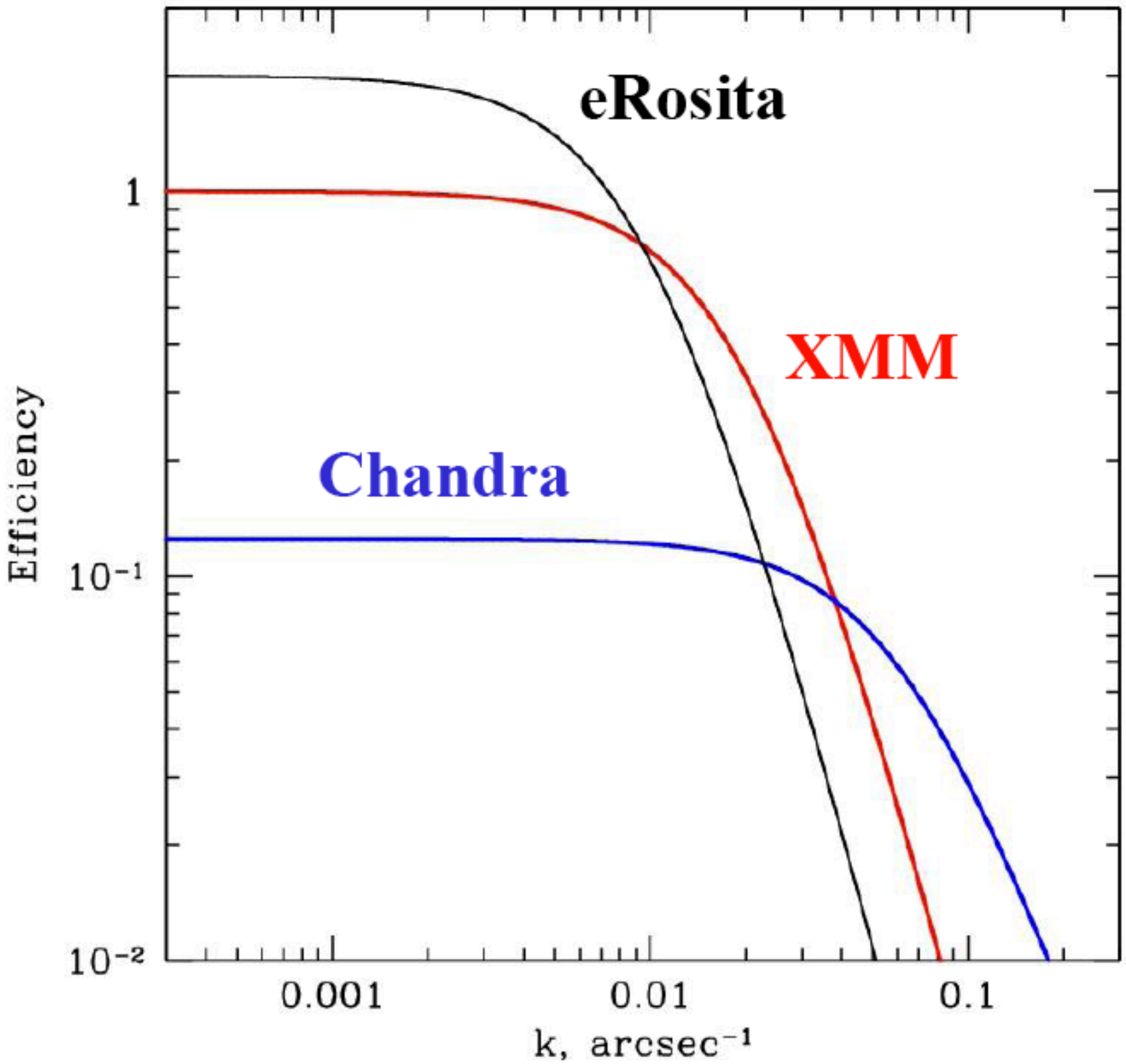


$$k = \frac{1}{x}$$

Density fluctuates by 5-10% at scales 30-1000 kpc

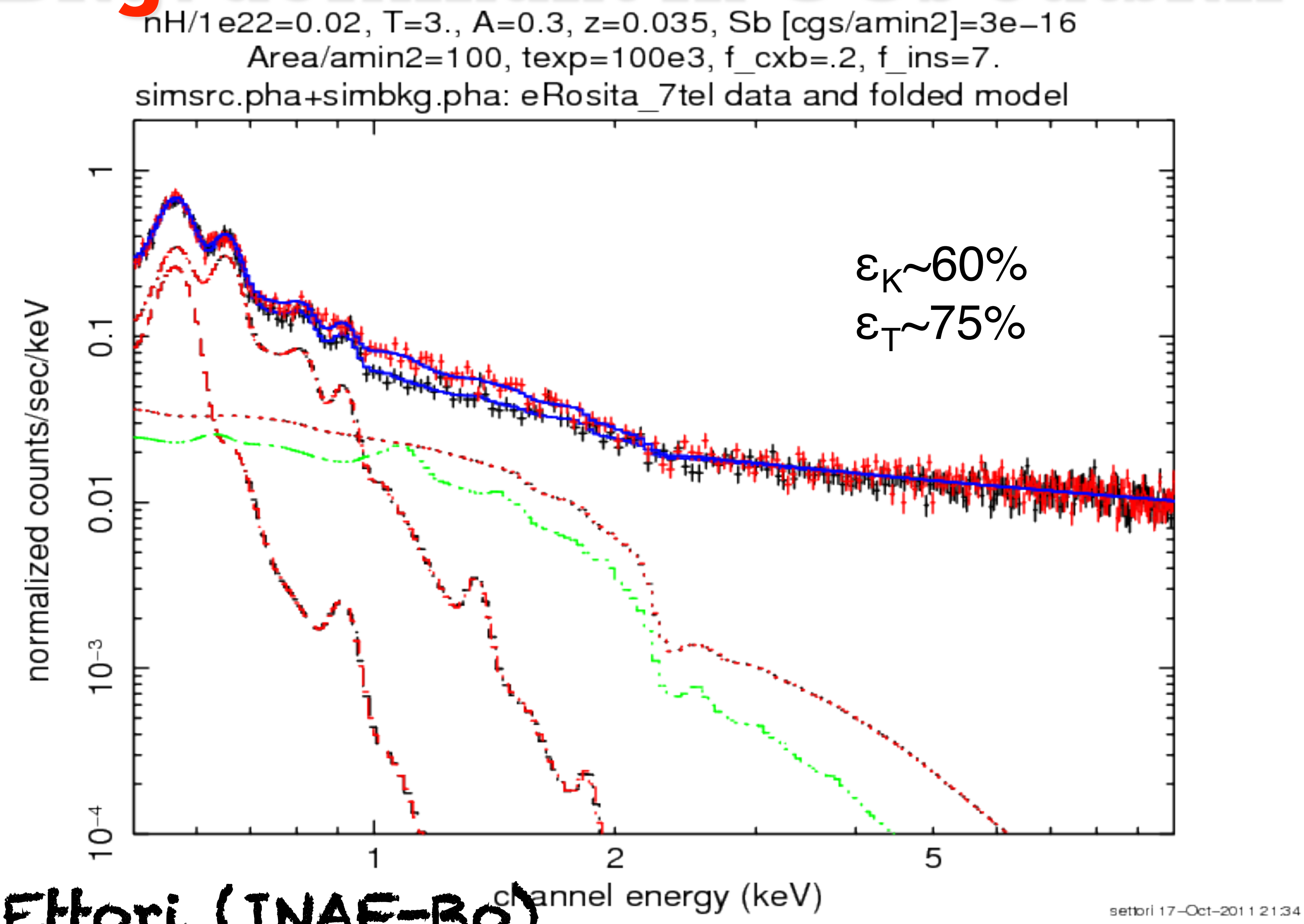
E. Churazov (MPA)

Efficiency for Power Spectra



E. Churazov (MPA)

Bkg: dominant in GCs outskirts

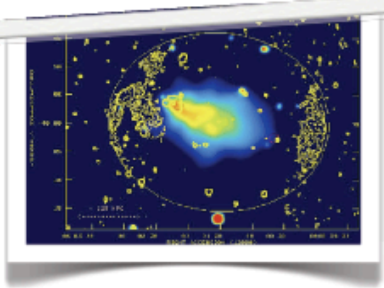


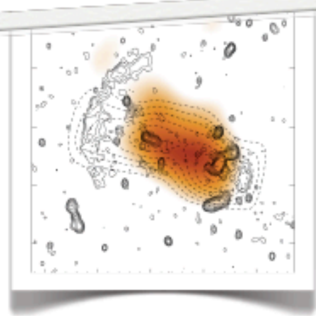
S. Ettori (INAF-Bo)

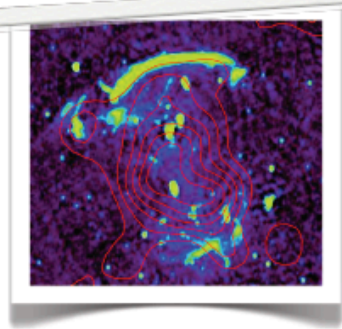
Some recently discovered relics

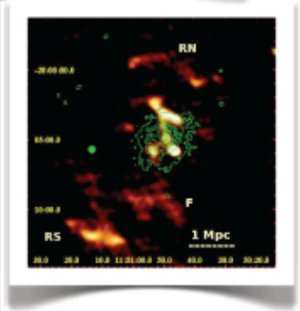
A 786
Contours: radio
$S_{1.4GHz}$ ~ 120 mJy
P_x ~ 1.5×10^{44} erg/s, z=0.12
[Harris et al. 93]

Relic identification is not straight forward
candidate → confirm cluster → deep radio obs
cluster X-ray contours are crucial



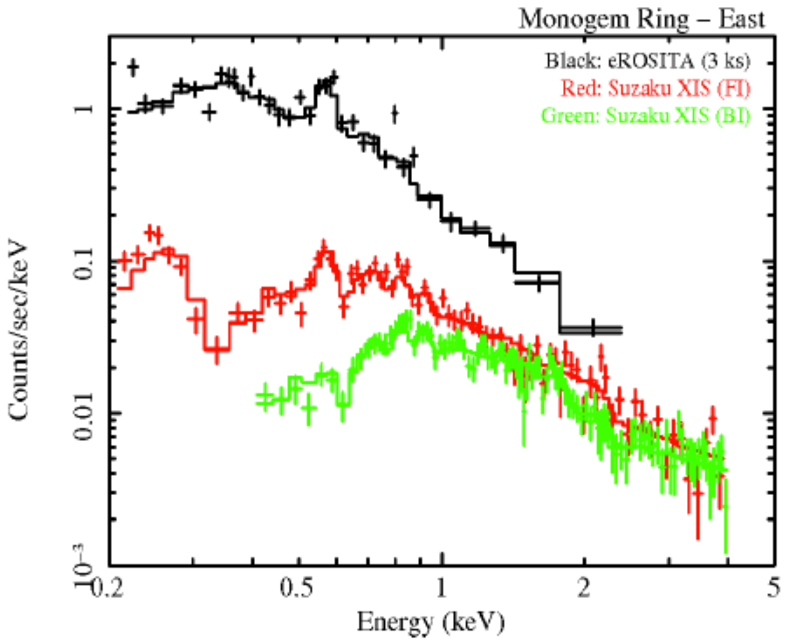




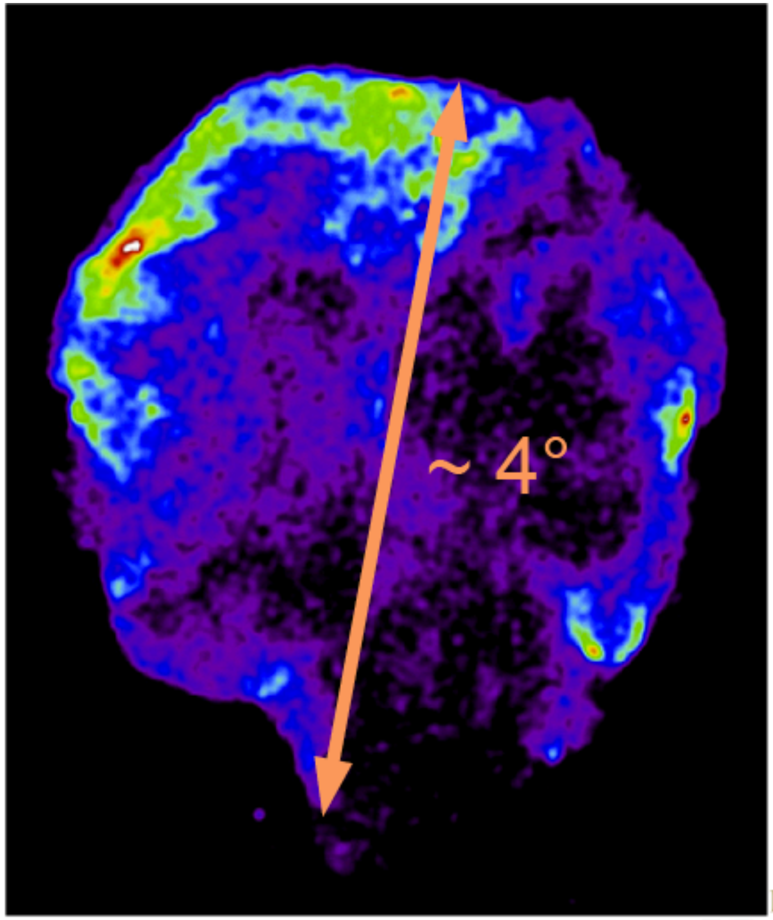


M. Hoeft (Tautenberg)

Unique combination of imaging and spectral capabilities

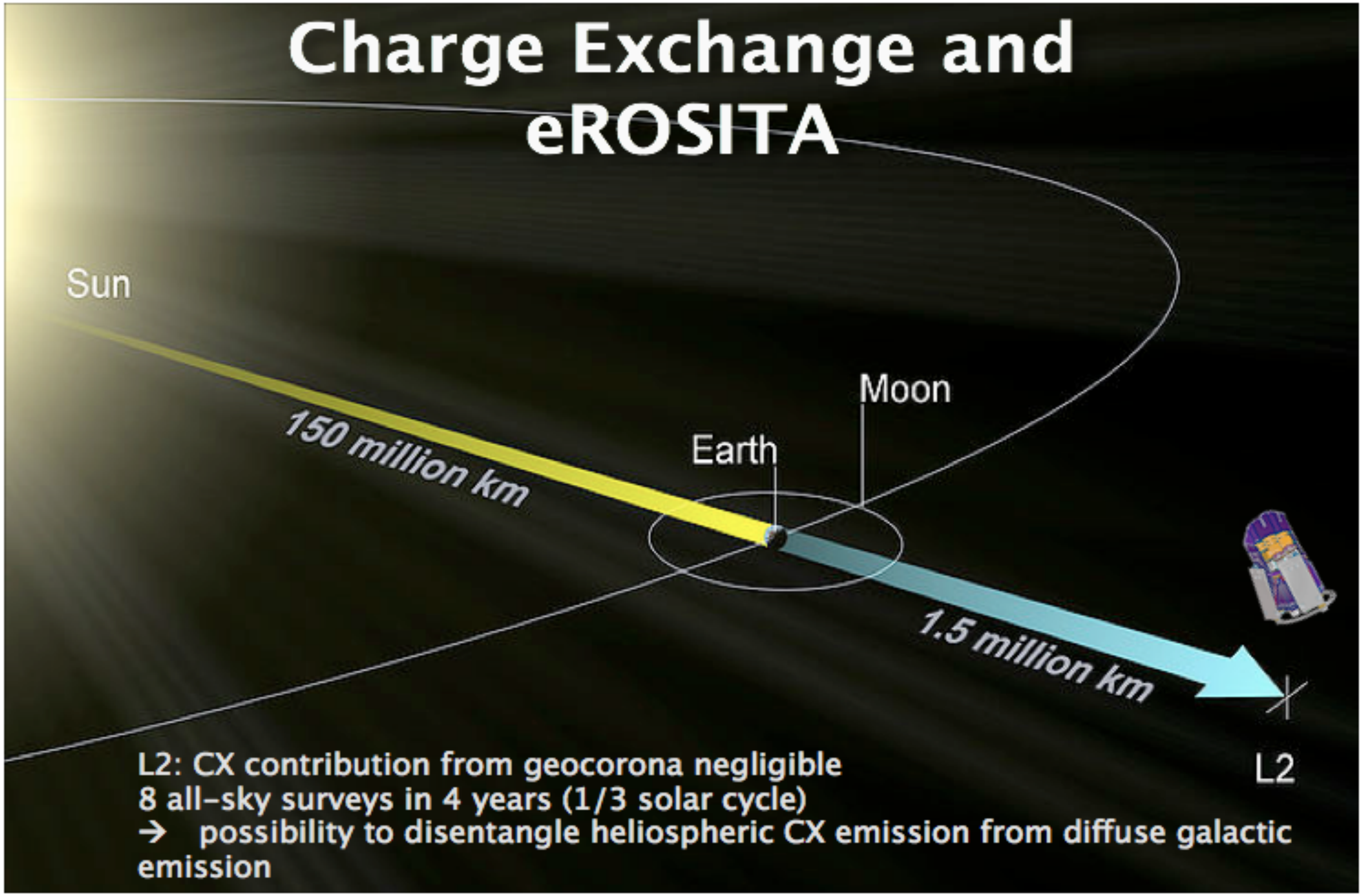


eROSITA simulation
Courtesy Christian Schmid,
University of Erlangen

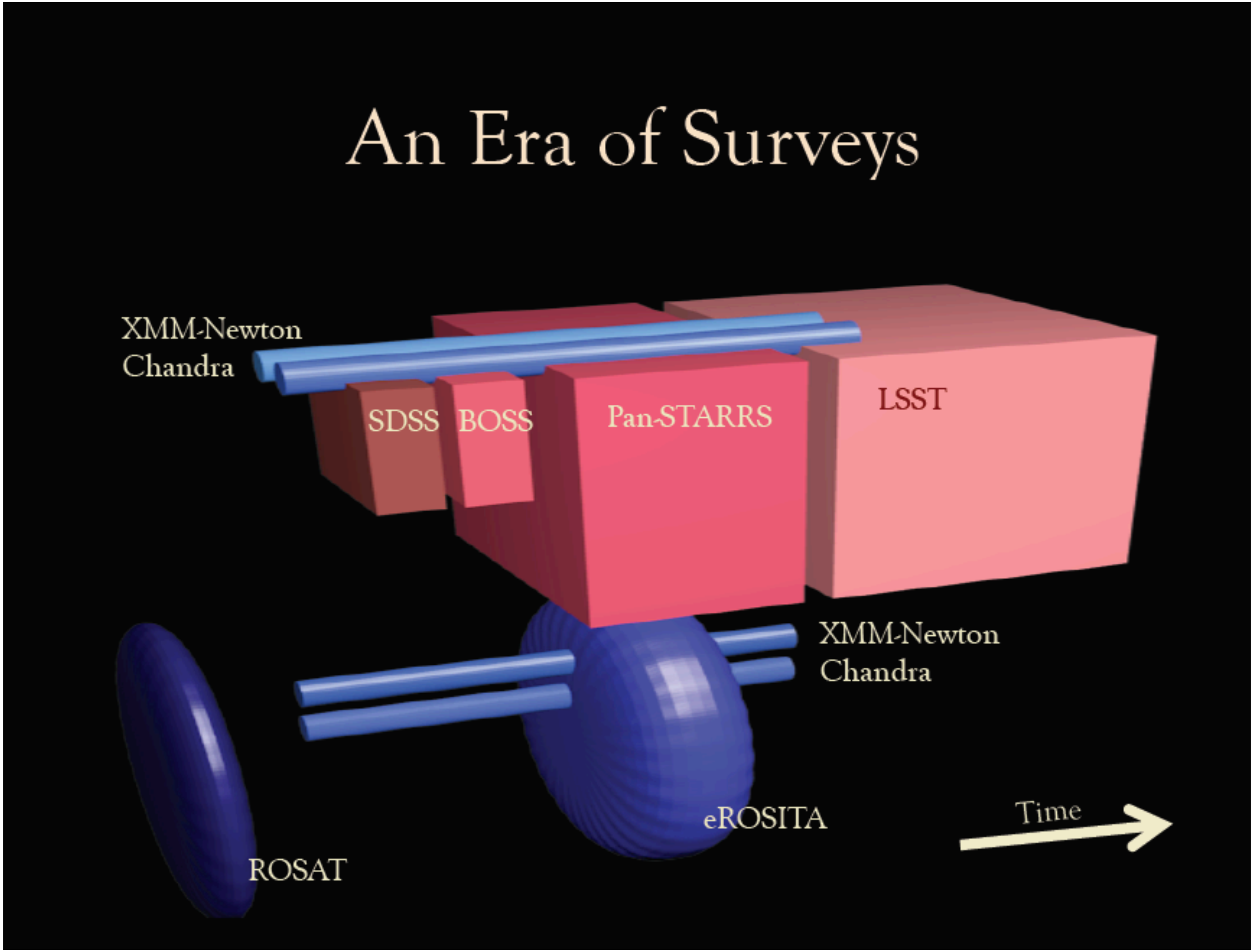


Obtain spectral information of the entire Cygnus Loop SNR!

M. Sasaki (IAAT), S. Snowden (NASA/GSFC)



K. Dennerl (MPE)



R. Gibson (Univ. of Washington)

VISTA Public Surveys Observations

Surveys	Area (deg^2)	Area Observed (Oct 2011)	Filters	Magnitude limit	Observation hours taken (Oct 2011)
Ultra-VISTA	1.7 deep 0.73 ultra-deep	1.7	Y J H K_s Y J H K_s NB118	25.7, 25.5, 25.1, 24.5 26.7, 26.6, 26.1, 25.6 26.0	320
VHS	17800	4208	Y J H K_s	21.2, 21.1, 20.6, 20.0	1050
VIDEO	12.0	10	Z Y J H K_s	25.7 24.6 24.5 24.0 23.5	357
VVV	560	562	Z Y J H K_s	21.9 21.1 20.2 18.2 18.1	385
VIKING	1500	470	Z Y J H K_s	23.1 22.3 22.1 21.5 21.2	619
VMC	180	54.3	Y J K_s	21.9, 21.4, 20.3	296

Deep high z Whole Sky Galactic Extragalactic Resolved SFH

VST Surveys Summary

Survey	Area (deg²)	Filters	Magnitude limits	Depth measure
KIDS	1500	u' g' r' i'	24.1, 24.6, 24.4, 23.4	10σ (AB)
Atlas	4700	u' g' r' i' z'	22.0, 22.2, 22.2, 21.3, 20.5	10σ (AB)
VPHAS+	~1800	u' g' Hα r' i'	21.8, 22.5, 21.6, 22.5, 21.8	10σ (AB)

Deep high z   Whole Sky   Galactic   Extragalactic   Resolved SFH

M. Rejkuba (ESO)

Comparison

	Depth	Width	Seeing
CFHLS	25.0	170	0.75
Pan-STARRS	25.4	70	~ 1.1
DES	25.2	5,000	~ 0.9
HSC	26.2	1,500	0.67

Key features: Depth and sharpness

Accuracy of the determination of WL mass of high z clusters

S. Miyazaki (NAOJ)

A Uniform Sky Survey

- 90% of time for a uniform survey: every 3-4 nights, the whole observable sky will be scanned
- Over 10 years, half of the sky will be imaged about 1000 times (ugrizy)
- About 100 PB of data, including a billion 16 Mpix images

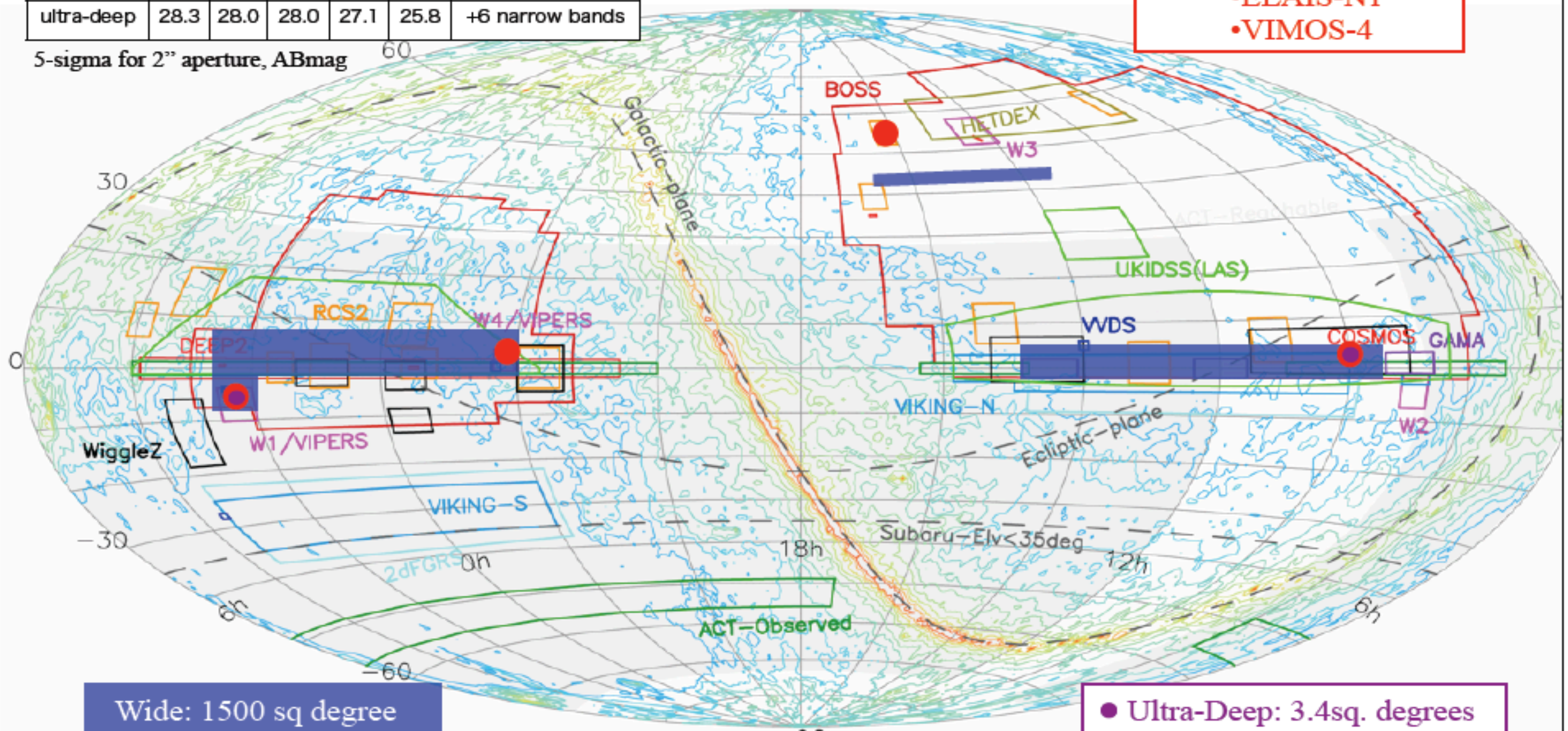
- Optical catalogs
- Find optical counterparts, morphology, neighbors
- Rapidly alert on transients
- Ten-year histories
- Deep drilling fields

LSST: R. Gibson (Univ. of Washington)

HSC survey parameters (tentative)

	g	r	i	z	y	
wide	26.2	25.9	26.2	25	24	
deep	22.7	27.4	27.0	25.7	24.5	+3 narrow bands
ultra-deep	28.3	28.0	28.0	27.1	25.8	+6 narrow bands

5-sigma for 2" aperture, ABmag



Deep: 28 sq. degree
- XMM-LSS
- E-COSMOS
- ELAIS-N1
- VIMOS-4

Wide: 1500 sq degree
- 3 fields

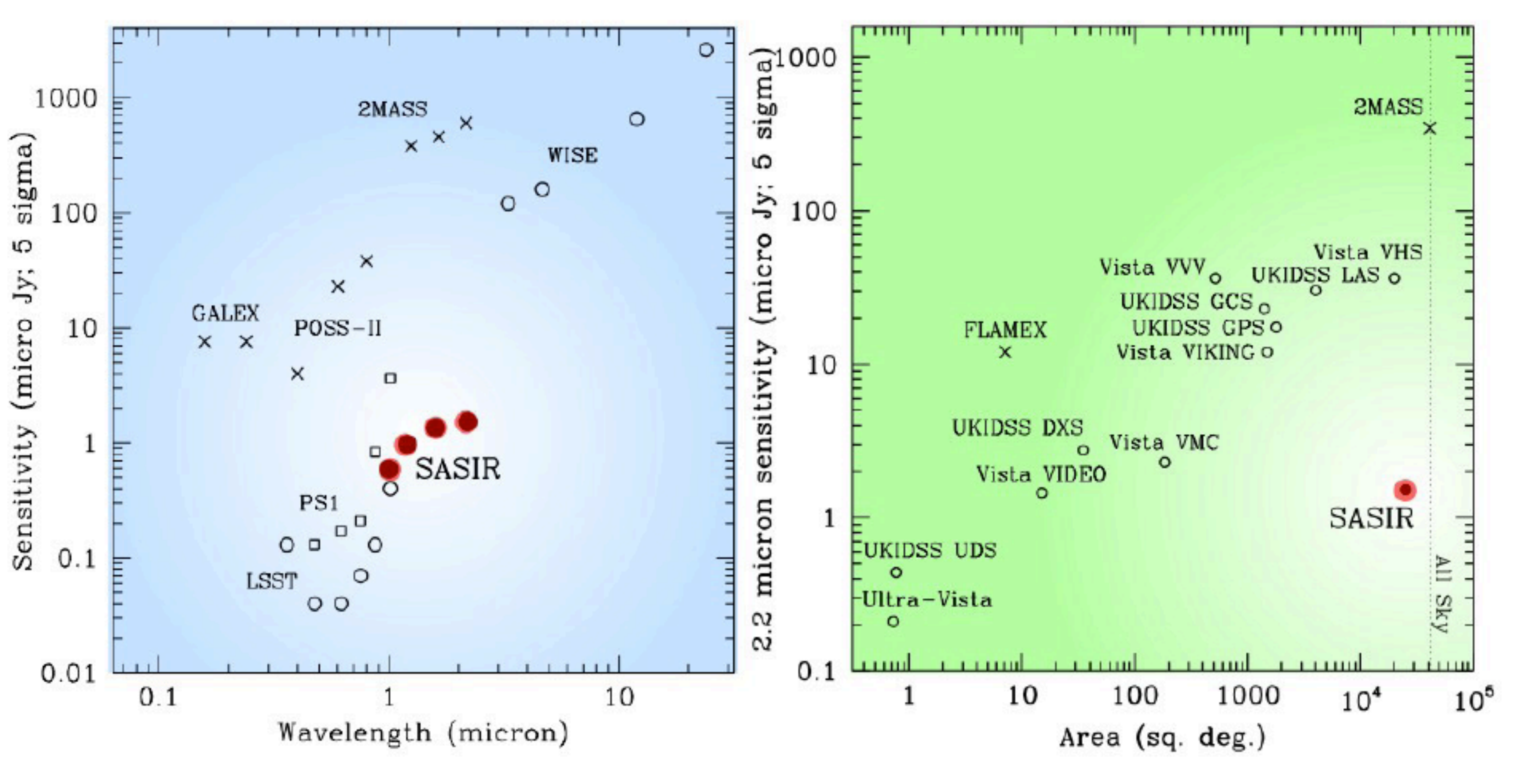
Figure Courtesy of A. Nishizawa

Ultra-Deep: 3.4sq. degrees
- SXDS/UKIDSS-UDS
- COSMOS-ultra VISTA

S. Miyazaki (NAOJ)

NAOJ

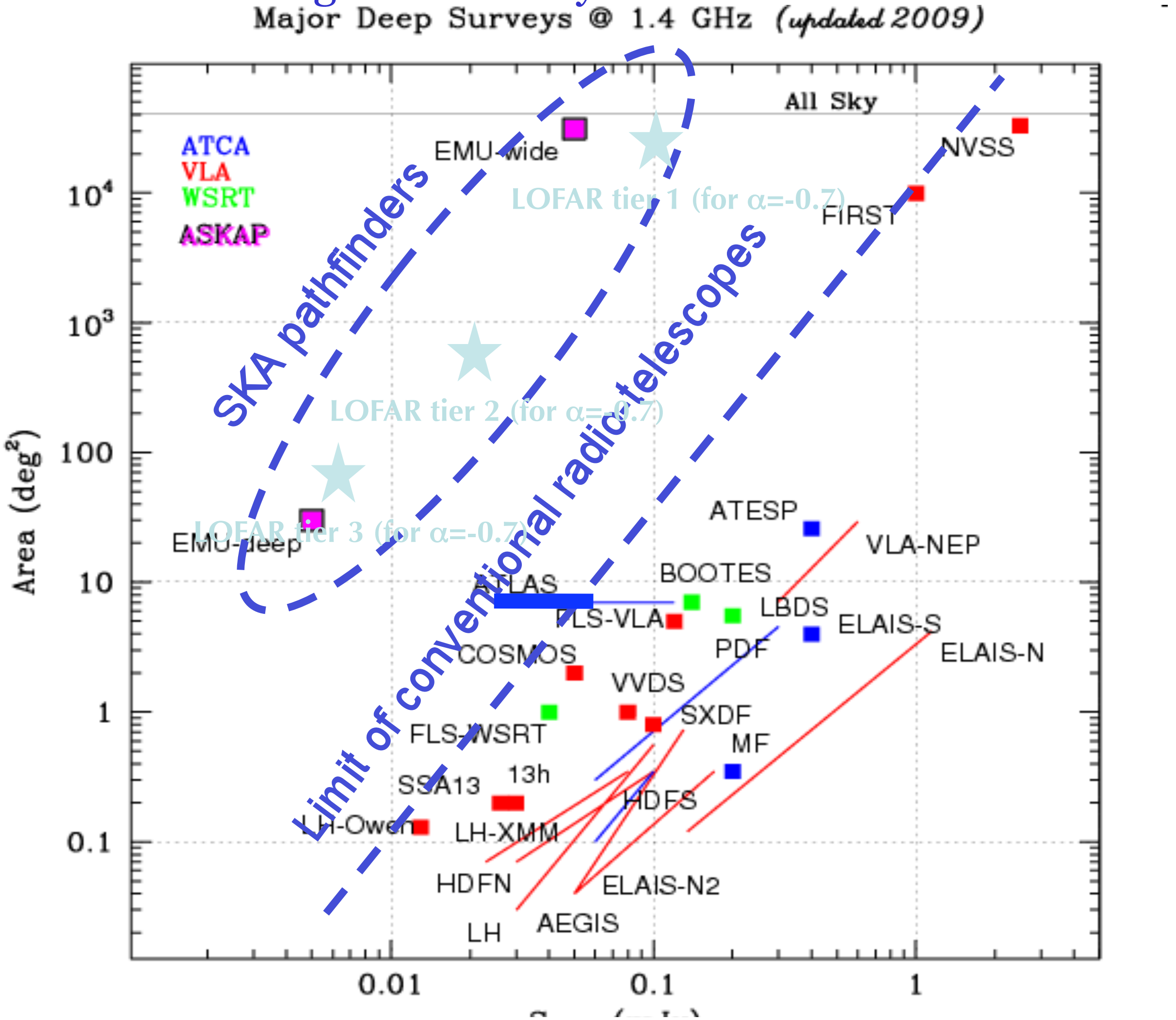
Sensitivity



T. Miyaji (IA-UNAM)

Radio synergies

Diagram courtesy of Isabella Prandoni



T. Reiprich (Bonn), H. Rottgering (Leiden)

CAASTRO
ARC CENTRE OF EXCELLENCE FOR ALL-SKY ASTROPHYSICS

The CAASTRO Vision

- New wide-field optical & radio telescopes
- Powerful supercomputers to analyse the data
- To exploit this opportunity, we now need:
  - a network of skilled researchers
  - a coordinated approach to complex experiments
  - a platform for maintaining a competitive advantage

S. Farrell (Univ. of Sydney)