Status of X-ray astronomy and first eROSITA highlights

Andrea Merloni (MPE)

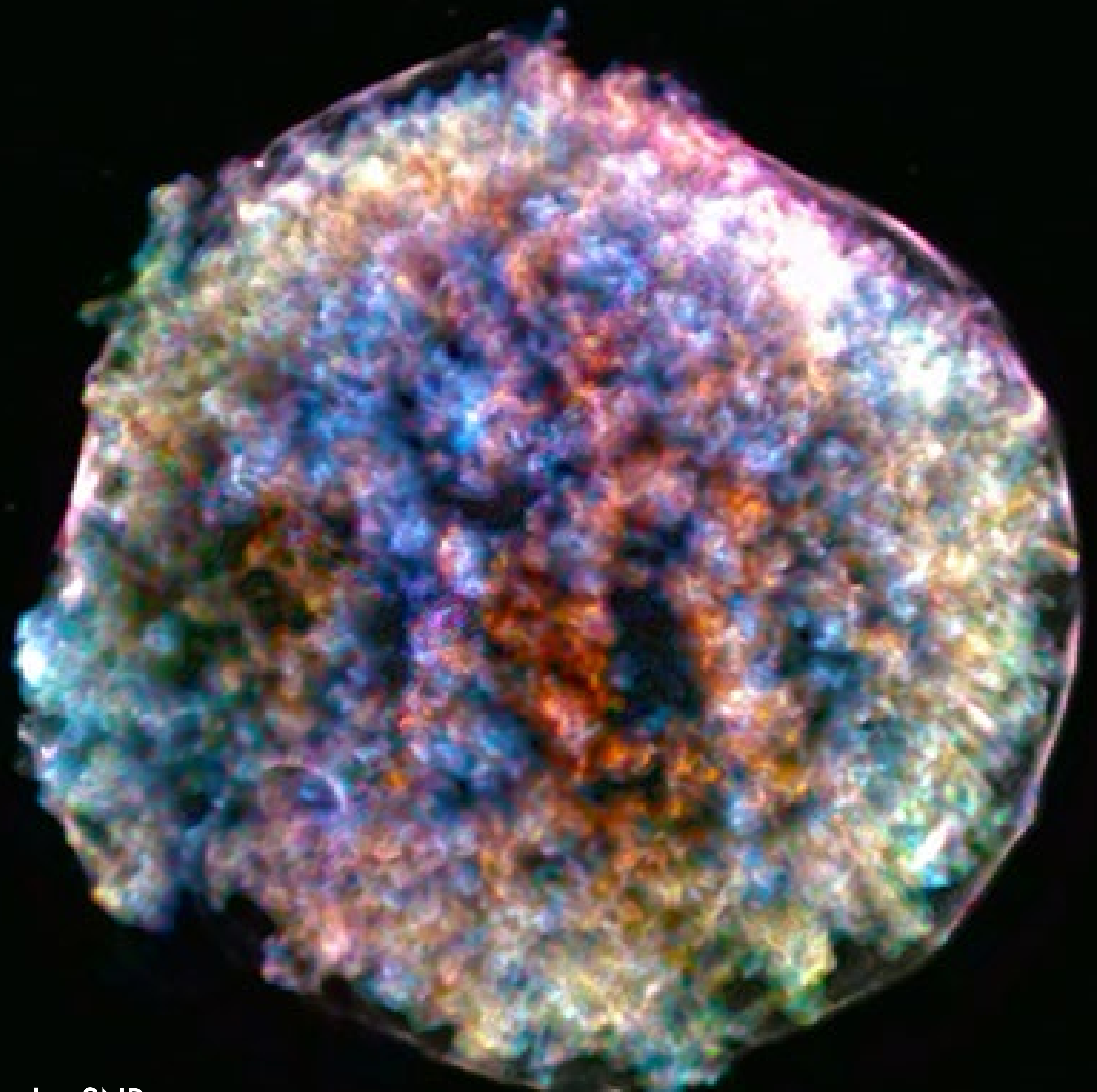
The solar corona

White Light filter; Credit: Kalpa Semasinghe

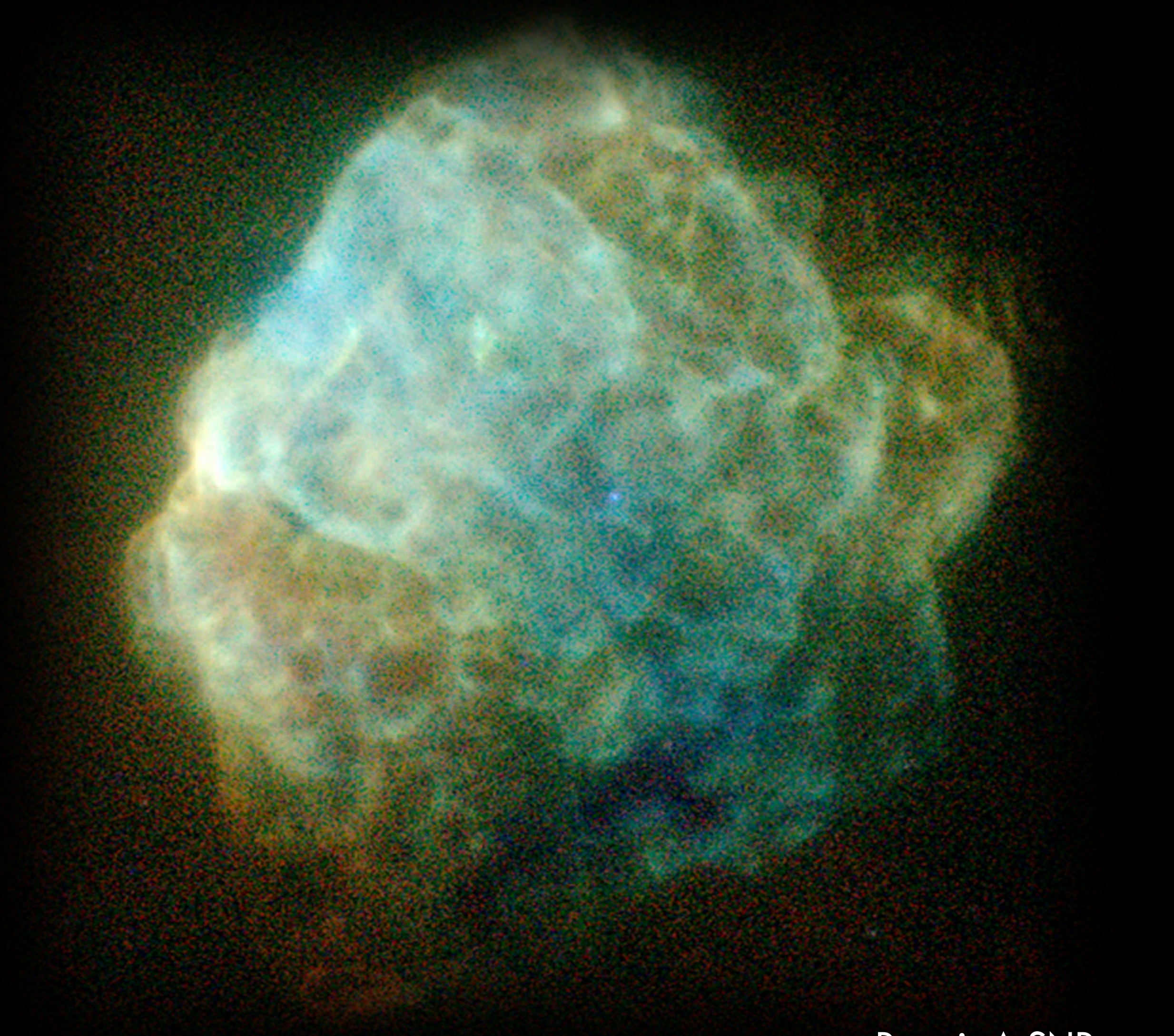
The solar corona in X-rays

Credit: NASA NuSTAR SDO

Dying Stars in X-rays

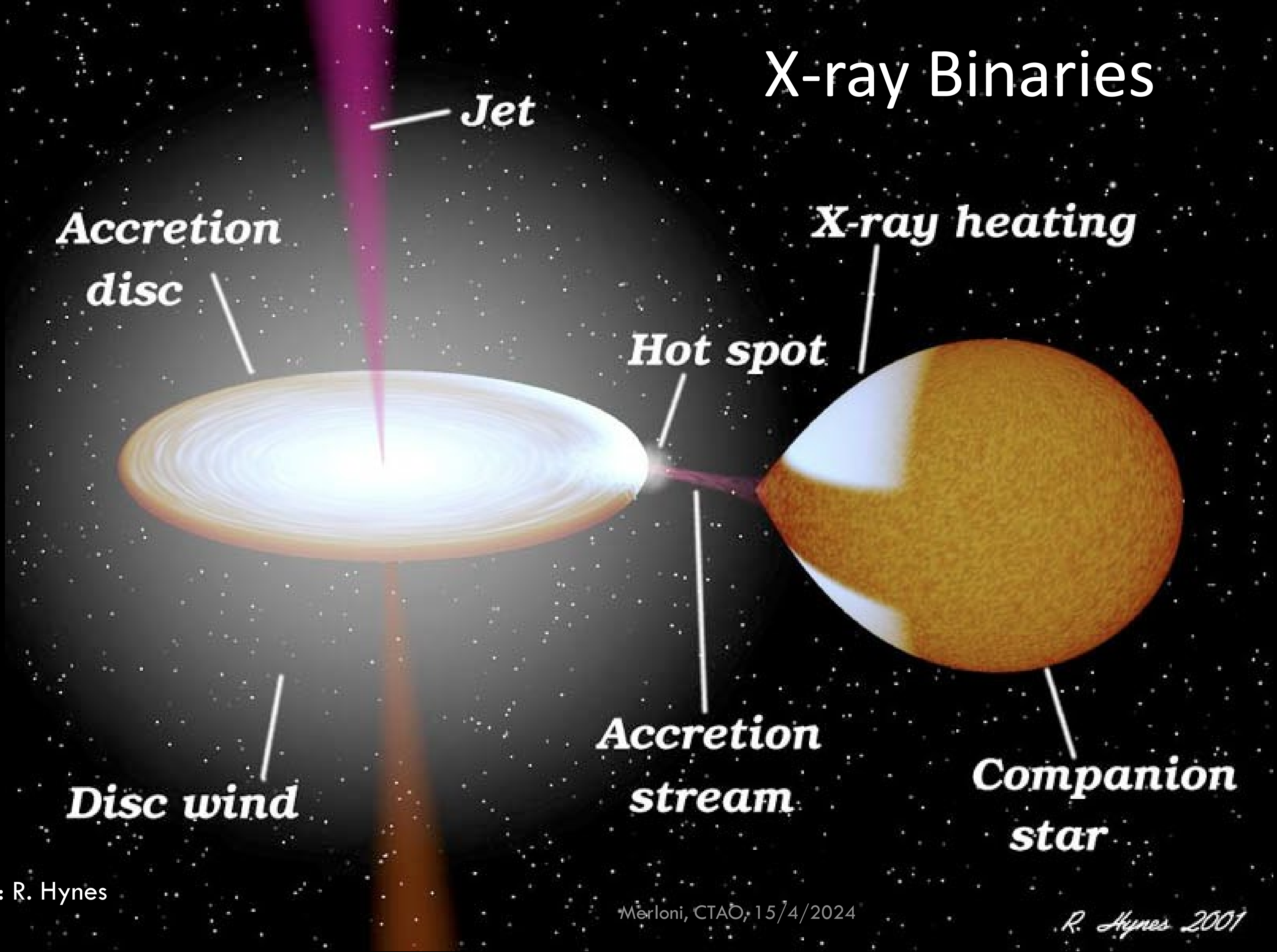


Tycho SNR
Credit: NASA/CXC/RIKEN & GSFC/T. Sato et al



Puppis A SNR
Credit: SRG/eROSITA MPE Predehl

X-ray Binaries

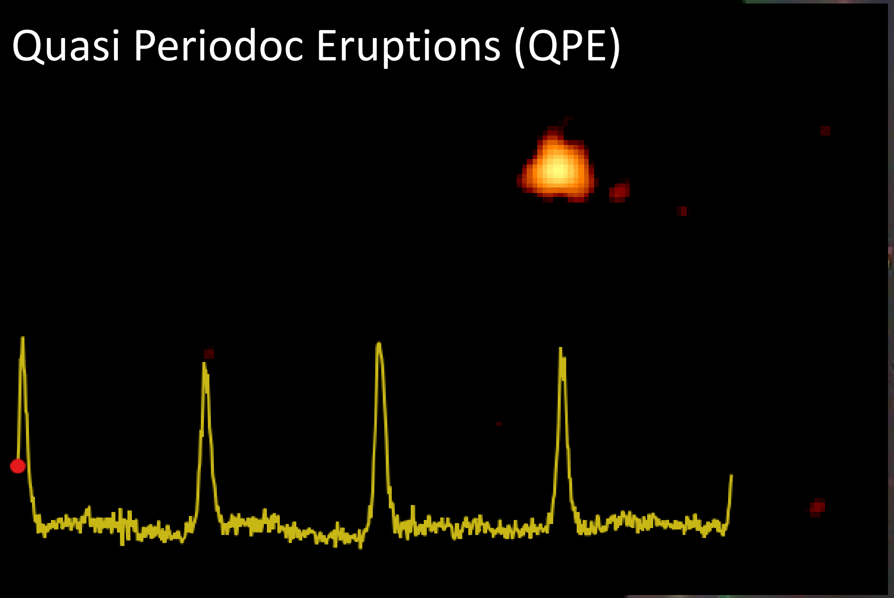


Credit: R. Hynes

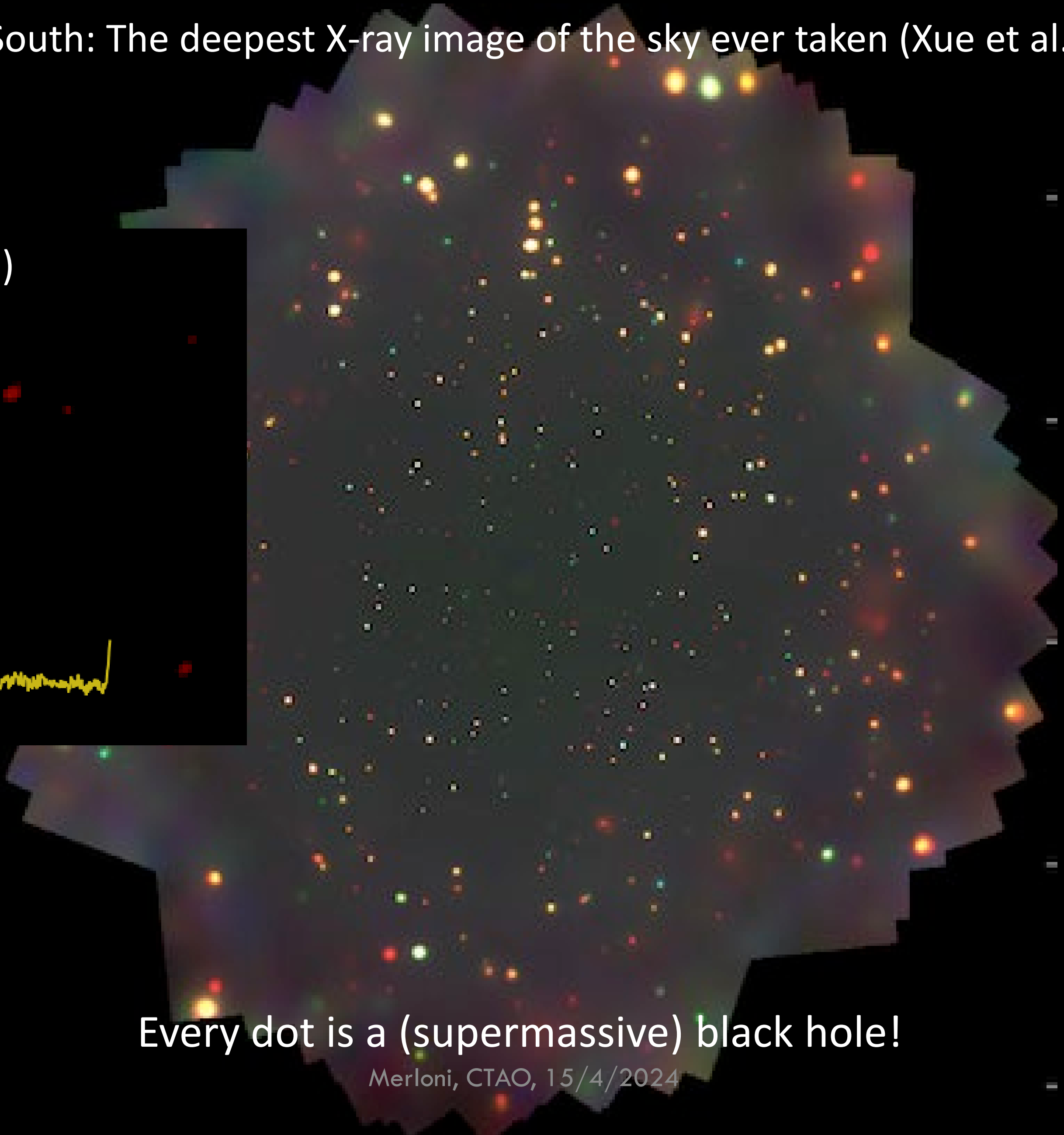
Accreting black holes

Chandra Deep Field South: The deepest X-ray image of the sky ever taken (Xue et al. 2011)

Quasi Periodoc Eruptions (QPE)



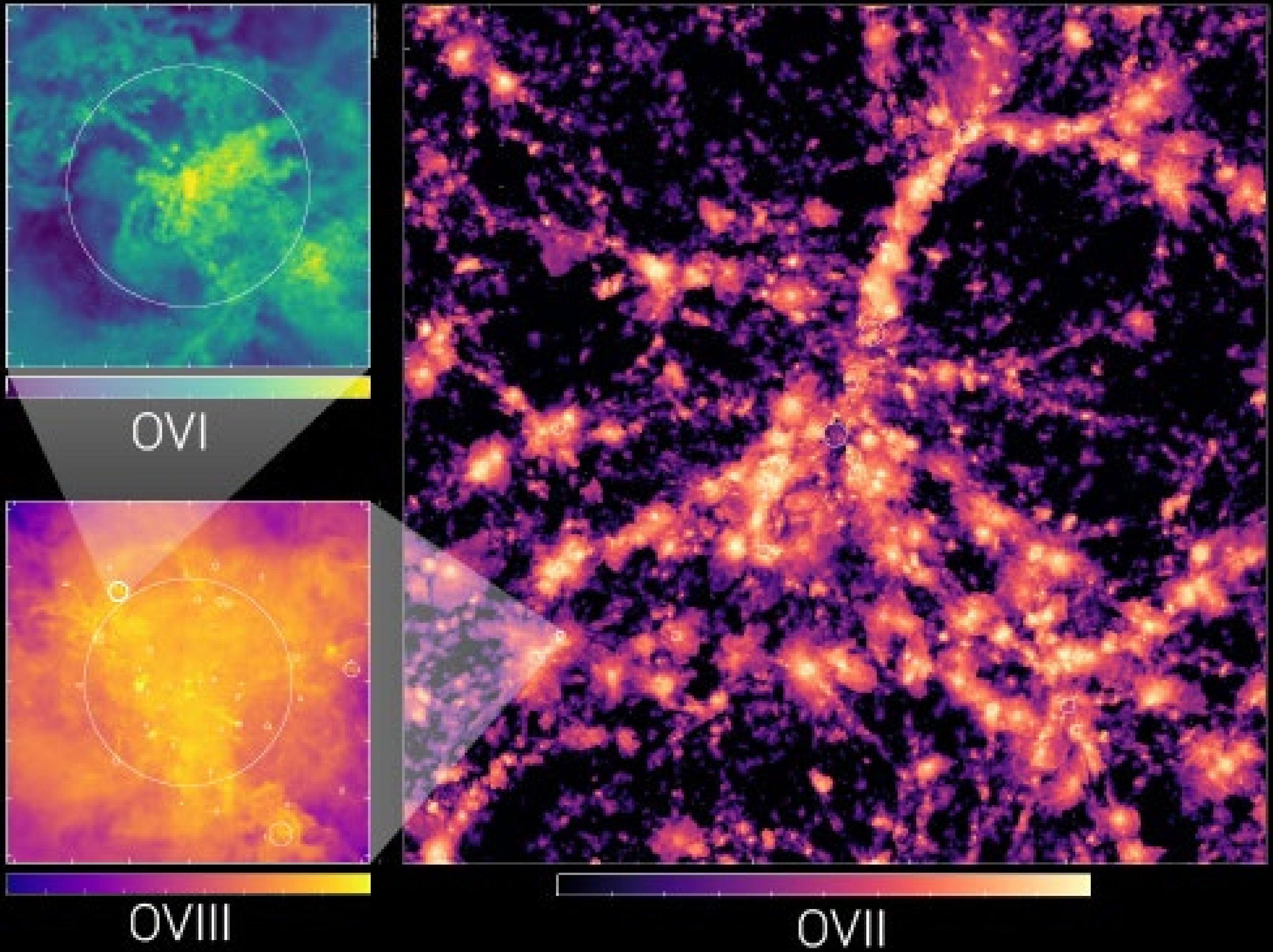
Credit: ESA XMM-Newton, G. Miniutti



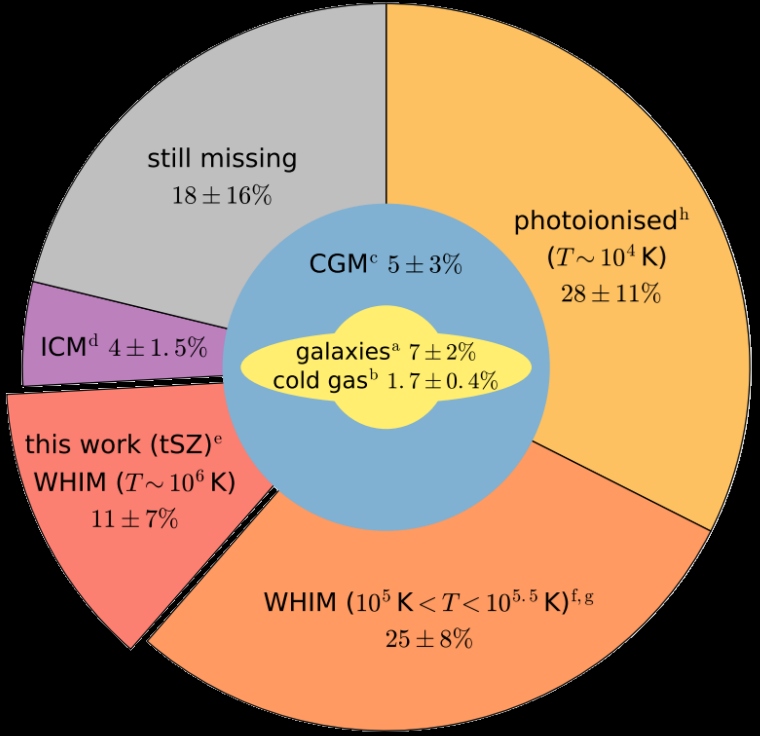
Every dot is a (supermassive) black hole!

Accreting black holes
Probes of GR

WHIM, Filaments, the hot CGM and the "missing baryons"



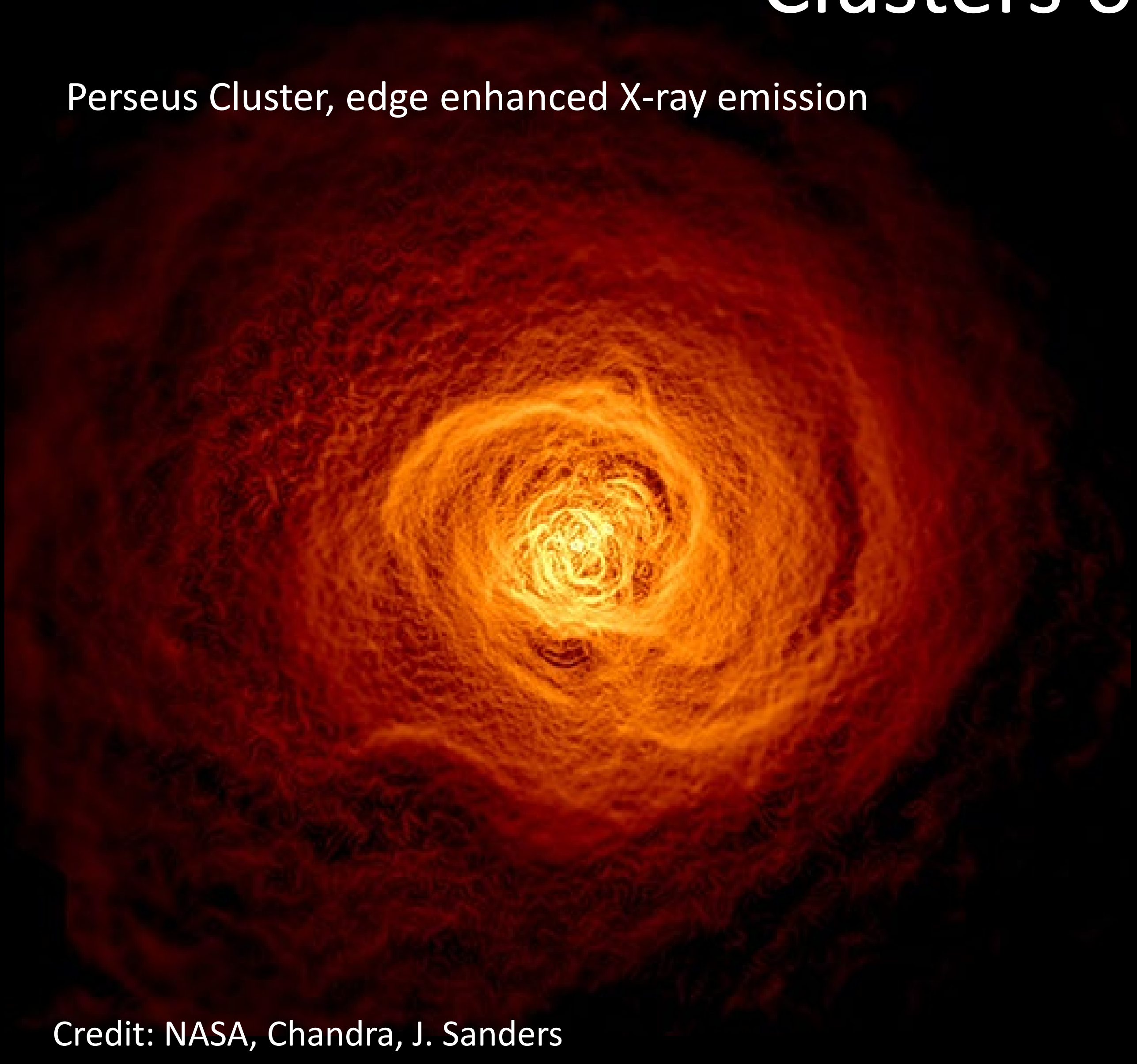
Credit: D. Nelson, Illustris TNG



Credit: de Graaf et al. 2020

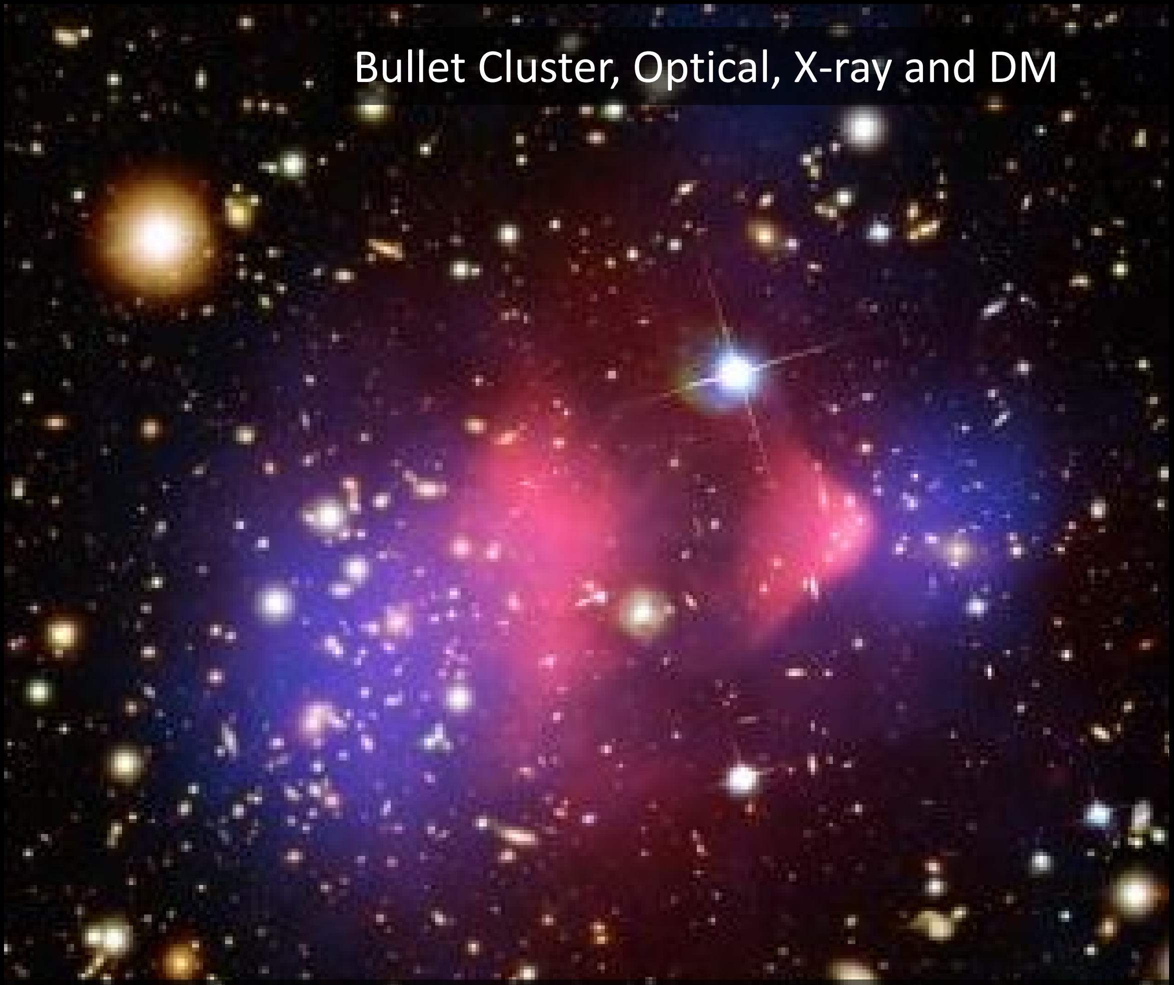
Clusters of Galaxies

Perseus Cluster, edge enhanced X-ray emission



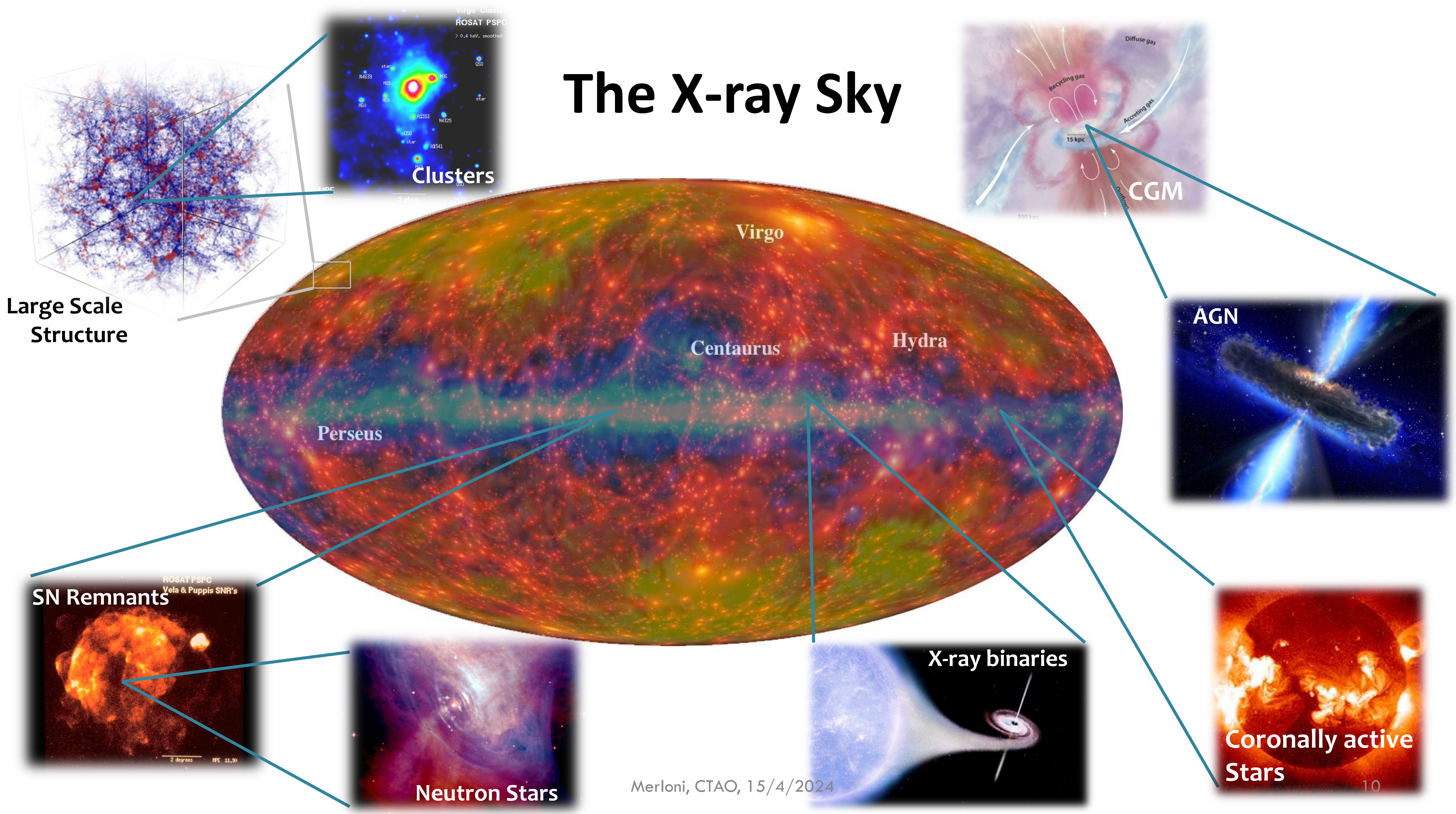
Credit: NASA, Chandra, J. Sanders

Bullet Cluster, Optical, X-ray and DM



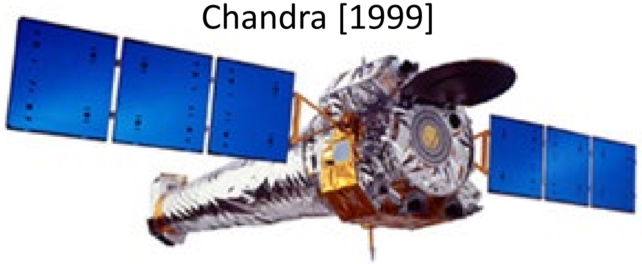
Credit: X-ray: NASA/CXC/CfA/M.Markevitch,
Optical and lensing map: NASA/STScI,
Magellan/U.Arizona/D.Clowe, Lensing map: ESO WFI

The X-ray Sky

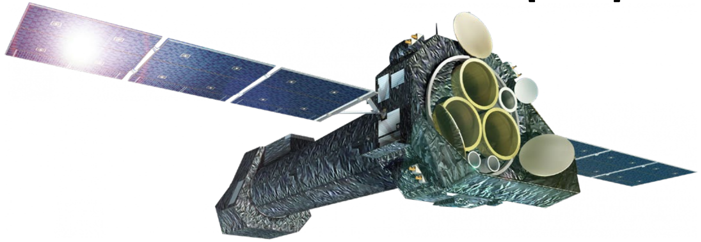


Large Scale Structure
ROSAT PSPC
Clusters
Diffuse gas
Recycling gas
Accreting gas
15 kpc
CGM
Virgo
Centaurus
Hydra
Perseus
AGN
SN Remnants
ROSAT PSPC
Vela & Puppis SNR's
2 degrees
Neutron Stars
X-ray binaries
Coronally active Stars

The X-ray Sky Observatories

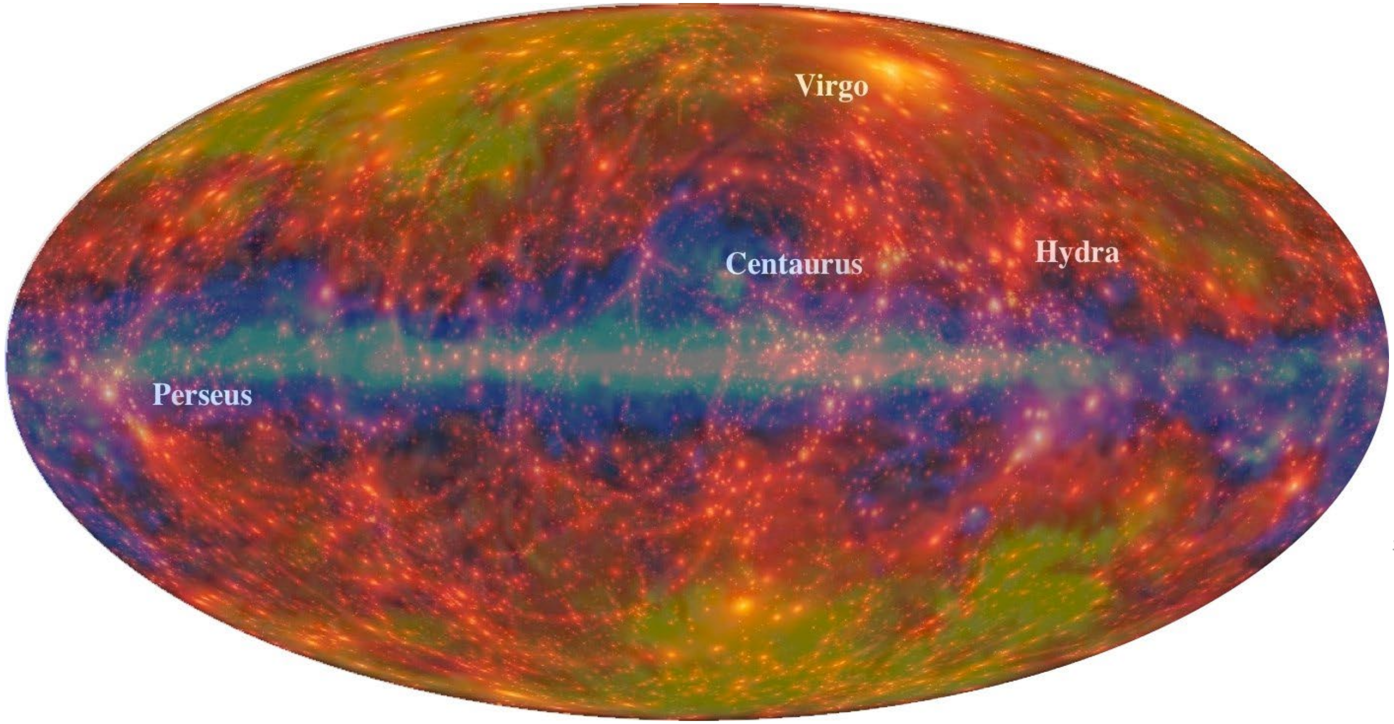


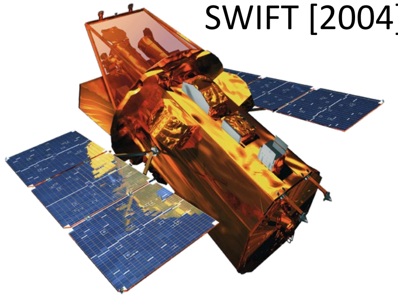
Chandra [1999]



XMM-Newton [1999]

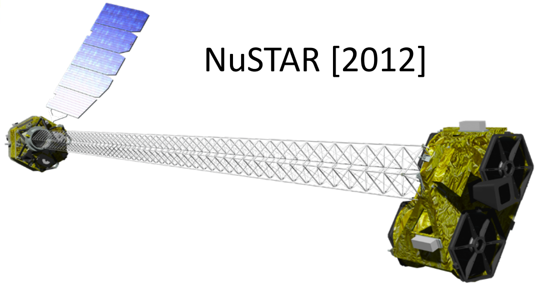
Einstein Probe [2024]



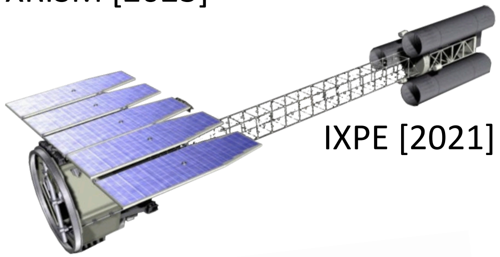


SWIFT [2004]

XRISM [2023]



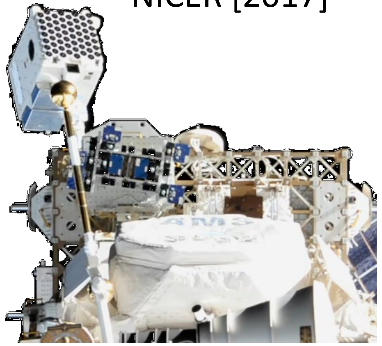
NuSTAR [2012]



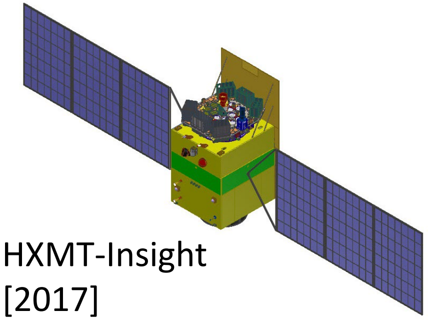
IXPE [2021]

MAXI [2009]

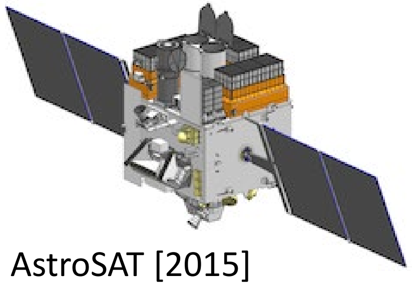
SRG eROSITA
ART-XC [2019]



NICER [2017]



HXMT-Insight
[2017]



AstroSAT [2015]

The X-ray Sky Observatories

Chandra [1999]

Sub-arcsec resolution imaging, Soft and Hard X-ray gratings spectroscopy

Sensitive Soft X-ray ~all-sky imaging and fast follow-up of transients

Einstein Probe [2024]

Wide FoV imaging and high-resolution calorimeter spectroscopy

Guainazzi's talk?

XRISM [2023]

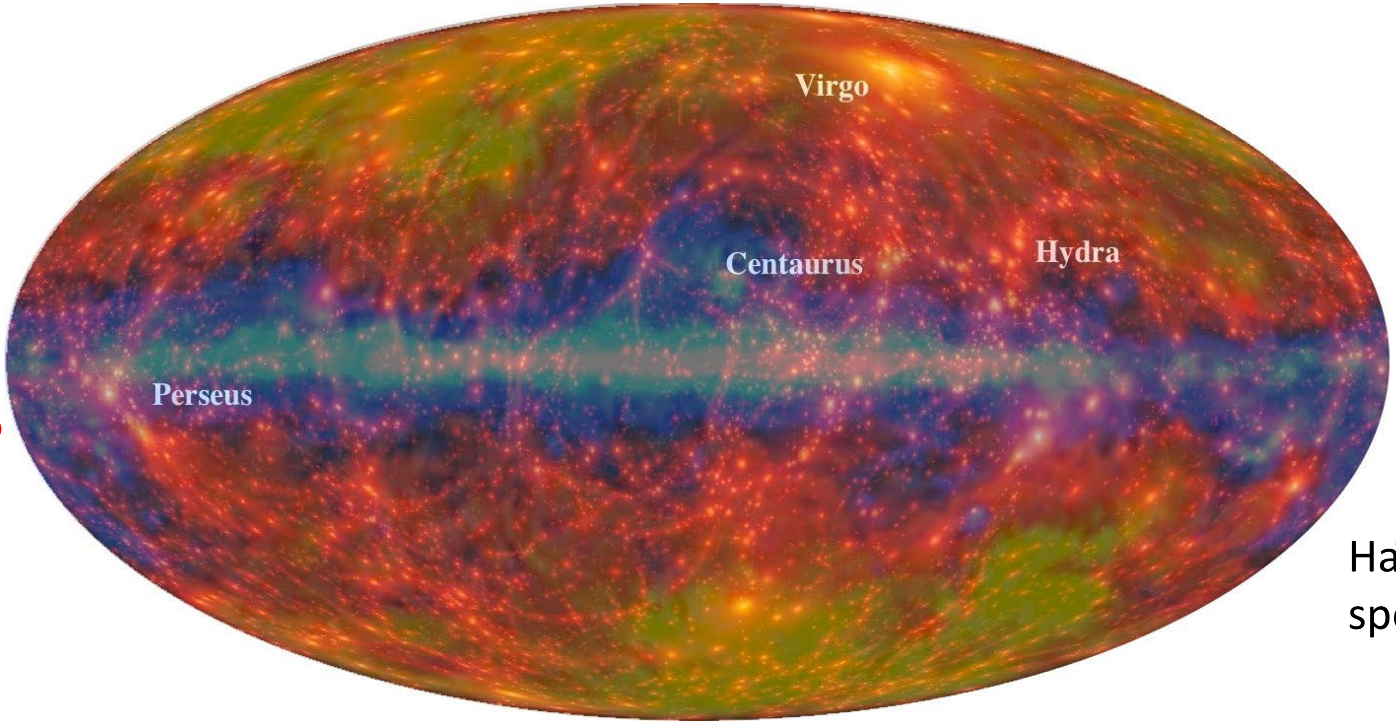
IXPE [2021]

Zane's talk

Imaging Polarimetry

This talk

SRG eROSITA
ART-XC [2019]



XMM-Newton [1999]

High-throughput CCD spectroscopy, soft X-ray gratings spectroscopy

SWIFT [2004]

Fast response, ToO, flexible scheduling, CCD imaging and spectroscopy

NuSTAR [2012]

Hard X-ray imaging and CCD spectroscopy

NICER [2017]

High-throughput (non-imaging) timing and spectroscopy of bright sources

Hard X-ray imaging and timing

HXMT-Insight [2017]

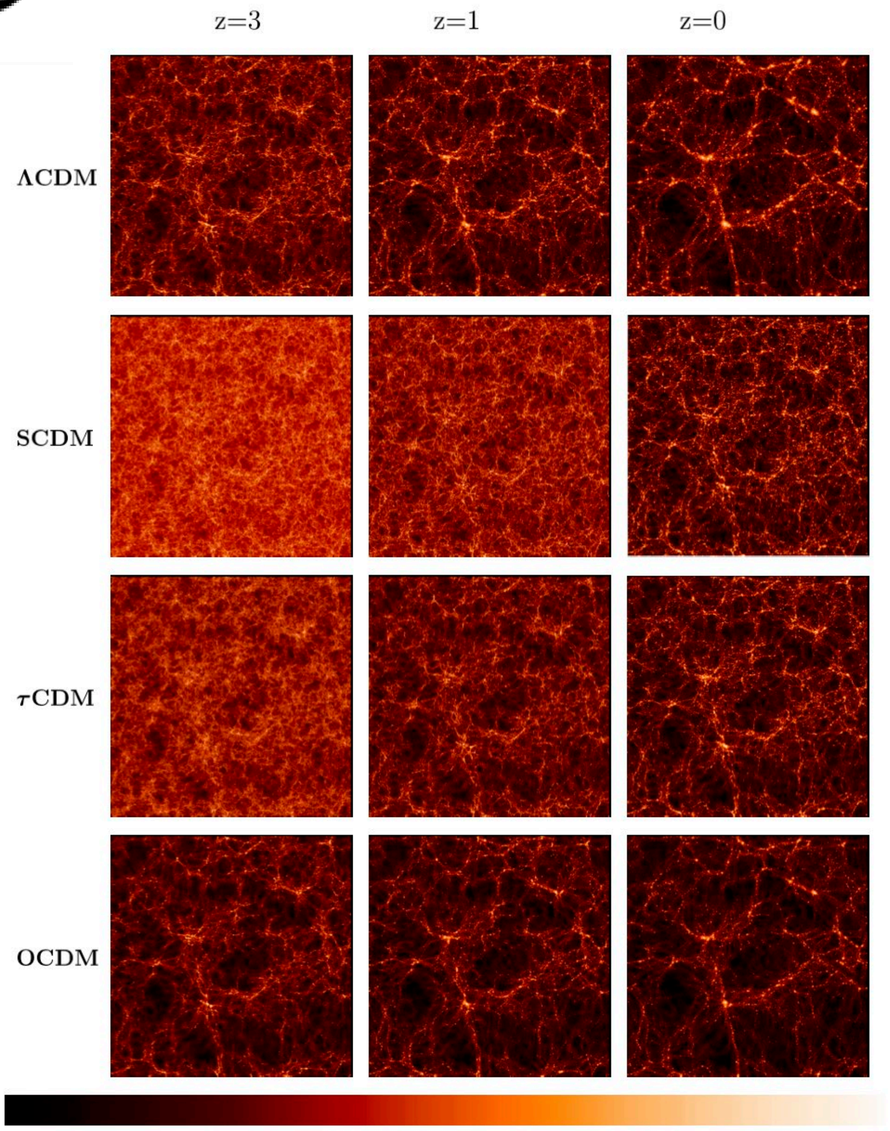
All-sky monitor, high-throughput timing, multi-wavelength

AstroSAT [2015]

MAXI [2009]

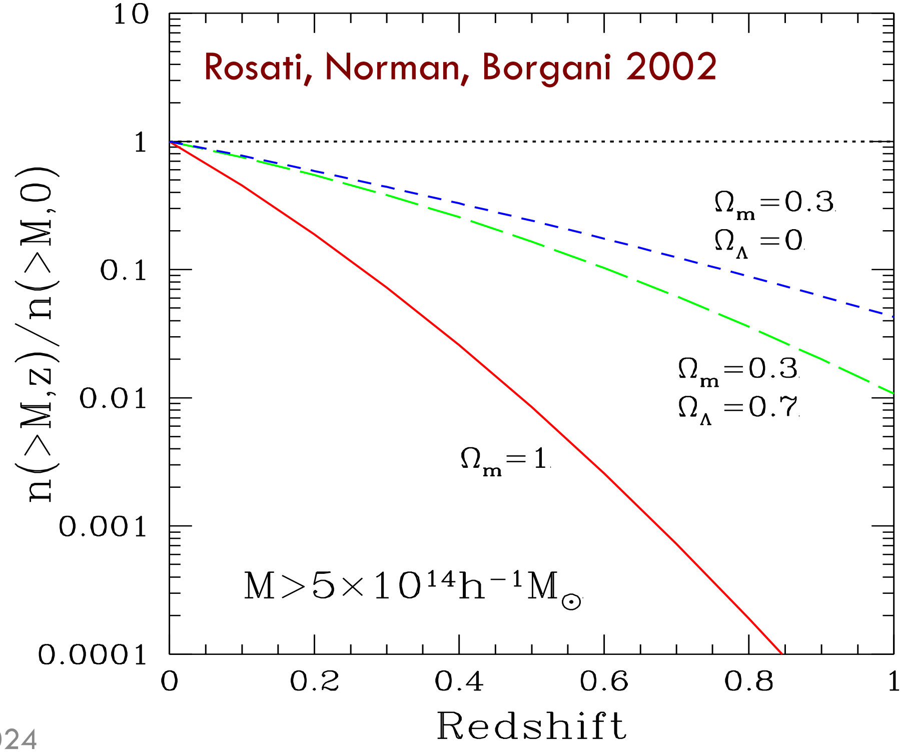
All-sky monitor, high-cadence observations of bright sources

Why eROSITA? Clusters Cosmology

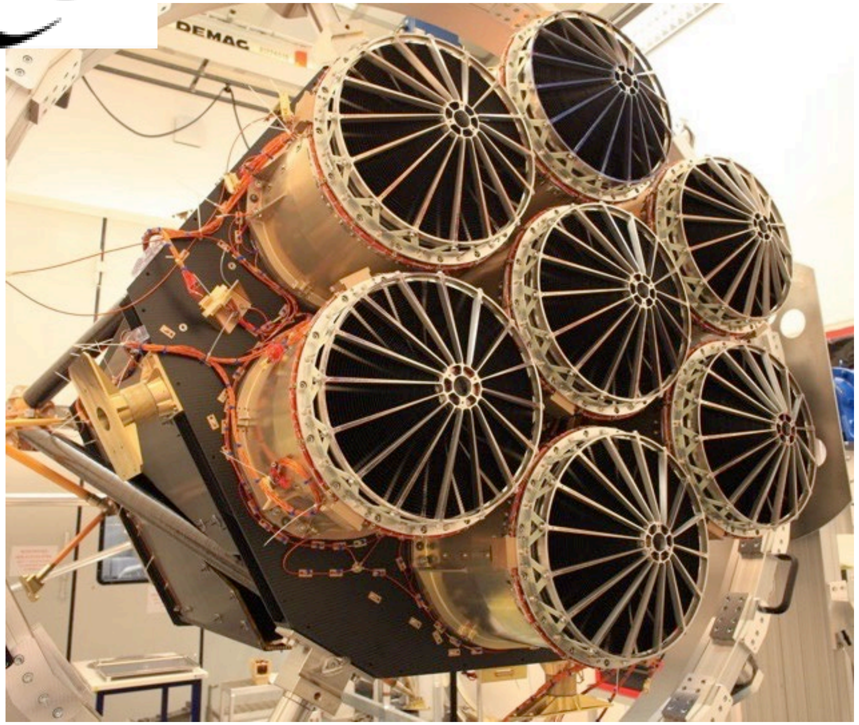


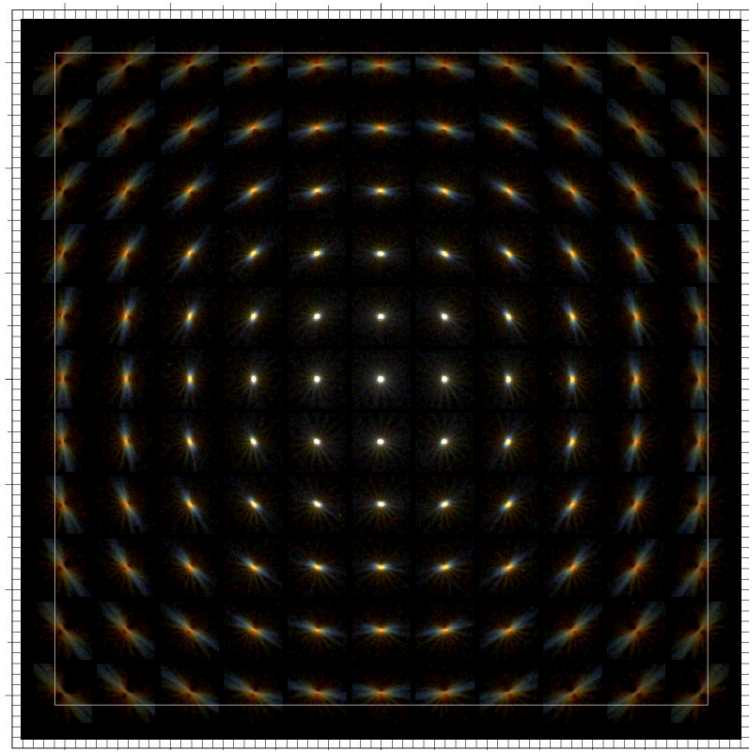
The Virgo Collaboration; Jenkins et al. 1998

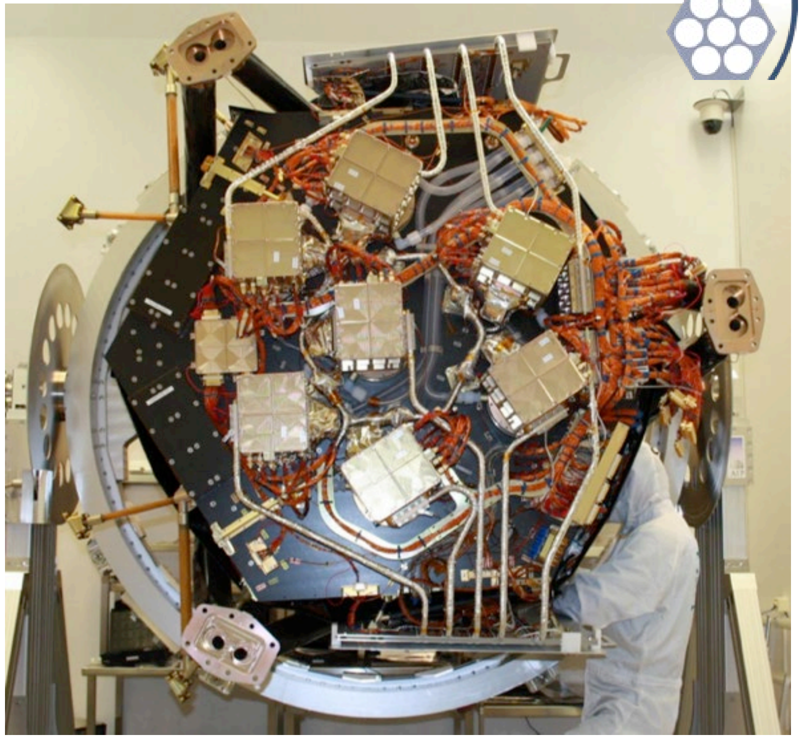
- Clusters are *exponentially sensitive* tracers of **growth of structures**
- A signature of clusters is the hot ($\sim 10^7$ K), extended X-ray ICM
- eROSITA (PSF, sensitivity) was designed to be able to detect $>10^5$ clusters (Pillepich+ 2018)



eROSITA on SRG [Predehl et al. 2021]







- Large Effective area (~**1300 cm^2 @1keV**, ~XMM-Newton)
- Large Field of view: 1 degree (diameter)
- Half-Energy width (HEW) ~18" (on-axis, point.); ~30" (FoV avg., survey)
  - Positional accuracy: ~4.5" (1σ)
- X-ray baffle: 92% stray light reduction
- pnCCD with framestore: 384x384x7~10^6 pixels (9.4"), no chip gaps, no 'out of time' events,
- **Spectral resolution** at all measured energies within specs (~80eV @1.5keV)

Moon diameter
30 arcmin

XMM-Newton
Field of view ~ 30 arcmin

Chandra
Field of view ~ 17 arcmin

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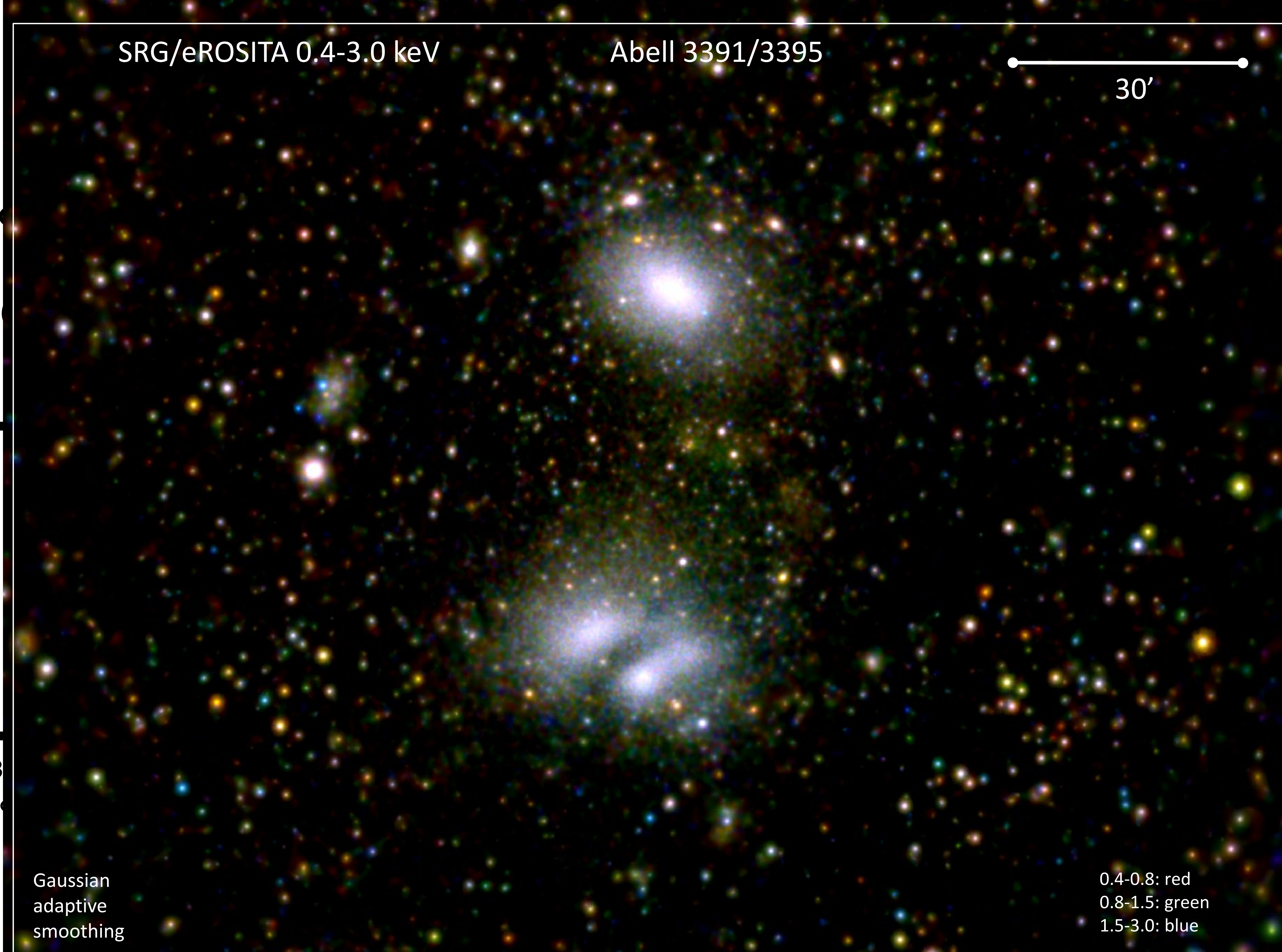
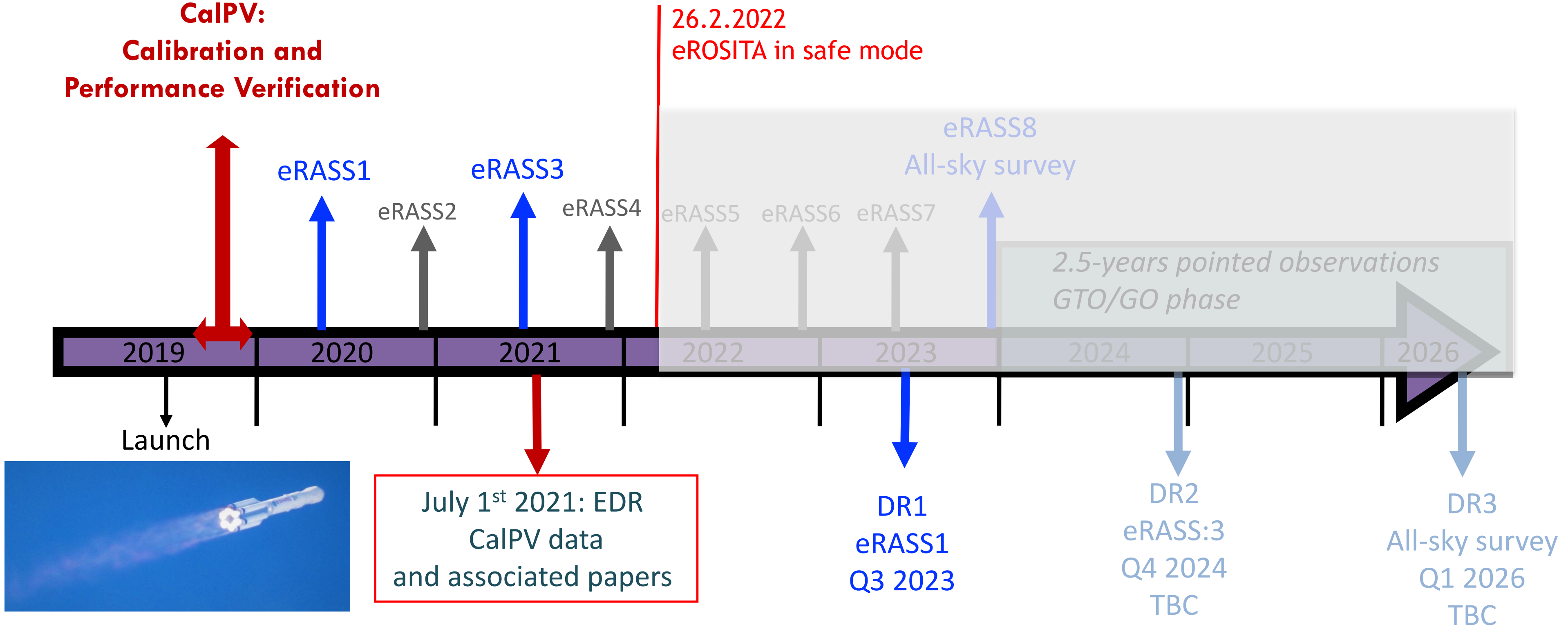


Programmatics

eRASS = eROSITA All-Sky Survey



- Early Data Release (EDR) in 2021: several fields, including eFEDS mini-survey
- DR1 on 31.1.2024
- DR2 (eRASS:4.x) TBD (about two years from now)

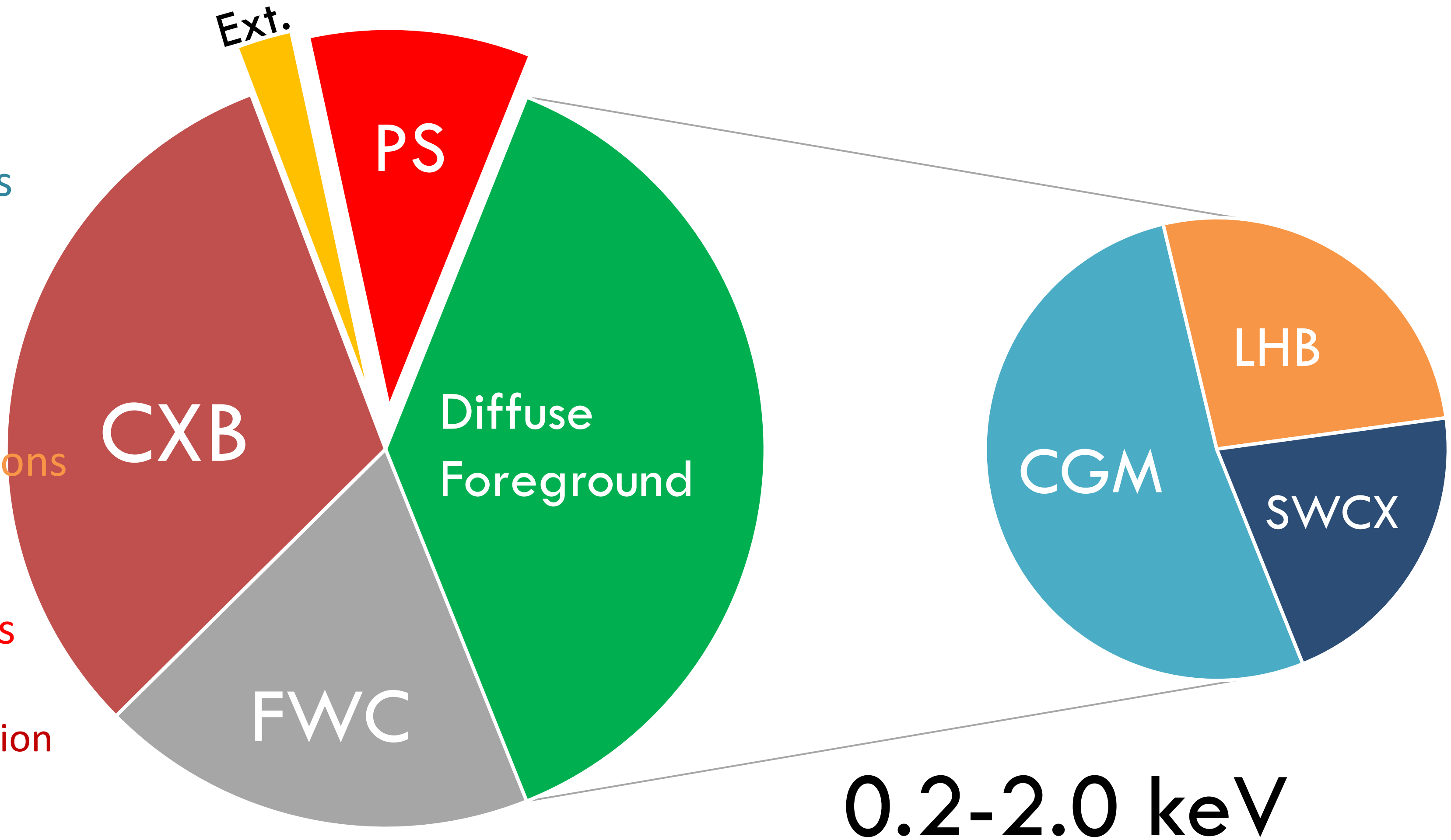
The All-Sky Surveys by Numbers

- Completed 4 all-sky survey (12/2019 – 12/2021)
- Uniform exposure, avg.~800s; up to 120ks at the Ecliptic Poles (confusion limited)
- Very few background flares, flexible mission planning: no gaps in exposure
- **~1.6 Billion** 0.2-5keV calibrated photons (~350 Gb telemetry)
- Typical (point-source) sensitivity:
  - Single pass (eRASS1,2,3,4)
    - ~5x10^{-14} erg/s/cm^2 [0.2-2.3 keV]; **4-5x deeper than RASS**
    - ~7x10^{-13} erg/s/cm^2 [2.3-5 keV]
  - Cumulative (eRASS:4)
    - ~2x10^{-14} erg/s/cm^2 [0.2-2.3 keV]
    - ~2x10^{-13} erg/s/cm^2 [2.3-5 keV]
- eRASS1 (half-sky): 0.9M point sources ~doubles the number of known X-ray sources!
- eRASS:4 (half-sky): 2.8M point sources; 87k extended; ~45k confirmed clusters

The eRASS1 (soft) photon Pie

~340 Million calibrated events

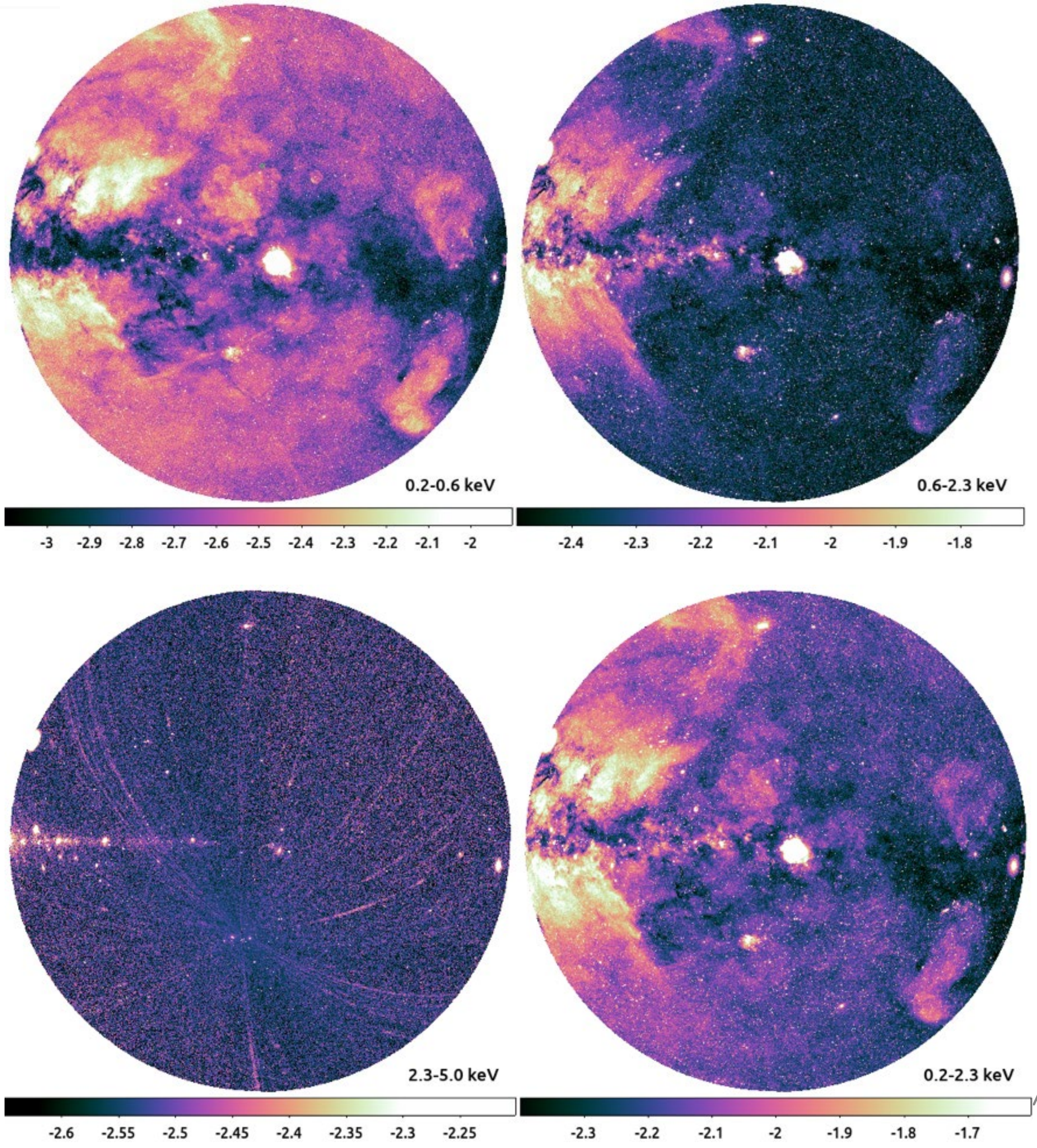
- 107 Million CXB photons
- 67 Million MW Hot CGM photons (58M halo + 9M 'Corona'; Ponti+'23)
- 63 Million Instrumental BKG photons (FWC)
- 34 Million Local Hot Bubble photons
- 27 Million Solar Wind Charge Exchange photons
- 32 Million Point Sources' photons
    - 24 Milllion AGN photons; 8 Million Stars photons
- 8 Million Extended Sources' photons



0.2-2.0 keV

Merloni et al. (2024)

eROSITA-DE Data Release 1 products



erosita.mpe.mpg.de/dr1/

- Software
- Calibration DB
- Attitude files
- Exposure maps
- Events
- Count rate maps
- Source catalogues
- X-ray Spectra
- Light-curves

Merloni et al. (2024)

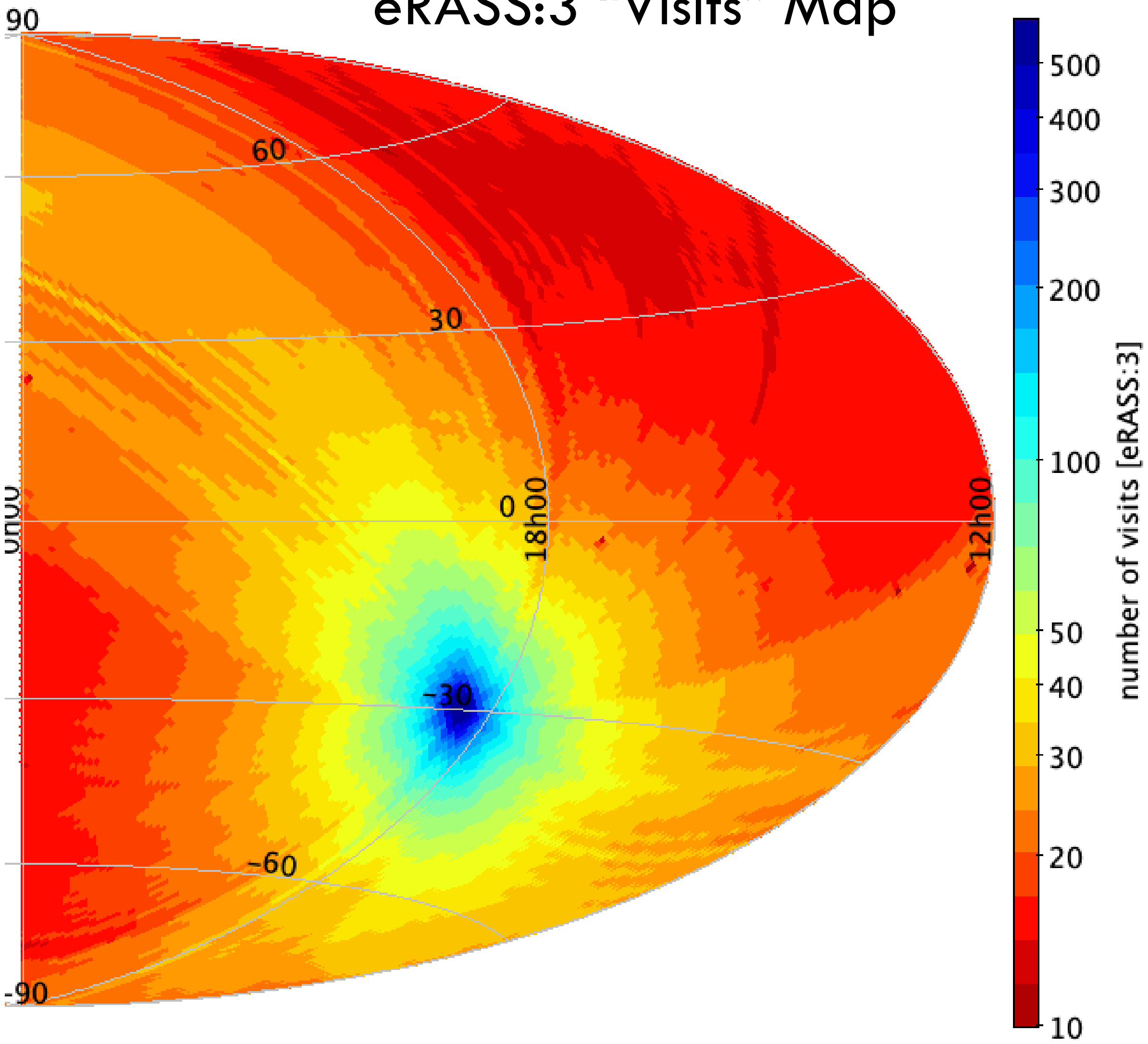
eRASS1 in time domain

eRASS1 cts rate image
Movie courtesy
of J. Sanders (MPE)

eRASS: Timescales

- **50 msec [Readout]:** Time resolution of each CCD (frame readout cycle)
- **40 sec [Visit]:** Scan speed + 1 deg. FoV (avg effective exposure)
- **4 hours [eRoday]:** Rotation period of SRG (Interval between scans/visits)
- **1 day [Visibility]:** avg. visibility length (~6 visits)
- **6 months [eRASS]:** one complete all-sky survey (revisit period for most of the sky)
- **2 years: 4** all-sky surveys

eRASS:3 "Visits" Map



eRASS: Timescales

- **50 msec [**
  CCD (fran
- **40 sec [Vi**
  effective
- **4 hours**
  (Interva
- **1 day [V**
  visits)
- **6 montl**
  survey (
- **2 years:**

Article

X-ray detection of a nova in the fireball phase

https://doi.org/10.1038/s41586-022-04635-y
Received: 11 January 2022
Accepted: 14 March 2022

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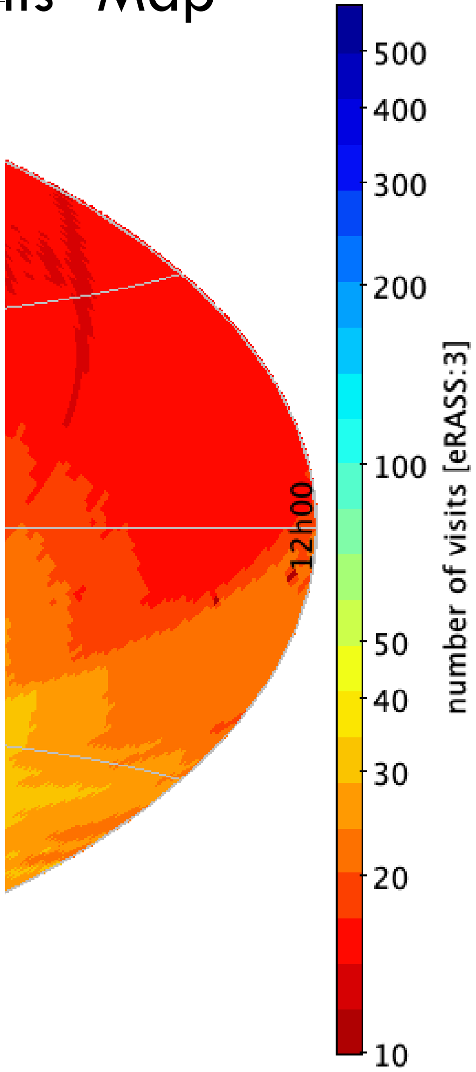
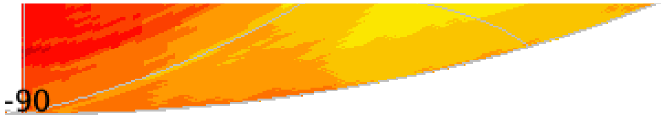
Novae are caused by runaway thermonuclear burning in the hydrogen-rich envelopes of accreting white dwarfs, which leads to a rapid expansion of the envelope and the ejection of most of its mass[1,2]. Theory has predicted the existence of a 'fireball' phase following directly on from the runaway fusion, which should be observable as a short, bright and soft X-ray flash before the nova becomes visible in the optical[3–5]. Here we report observations of a bright and soft X-ray flash associated with the classical Galactic nova YZ Reticuli 11 h before its 9 mag optical brightening. No X-ray source was detected 4 h before and after the event, constraining the duration of the flash to shorter than 8 h. In agreement with theoretical predictions[4,6–8], the source's spectral shape is consistent with a black-body of $3.27^{+0.11}_{-0.33} \times 10^5$ K ($28.2^{+0.9}_{-2.8}$ eV), or a white dwarf atmosphere, radiating at the Eddington luminosity, with a photosphere that is only slightly larger than a typical white dwarf.

its" Map





- **50 msec [Readout]:** Tin
CCD (frame readout cyc
- **40 sec [Visit]:** Scan spe
effective exposure)
- **4 hours [eRoday]:** Rota
(Interval between scans,
- **1 day [Visibility]:** avg. v
visits)
- **6 months [eRASS]:** one
survey (revisit period fo
- **2 years:** 4 all-sky survey

Article

X-ray quasi-periodic eruptions from two previously quiescent galaxies

https://doi.org/10.1038/s41586-021-03394-6
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Check for updates

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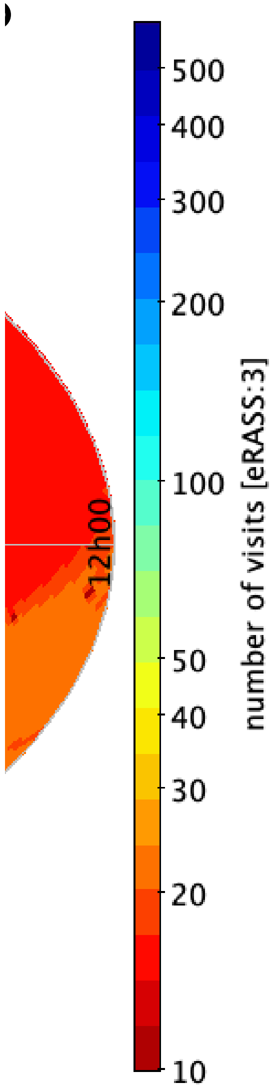
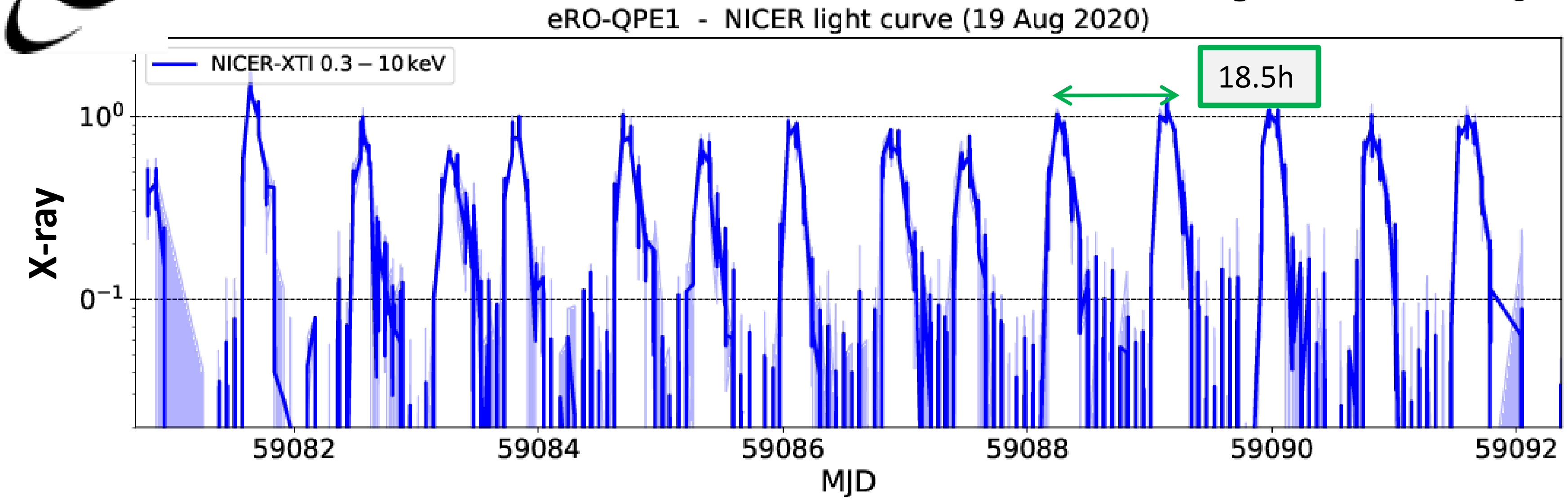
Quasi-periodic eruptions (QPEs) are very-high-amplitude bursts of X-ray radiation recurring every few hours and originating near the central supermassive black holes of galactic nuclei[1,2]. It is currently unknown what triggers these events, how long they last and how they are connected to the physical properties of the inner accretion flows. Previously, only two such sources were known, found either serendipitously or in archival data[1,2], with emission lines in their optical spectra classifying their nuclei as hosting an actively accreting supermassive black hole[3,4]. Here we report observations of QPEs in two further galaxies, obtained with a blind and systematic search of half of the X-ray sky. The optical spectra of these galaxies show no signature of black hole activity, indicating that a pre-existing accretion flow that is typical of active galactic nuclei is not required to trigger these events. Indeed, the periods, amplitudes and profiles of the QPEs reported here are inconsistent with current models that invoke radiation-pressure-driven instabilities in the accretion disk[5–9]. Instead, QPEs might be driven by an orbiting compact object. Furthermore, their observed properties require the mass of the secondary object to be much smaller than that of the main body[10], and future X-ray observations may constrain possible changes in their period owing to orbital evolution. This model could make QPEs a viable candidate for the electromagnetic counterparts of so-called extreme-mass-ratio inspirals[11–13], with considerable implications for multi-messenger astrophysics and cosmology[14,15].



Quasi Periodic Eruptions (QPEs)



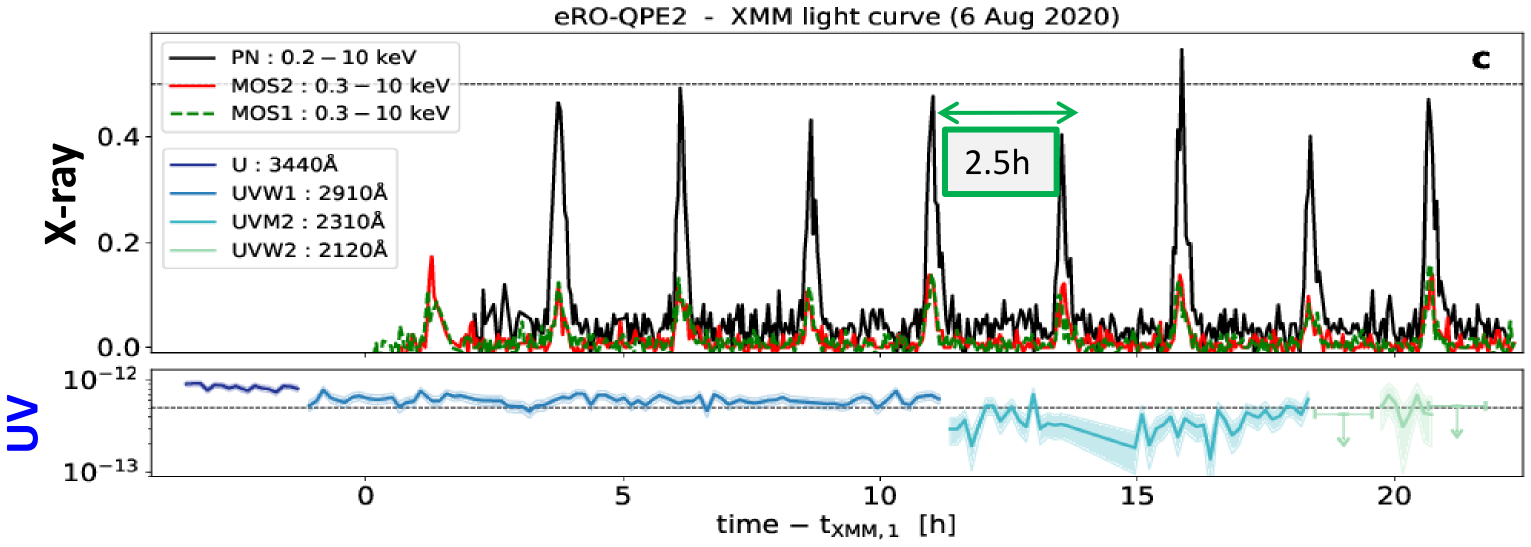
Arcodia+21

QPE1

followed-up with XMM+NICER

$$Lx_{0.5-2keV}^{peak} \approx 1e43\ erg\ s^{-1}$$

11 days!



Arcodia+21

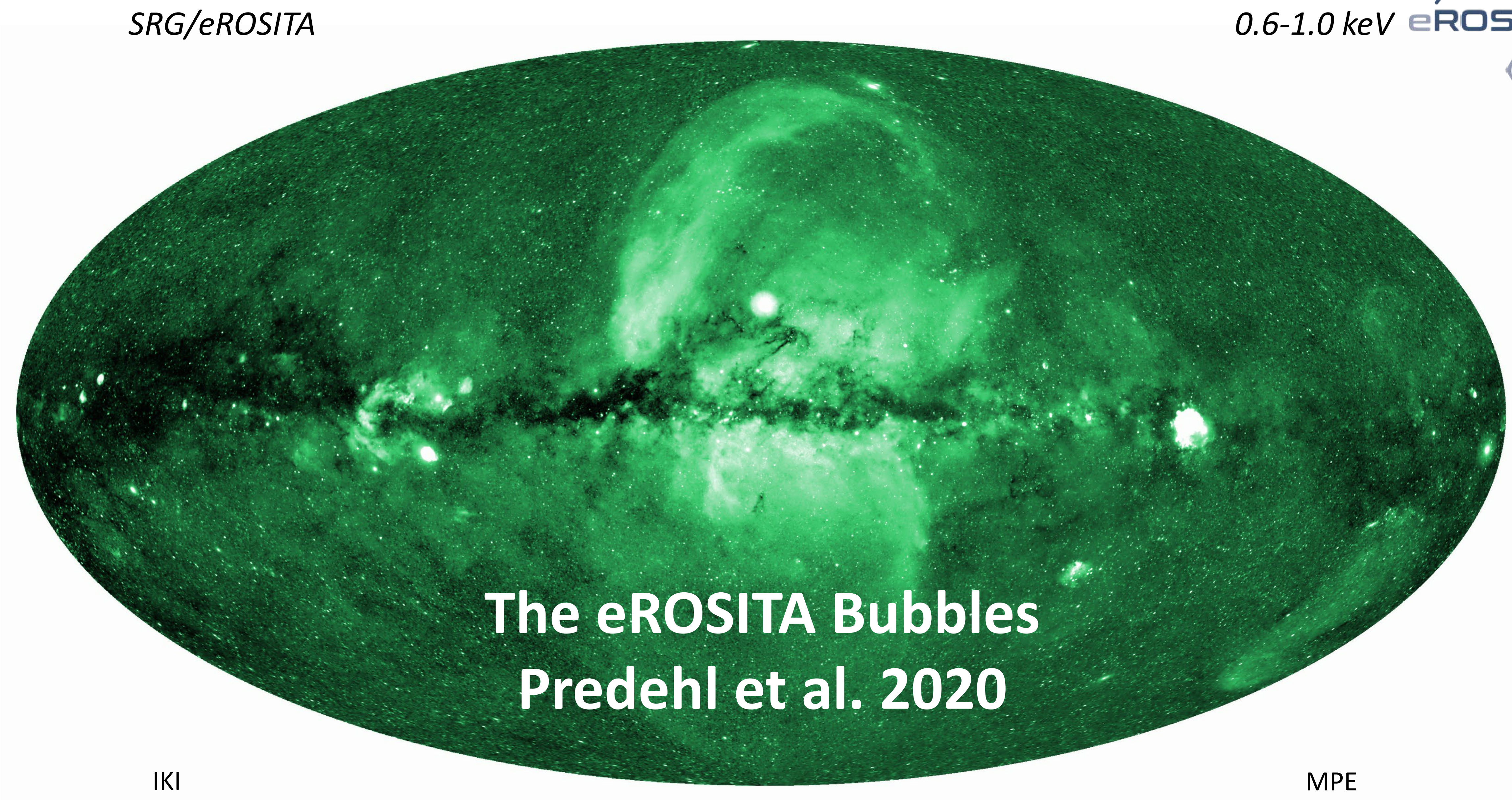
QPE2

followed-up with XMM-Newton

$$Lx_{0.5-2keV}^{peak} \approx 1e42\ erg\ s^{-1}$$

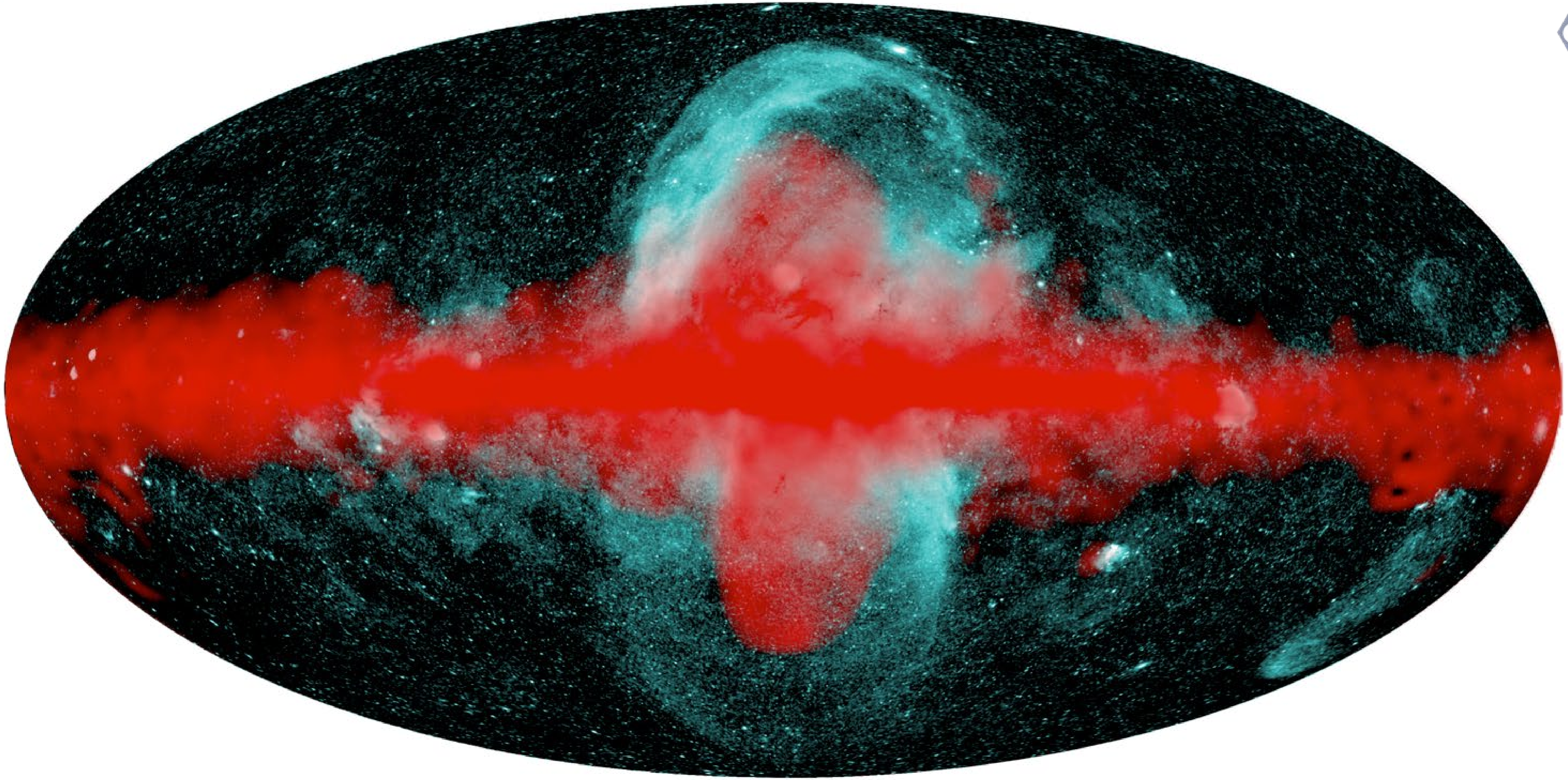
1 day!

Arcodia et al. 2021, Nature



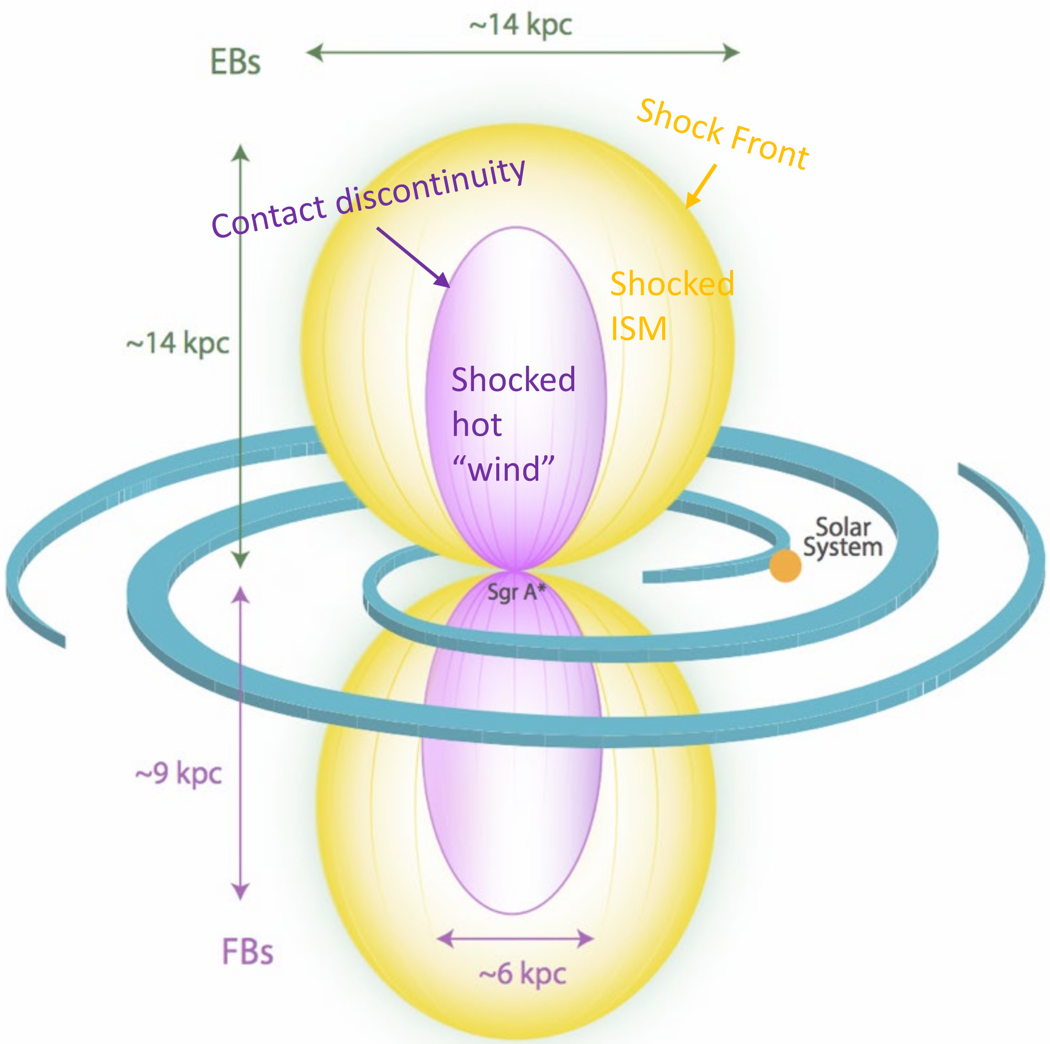
Credit: Sanders, Brunner (MPE); Churazov, Gilfanov (IKI)

Fermi (>1GeV) vs. eRASS1, 0.6-1 keV



Credit: Khabibullin, Selig (MPA)

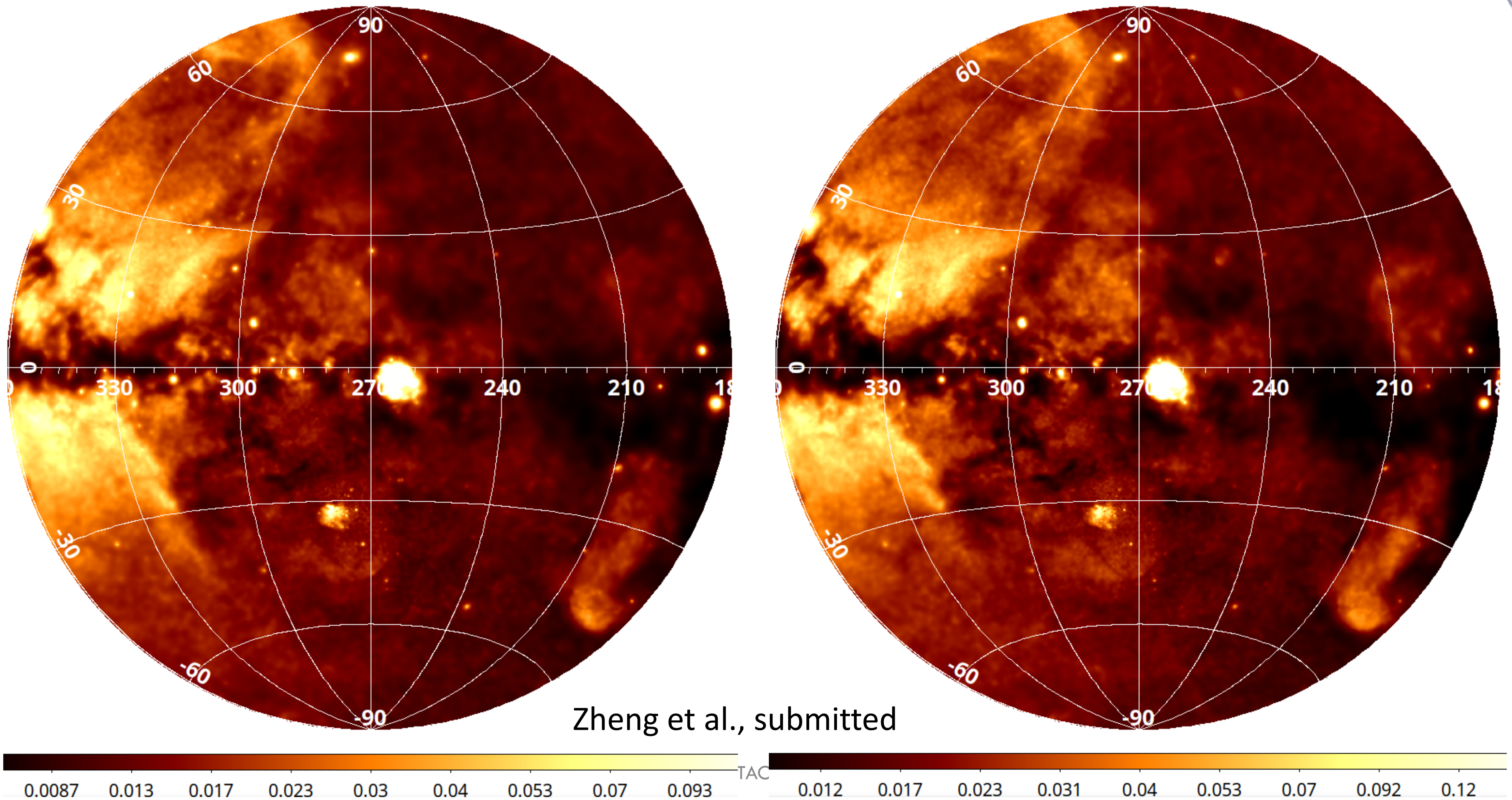
The eROSITA Bubbles



- $L_{X,tot}$~10^{39} erg/s
- Energetics:
  - Assume kT=0.3 keV and abundances of 0.2 Solar
  - Shock with M~1.5 (from T jump)
- **E_{tot}~10^{56} erg** (~ 10x Fermi bubbles!)
  - Age~20 Myr
  - Energy release rate of ~1-3×10^{41} erg/s
- Gas Cooling time ~2 x 10^8 years (>> age of bubbles)

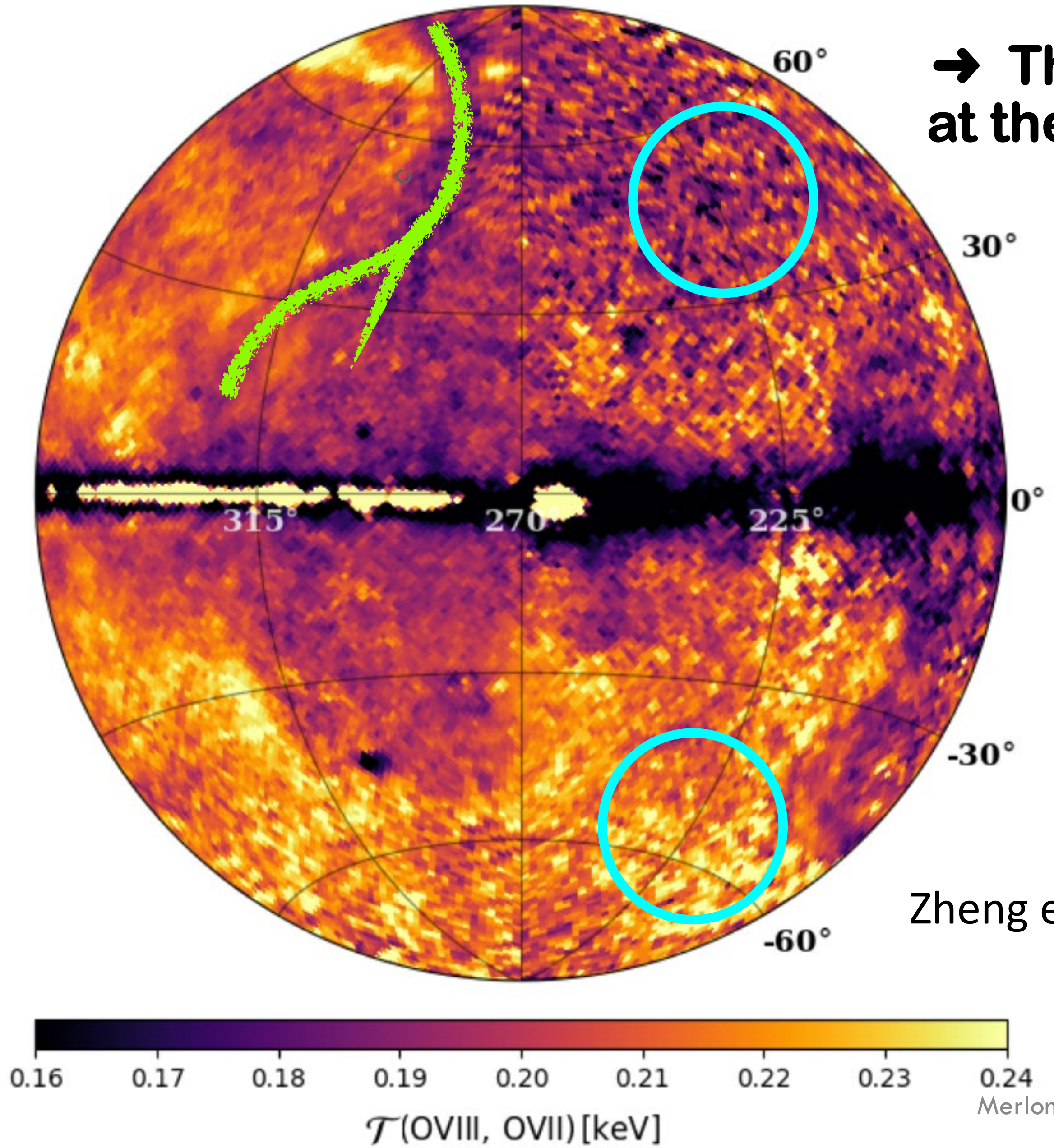
Predehl, Sunyaev et al. Nature (2020)

Narrow band maps: OVII and OVIII

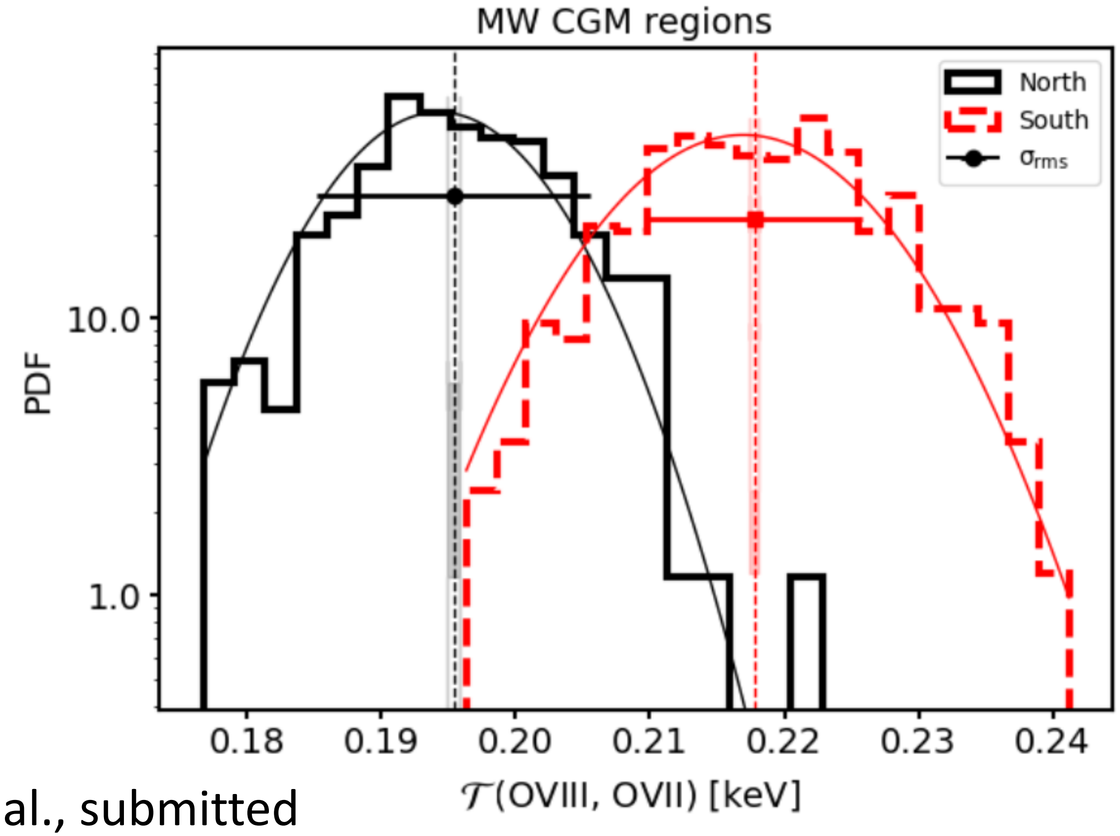


Zheng et al., submitted

Pseudo-temperature map from OVIII/OVII



➜ **Thick (~10º) shell of (colder?) plasma at the interface with the Galactic outflow**



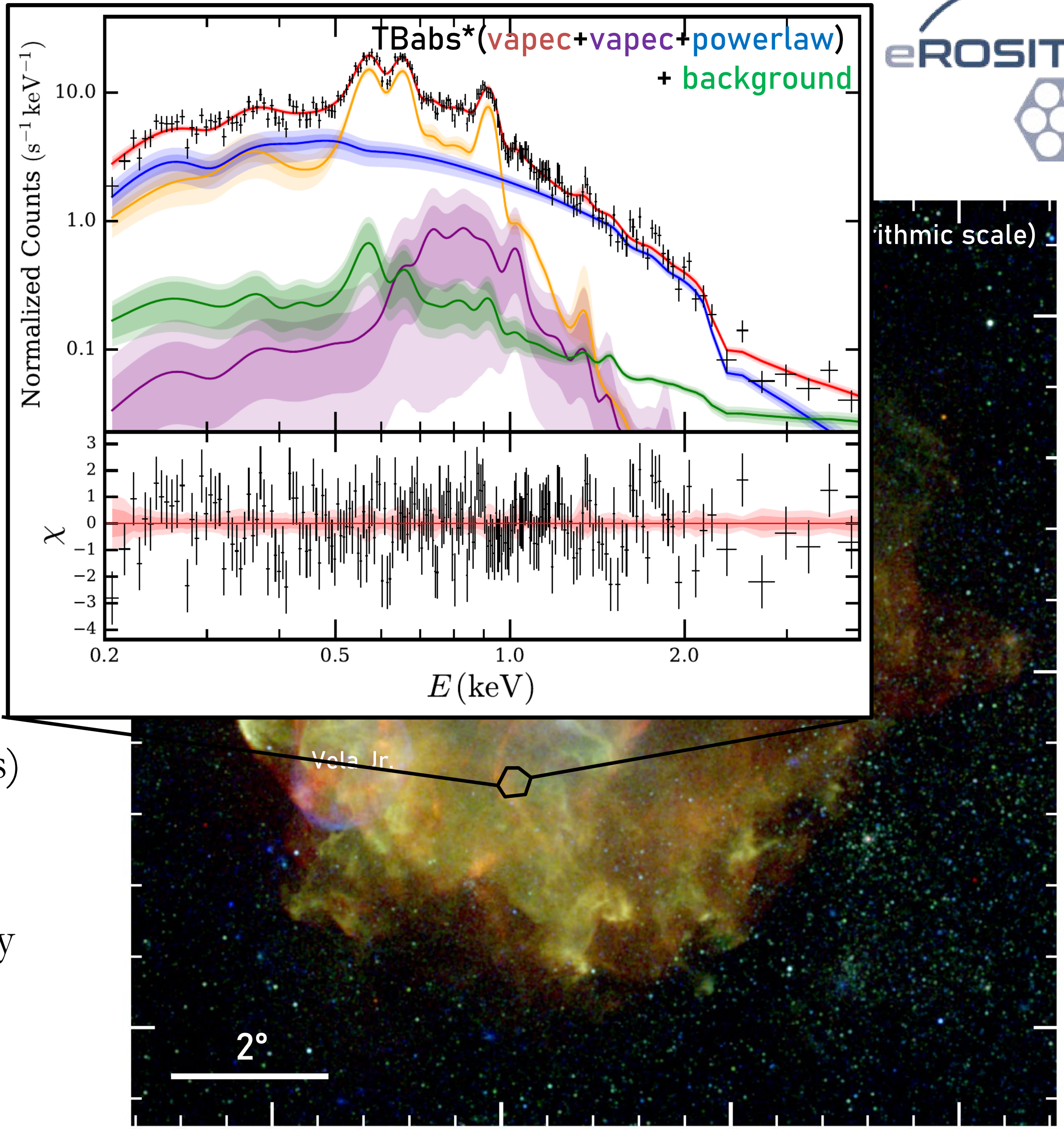
Zheng et al., submitted

➜ ΔkT_{CGM} **< 4% on small (2º-20º) scales**

The Vela Supe

- Very extended X-ray-bright core-collapse SNR
  - Central energetic pulsar PSR B0833-45 & pulsar wind nebula (Vela X)
  - Nearby (~ 290 pc; *Dodson+03*)
  - Age ~ 11 – 30 kyr (*Manchester+05, Espinoza+17*)

➢ eRASS:4 data provide opportunity to study
  - Foreground absorption (➢ Local ISM properties)
  - Ejecta distribution & composition (➢ SN nucleosynthesis)
  - Synchrotron emission from PWN (➢ Cosmic ray acceleration)

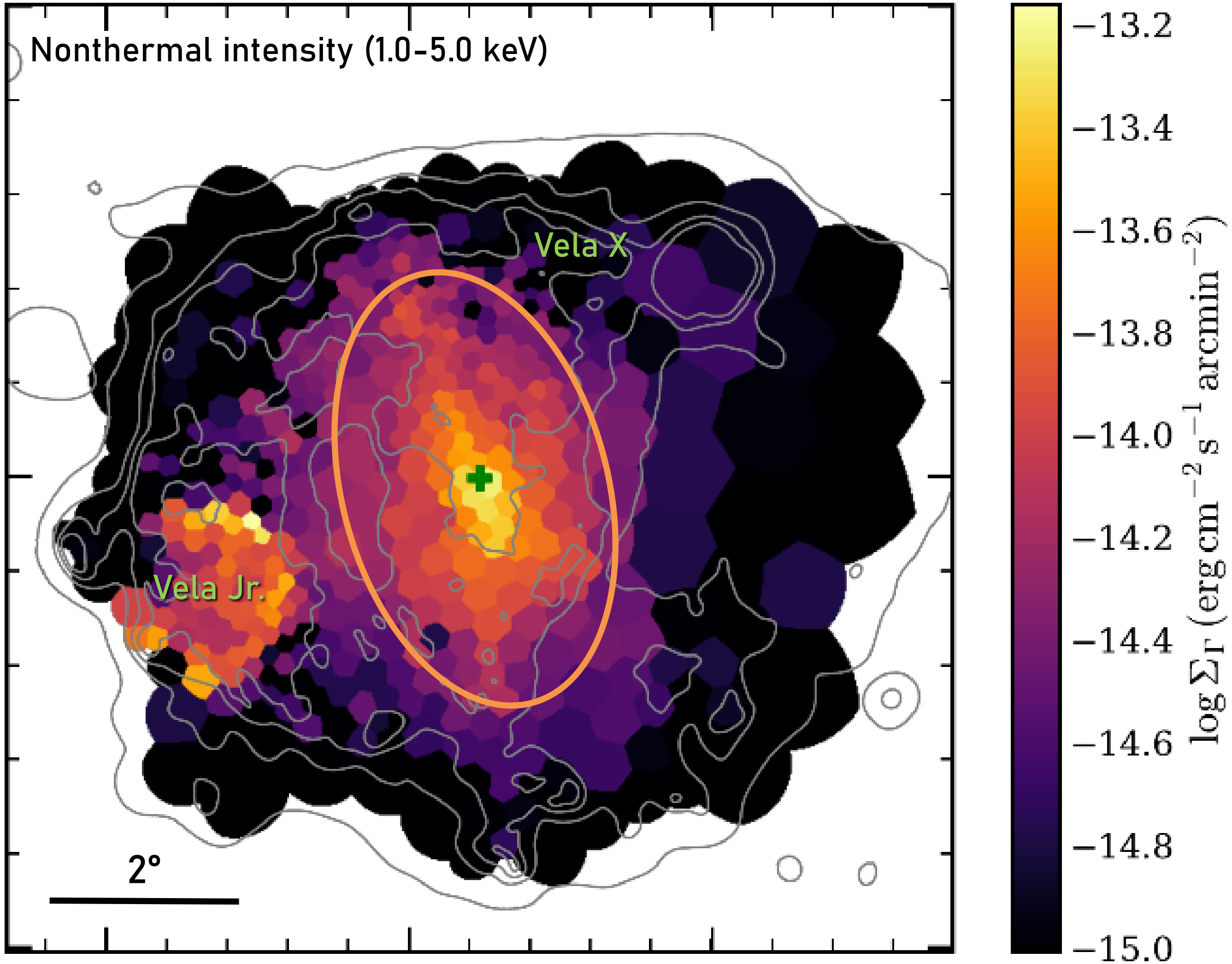


Mayer, Becker et al. (2023)

Vela SNR: Non-thermal Emission

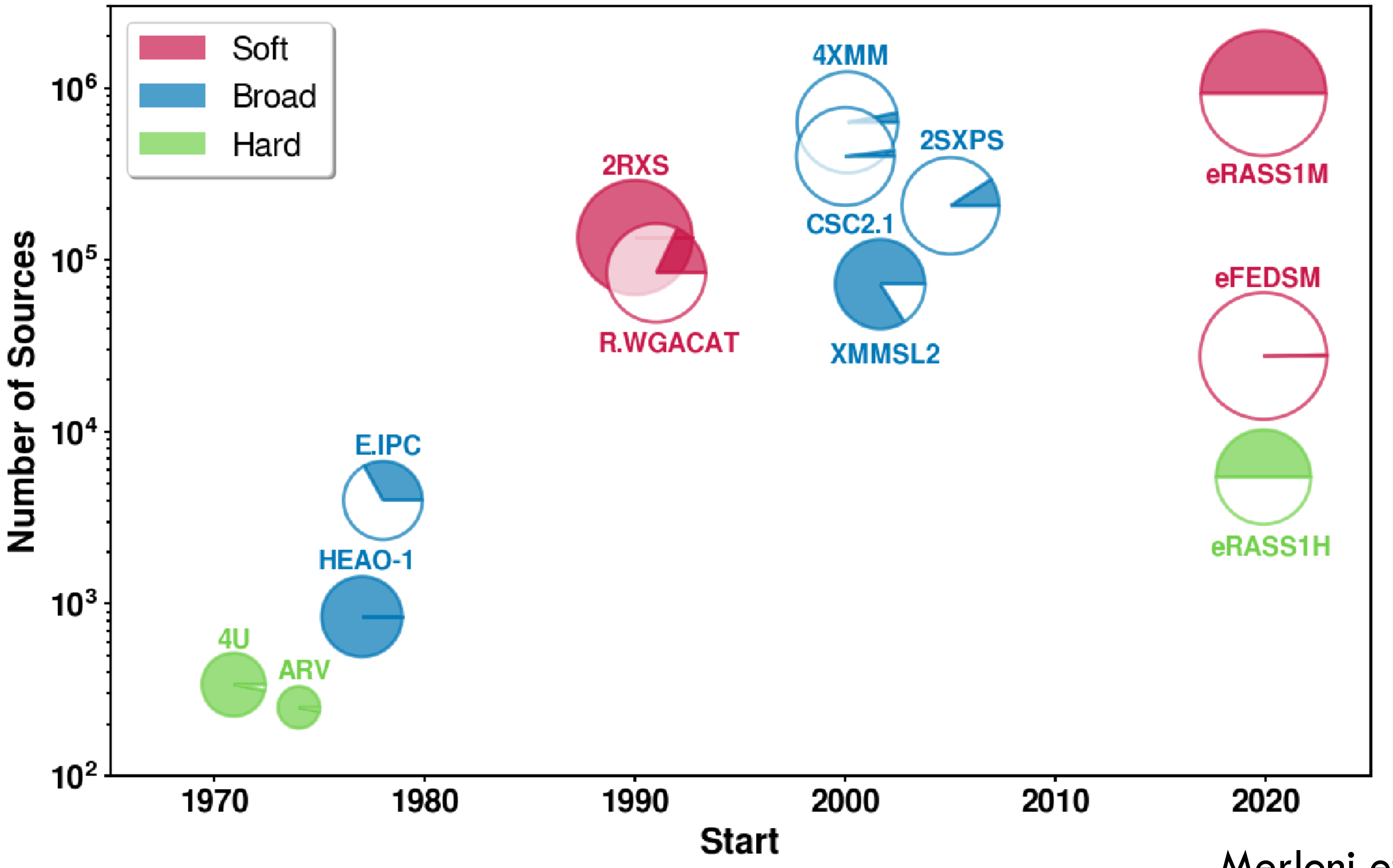
- Vela X, prior to eROSITA:
  - Synchrotron emission in „Cocoon“ visible with ROSAT & XMM (*e.g. Slane+2018*)

➢With eROSITA, observe much larger size of pulsar‘s diffuse X-ray nebula, with a radial extent of 2° - 3°



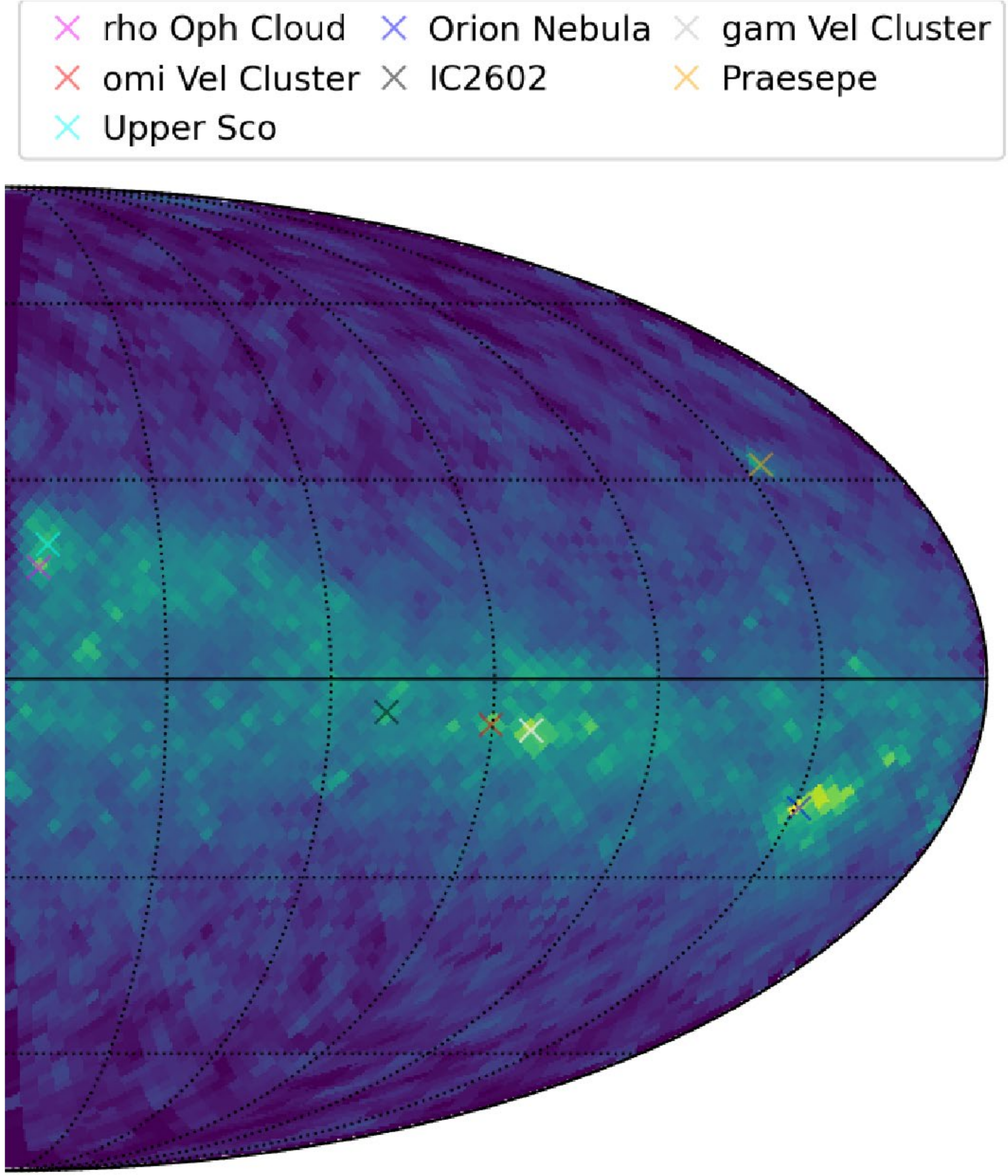
Mayer, Becker et al. (2023)

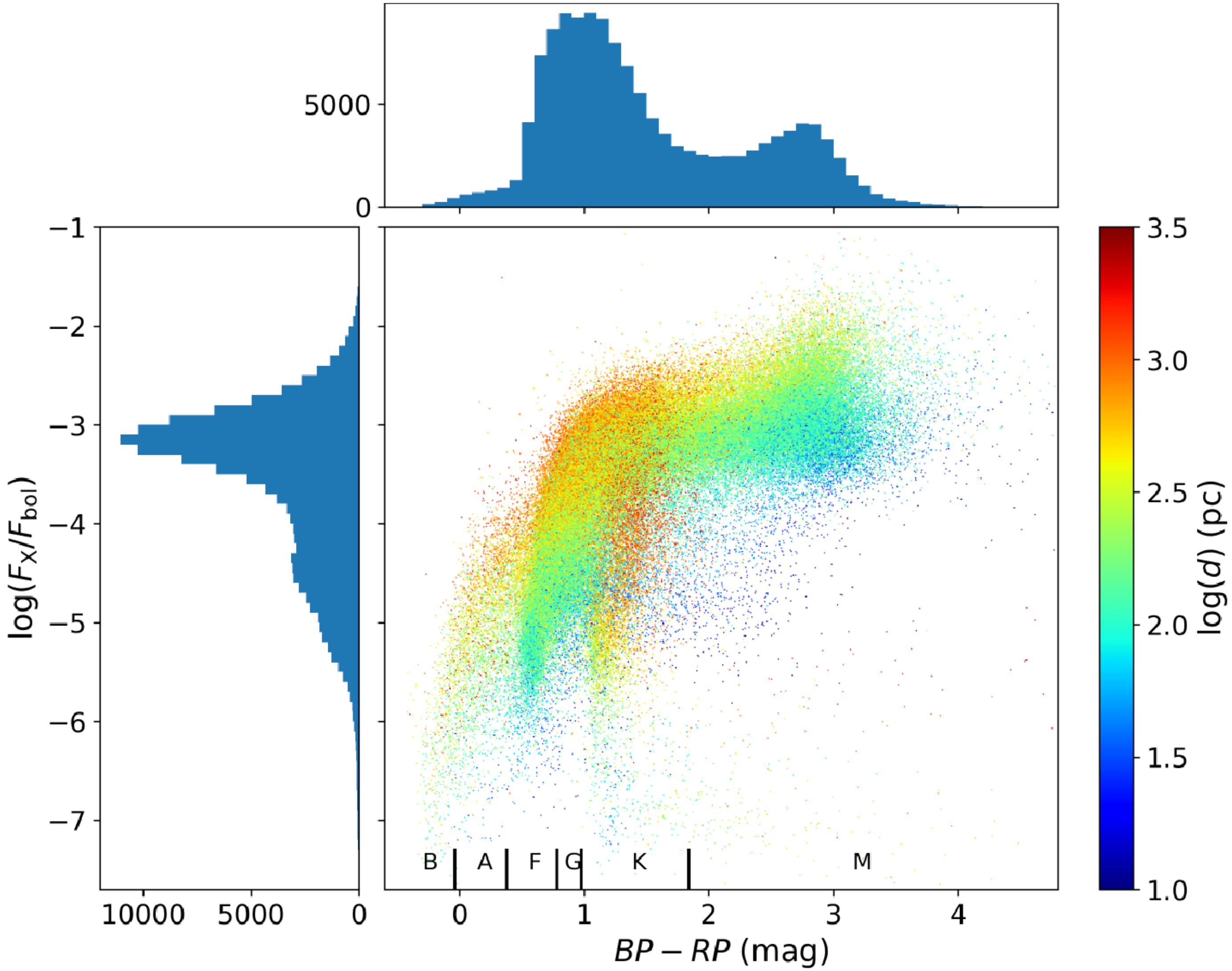
eRASS1 and X-ray catalogues



Merloni et al. (2024)

The SRG/eROSITA all-sky survey: Identifying ~130k coronal-emitting stars Freund et al. (2024)





Searching for X-ray counterparts of unassociated Fermi-LAT sources and rotation-powered pulsars with SRG/eROSITA

Mayer and Becker, (2024)

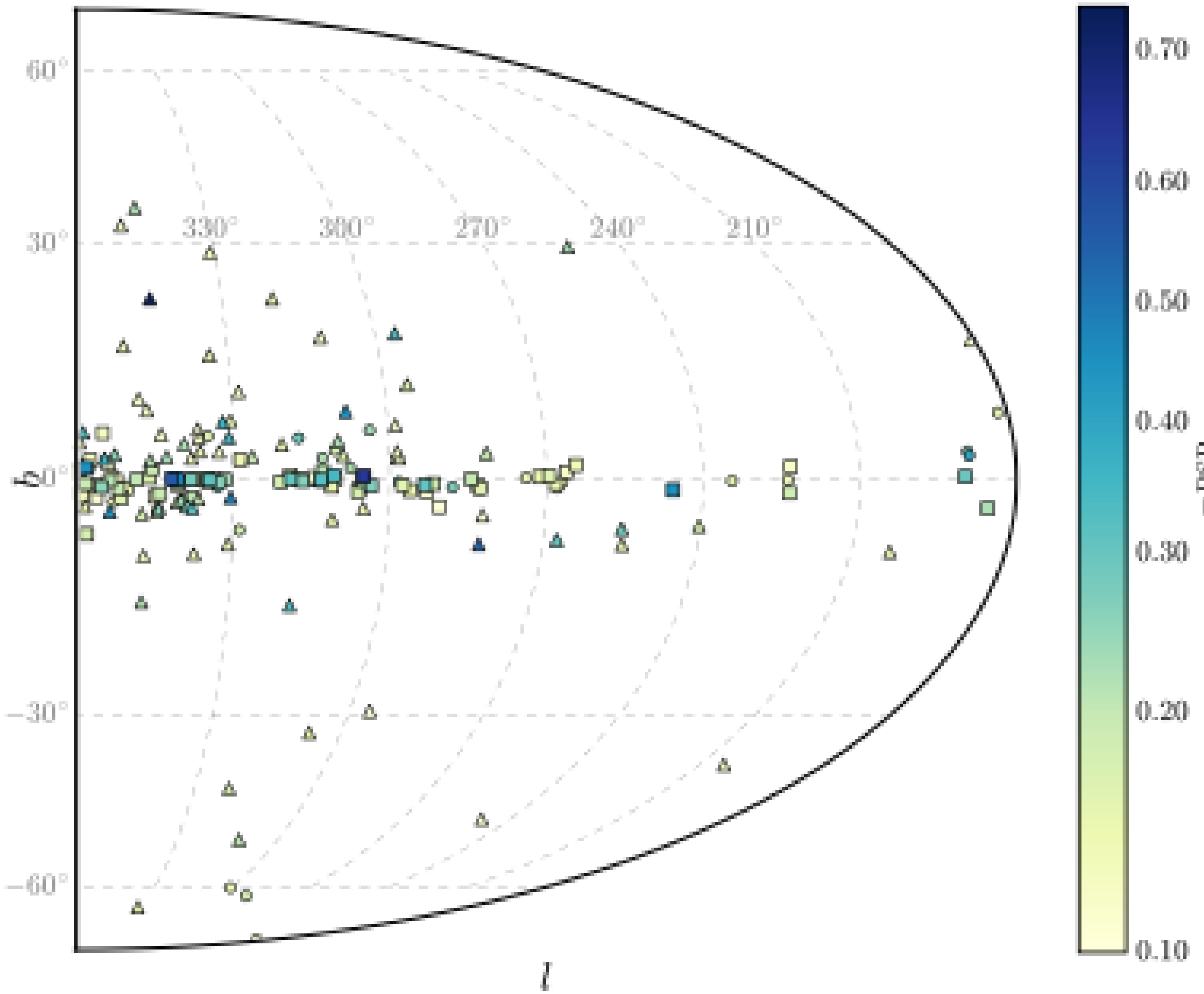
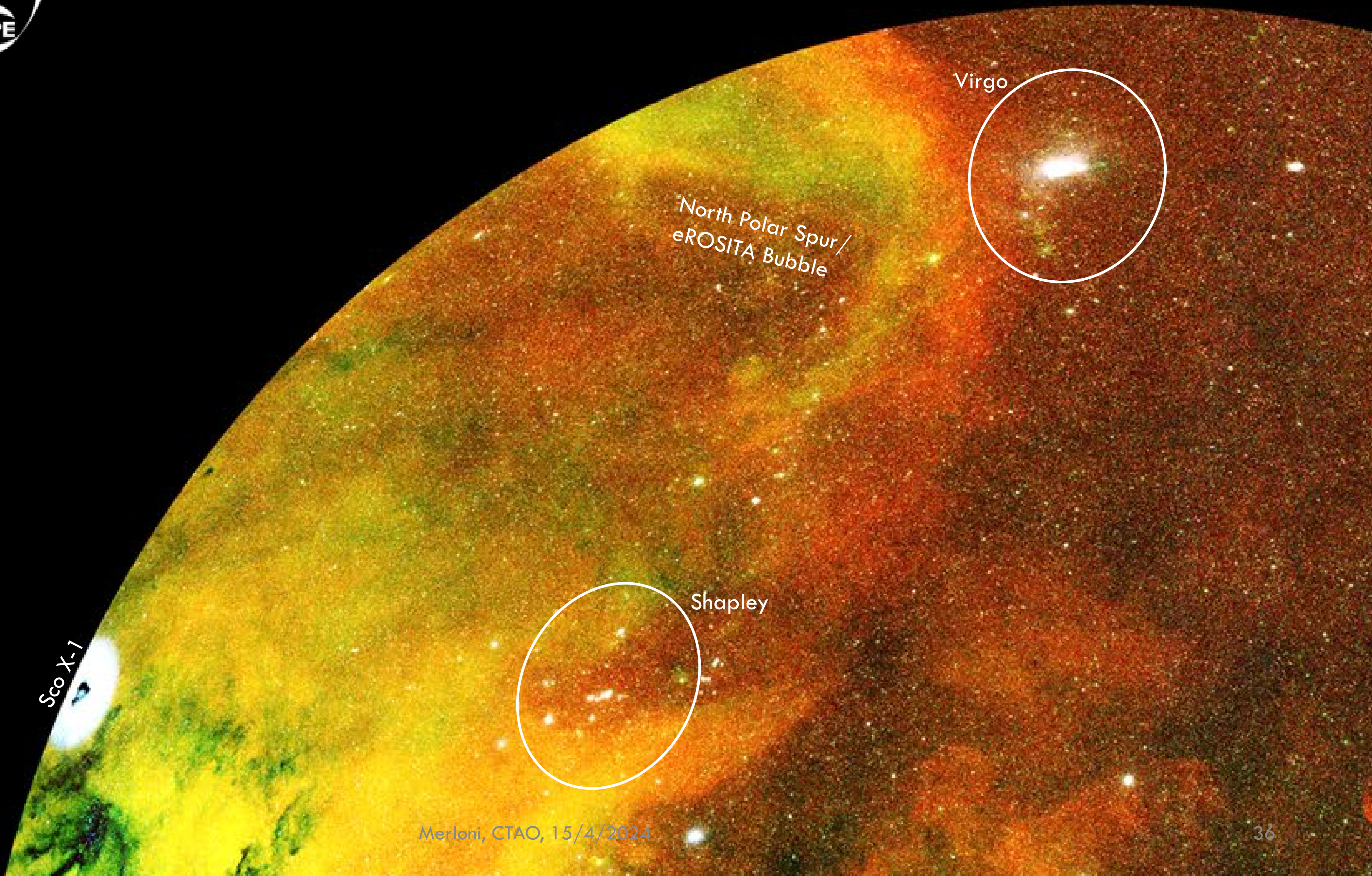


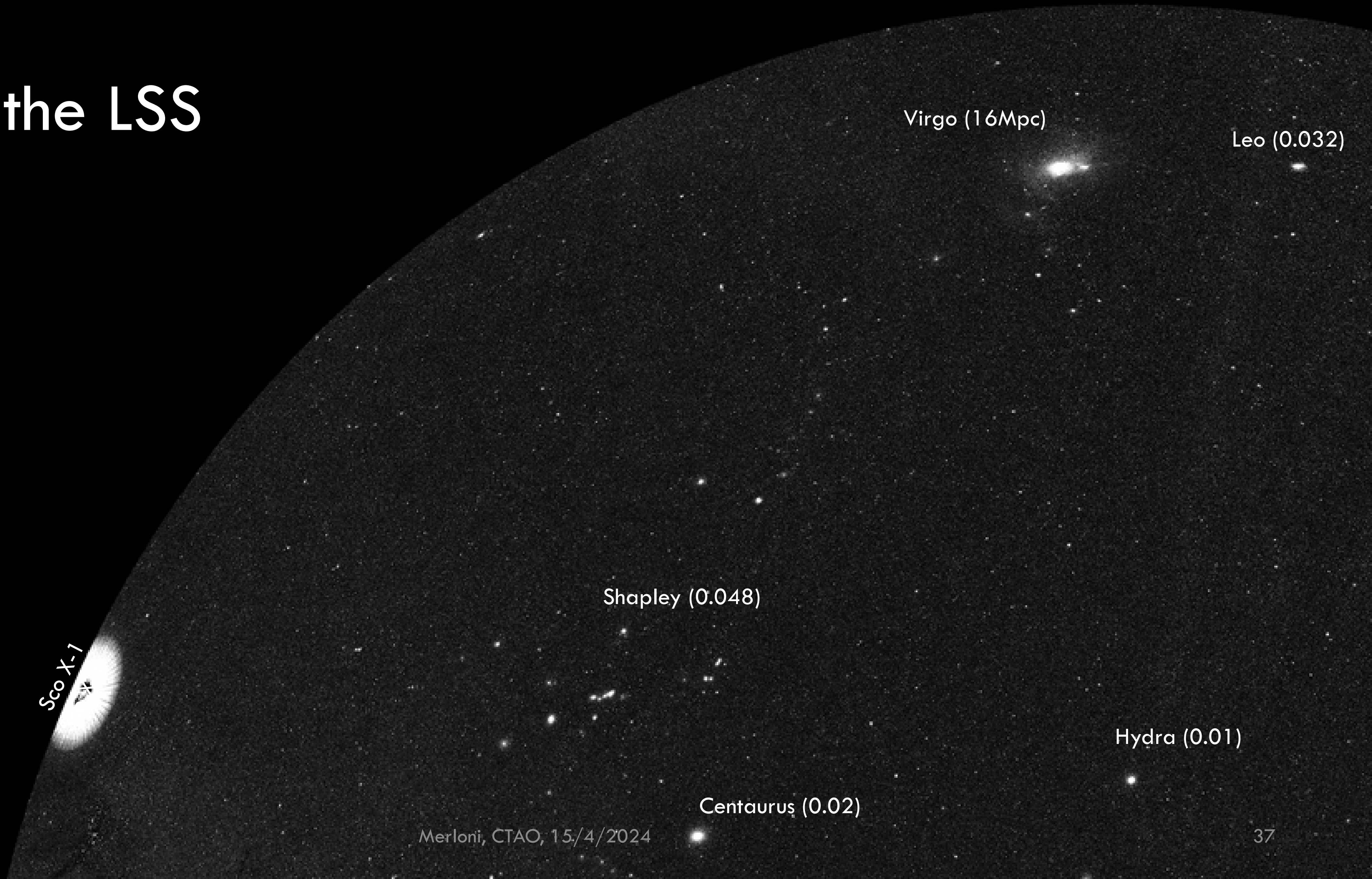
Table 4: List of top 50 candidate pulsar-type matches to 4FGL sources.

#	α_X deg	δ_X deg	σ_X arcsec	$\mathcal{L}_{det}$	$\mathcal{L}_{ext}$	Source_Name_4FGL	P_γ^{PSR}	P_i^{PSR}	P_i^{YNG}	P_i^{MSP}	P_i^{AGN}	Comment
1	236.06418	−25.92528	3.0	19.8	0.0	4FGL J1544.2-2554	0.997	0.753	0.000	0.753	0.001	
2	197.23184	−62.41172	1.6	180	0.0	4FGL J1309.1-6223	0.997	0.637	0.630	0.007	0.003	
3	253.31237	−43.82513	4.2	5.2	0.0	4FGL J1653.2-4349	0.989	0.563	0.562	0.000	0.000	
4	143.50470	−62.56495	2.5	38	0.0	4FGL J0933.8-6232	1.000	0.540	0.032	0.509	0.000	(a)
5	244.20254	−53.69458	2.3	48	0.0	4FGL J1616.6-5341	1.000	0.480	0.176	0.303	0.000	(b)
6	252.34131	−44.73401	1.8	112	0.0	4FGL J1649.3-4441	0.990	0.477	0.460	0.017	0.009	(b)
7	118.04167	−29.50531	1.6	217	0.0	4FGL J0752.0-2931	0.999	0.452	0.436	0.016	0.003	(c)
8	263.86181	−29.75370	7.7	18.0	6.1	4FGL J1735.4-2944	0.913	0.451	0.427	0.024	0.291	
9	201.34839	−54.23968	3.8	10.3	0.0	4FGL J1325.3-5413	0.968	0.448	0.018	0.430	0.005	(d)
10	266.41332	−36.42802	3.0	37	0.0	4FGL J1745.6-3626	0.751	0.448	0.023	0.425	0.267	
11	236.33279	−45.90416	2.2	77	0.0	4FGL J1545.2-4553	0.911	0.361	0.024	0.337	0.131	
12	260.52566	−32.08855	4.2	5.4	0.0	4FGL J1722.1-3205	0.971	0.349	0.033	0.316	0.003	
13	209.23867	−61.38800	1.8	130	0.0	4FGL J1357.3-6123	0.952	0.348	0.337	0.011	0.037	(b, e)
14	236.81672	−48.00443	3.5	16.1	0.0	4FGL J1547.4-4802	0.944	0.348	0.035	0.313	0.018	
15	183.49466	−44.25681	4.0	10.8	0.0	4FGL J1213.9-4416	0.945	0.335	0.002	0.332	0.007	
16	214.66390	−61.19200	5.2	10.3	0.0	4FGL J1418.7-6110	0.917	0.326	0.318	0.007	0.005	
17	260.15801	−26.87634	2.5	33	0.0	4FGL J1720.6-2653c	0.400	0.324	0.031	0.293	0.539	
18	245.57301	−72.05278	4.1	13.2	0.0	4FGL J1622.2-7202	0.997	0.323	0.000	0.323	0.001	
19	253.57303	−49.11719	3.3	12.6	0.0	4FGL J1654.2-4907c	0.287	0.319	0.046	0.273	0.306	
20	246.53852	−49.29462	2.6	28.3	0.0	4FGL J1626.0-4917c	0.483	0.311	0.293	0.018	0.248	
21	225.02645	−58.77219	5.1	7.5	0.0	4FGL J1500.1-5846	0.509	0.306	0.301	0.005	0.068	
22	171.97380	−62.02326	1.5	163	0.0	4FGL J1127.9-6158	0.998	0.303	0.291	0.012	0.001	(f)
23	126.56484	−50.90072	4.2	8.9	0.0	4FGL J0826.1-5053	0.986	0.301	0.002	0.298	0.001	
24	92.18263	20.59542	4.0	39	0.0	4FGL J0608.8+2034c	0.969	0.299	0.286	0.013	0.018	
25	249.93840	−46.68515	4.9	10.2	0.0	4FGL J1639.8-4642c	0.957	0.280	0.279	0.001	0.001	(e)
26	118.73457	−39.88257	4.4	7.4	0.0	4FGL J0754.9-3953	1.000	0.279	0.003	0.276	0.000	
27	252.85143	−44.36273	1.1	1220	0.0	4FGL J1650.9-4420c	0.915	0.279	0.270	0.009	0.258	(b, e)
28	254.16530	−48.22062	2.6	39	0.0	4FGL J1656.9-4814	0.722	0.270	0.077	0.194	0.110	
29	194.20780	−63.66546	4.2	6.8	0.0	4FGL J1257.0-6339	0.959	0.265	0.155	0.111	0.001	
30	221.32135	−60.00743	3.1	18.7	0.0	4FGL J1445.1-5958c	0.816	0.259	0.254	0.005	0.027	
31	244.81362	−50.78953	3.2	22.0	0.0	4FGL J1619.3-5047	0.982	0.258	0.253	0.005	0.002	
32	259.37013	−44.03974	2.4	62	0.0	4FGL J1717.6-4404	0.760	0.253	0.095	0.158	0.238	
33	258.72454	−33.38508	3.6	10.9	0.0	4FGL J1714.9-3324	0.999	0.252	0.046	0.206	0.000	
34	264.39070	−33.54471	2.5	22.3	0.0	4FGL J1737.3-3332	0.942	0.250	0.212	0.038	0.007	(b)
35	198.12297	−62.57599	2.4	41	0.0	4FGL J1312.6-6231c	0.987	0.245	0.200	0.045	0.004	(g)
36	246.65399	−48.96485	3.5	18.8	0.0	4FGL J1626.5-4858c	0.882	0.237	0.231	0.006	0.013	(b)
37	252.33402	−45.23386	4.2	15.8	0.0	4FGL J1649.2-4513c	0.964	0.232	0.221	0.011	0.002	
38	148.43061	−15.16169	5.3	5.2	0.0	4FGL J0953.6-1509	1.000	0.229	0.000	0.228	0.000	
39	251.25342	−41.38724	2.7	27.5	0.0	4FGL J1645.1-4123c	0.947	0.228	0.022	0.206	0.031	
40	254.48273	−46.92163	1.9	96	0.0	4FGL J1657.7-4656c	0.527	0.226	0.102	0.123	0.433	(b)
41	243.00184	−51.42570	3.7	17.5	0.0	4FGL J1611.9-5125c	0.957	0.224	0.222	0.002	0.001	(b)
42	86.16917	22.63266	2.8	44	0.0	4FGL J0544.4+2238	0.688	0.222	0.180	0.042	0.103	
43	228.44197	−15.34978	4.9	9.2	0.0	4FGL J1513.7-1519	0.989	0.219	0.002	0.217	0.004	
44	246.72777	−42.87342	2.9	25.0	0.0	4FGL J1626.6-4251	0.908	0.217	0.025	0.192	0.016	(b)
45	205.67808	−57.48130	4.0	17.2	0.0	4FGL J1342.6-5730	0.473	0.216	0.064	0.152	0.281	
46	275.72745	−47.31907	5.3	5.2	0.0	4FGL J1822.9-4718	0.961	0.212	0.000	0.212	0.008	
47	213.09350	−60.30956	2.4	37	0.0	4FGL J1412.2-6018	0.427	0.212	0.191	0.021	0.625	
48	254.33750	−39.28219	3.9	13.1	0.0	4FGL J1657.4-3917c	0.630	0.211	0.083	0.128	0.059	
49	198.15828	−62.95837	3.1	18.7	0.0	4FGL J1312.3-6257	0.606	0.209	0.201	0.008	0.025	
50	262.51595	−34.32575	3.1	22.1	0.0	4FGL J1730.1-3422	0.930	0.208	0.193	0.014	0.002	


Virgo
North Polar Spur/
eROSITA Bubble
Shapley
Sco X-1

1.04-2.3 keV

Imaging the LSS

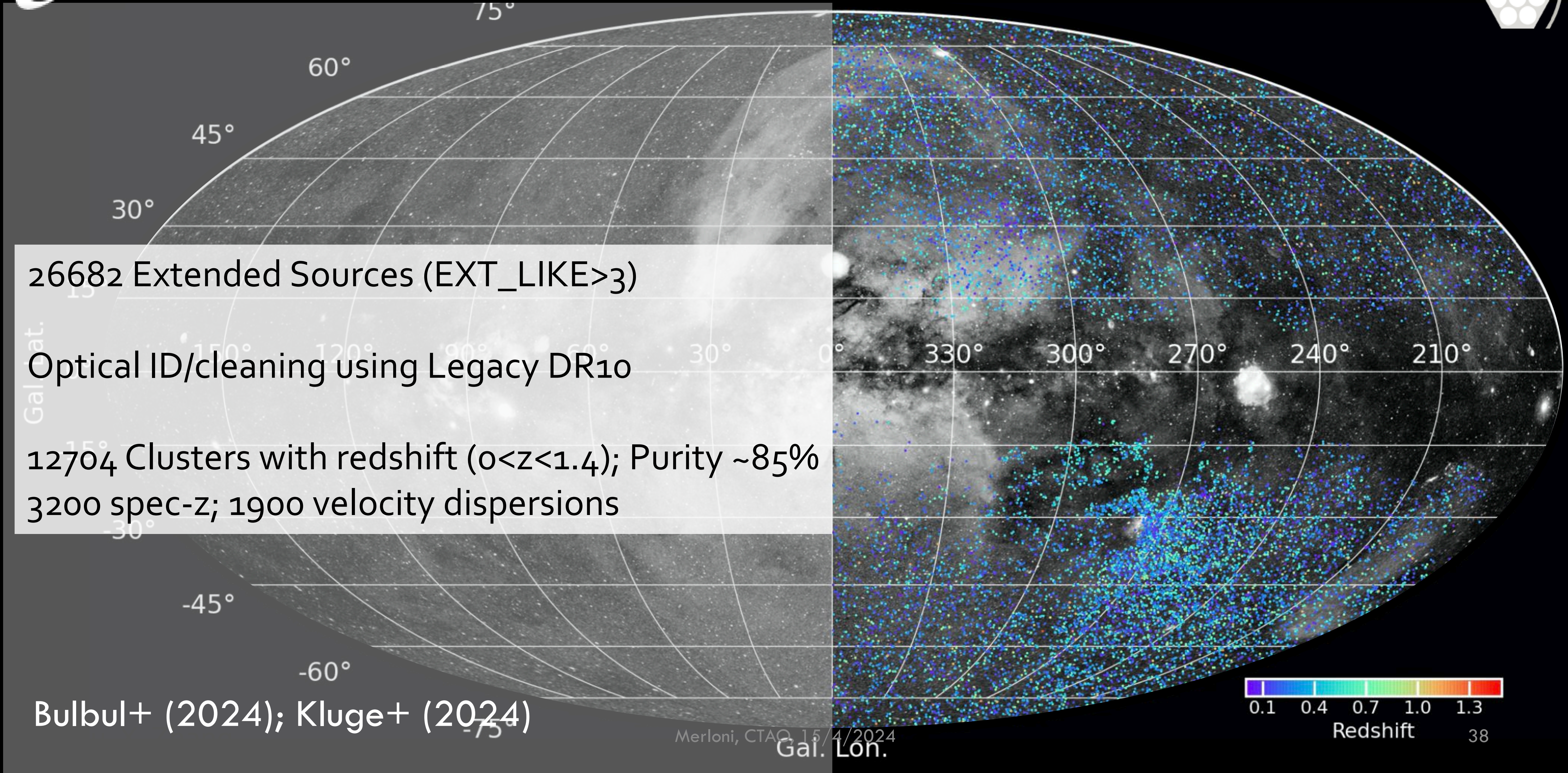


Clusters and Groups in eRASS1

26682 Extended Sources (EXT_LIKE>3)

Optical ID/cleaning using Legacy DR10

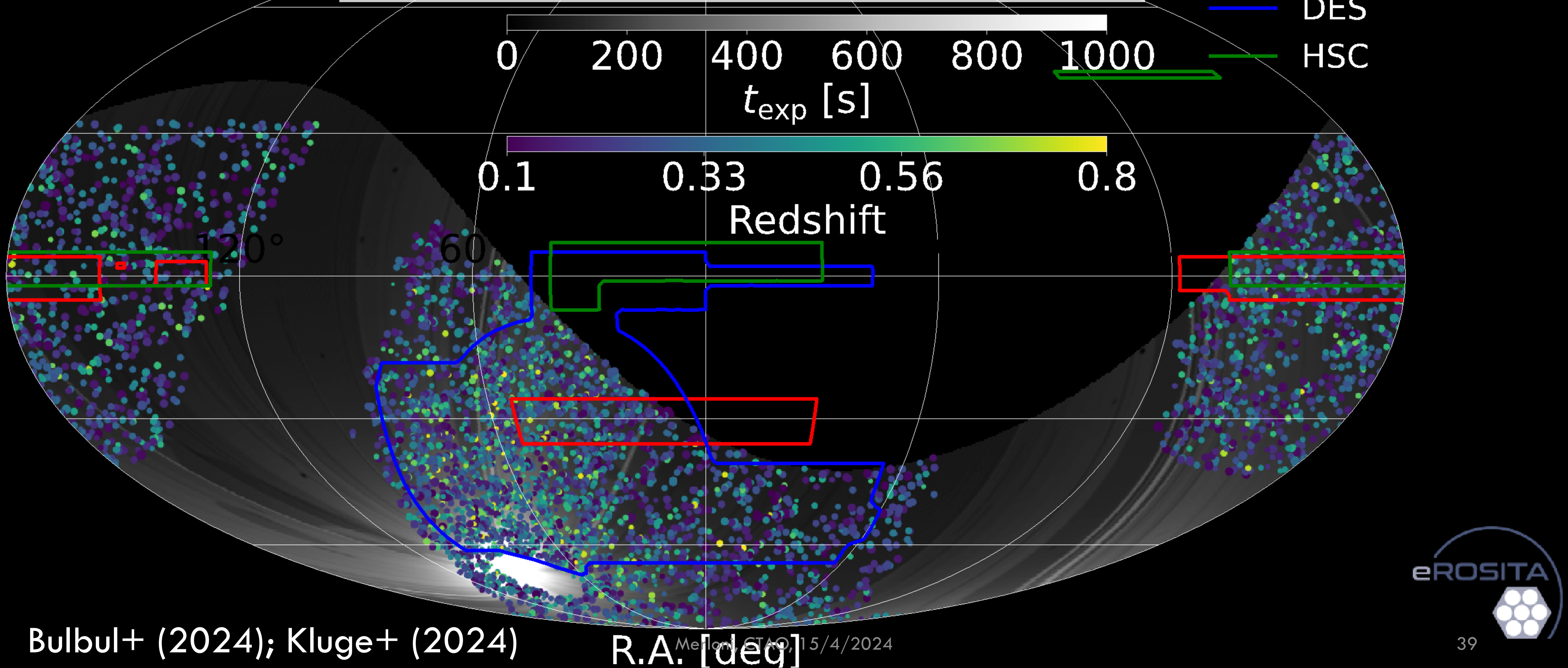
12704 Clusters with redshift (0<z<1.4); Purity ~85%
3200 spec-z; 1900 velocity dispersions



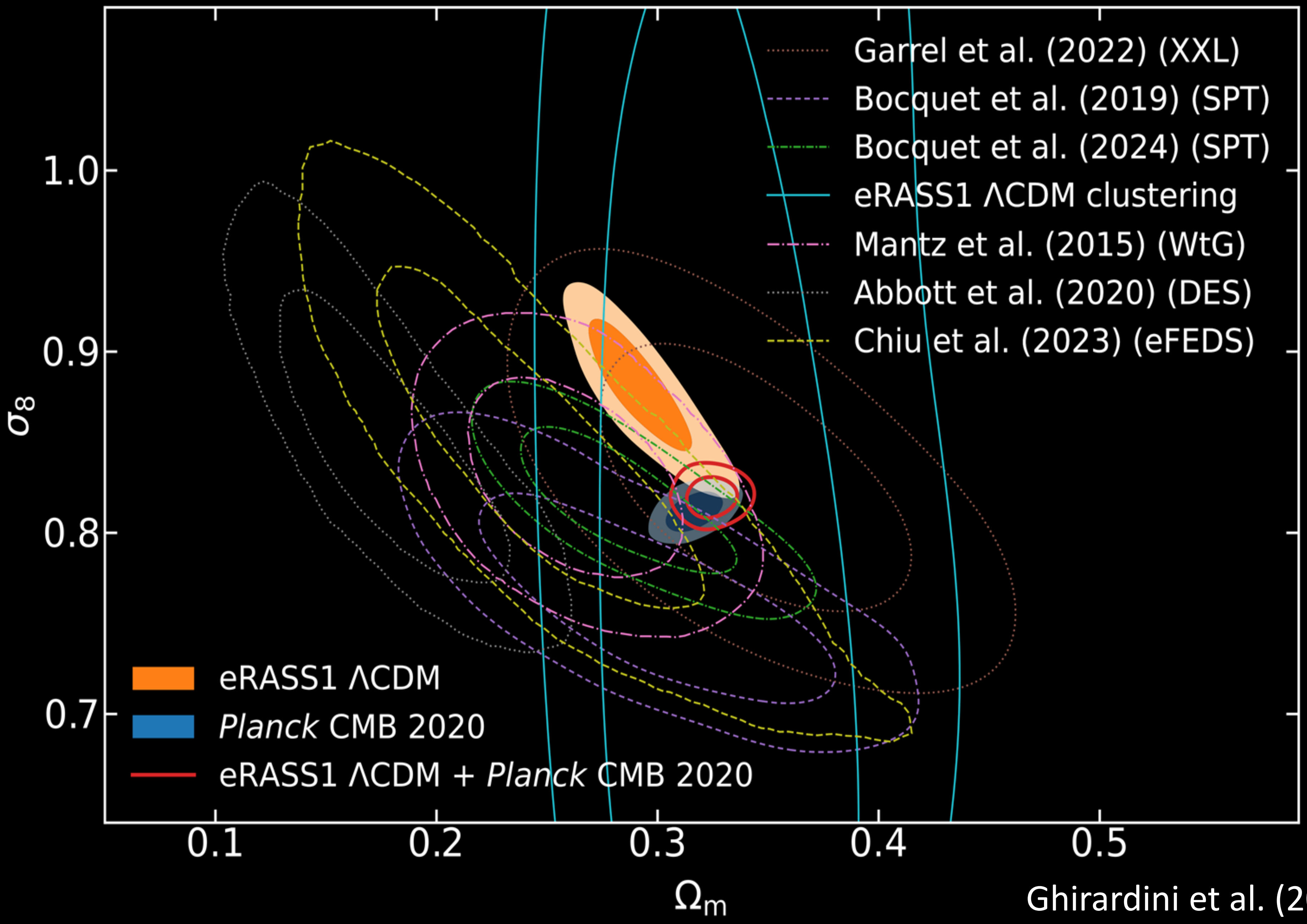
Bulbul+ (2024); Kluge+ (2024)

Clusters Cosmology sample

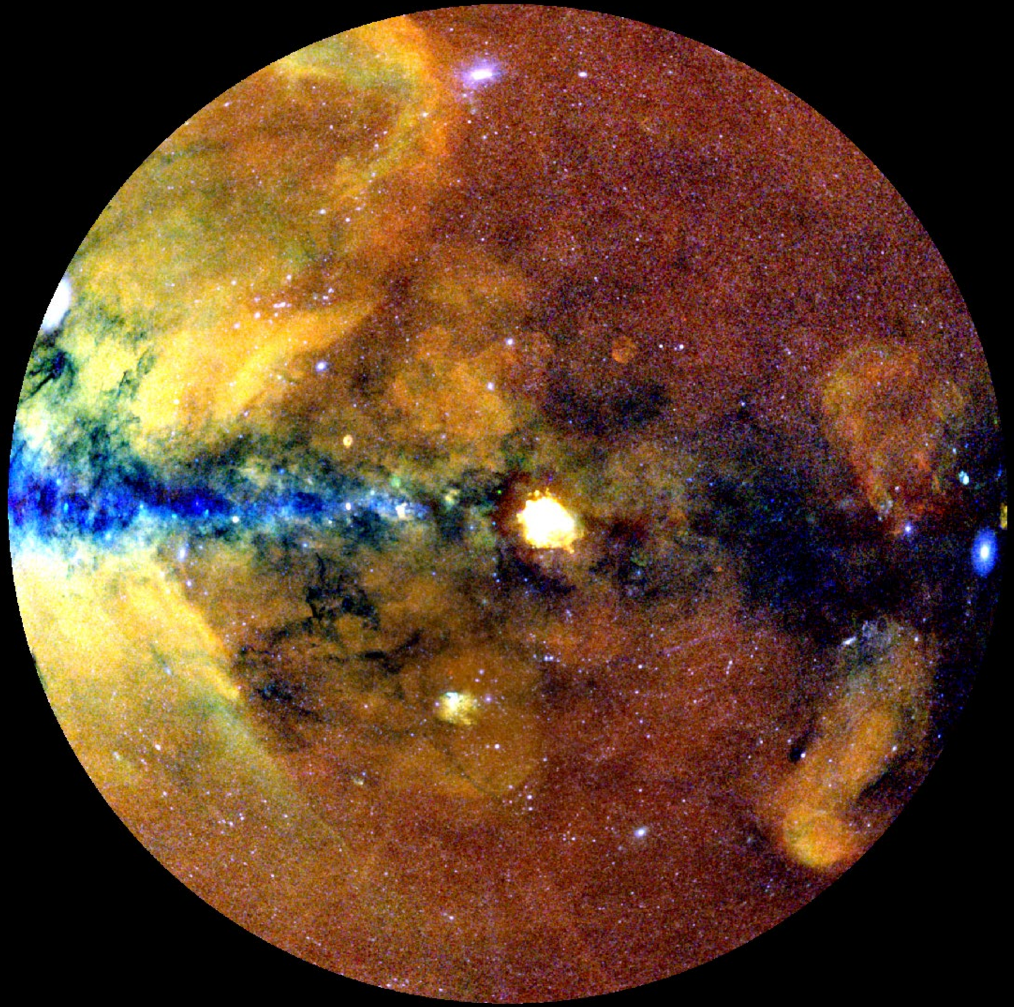
5263 Extended Sources (EXT_LIKE>6) in LS10 area with redshift (0.1<z<0.8); Purity ~95%



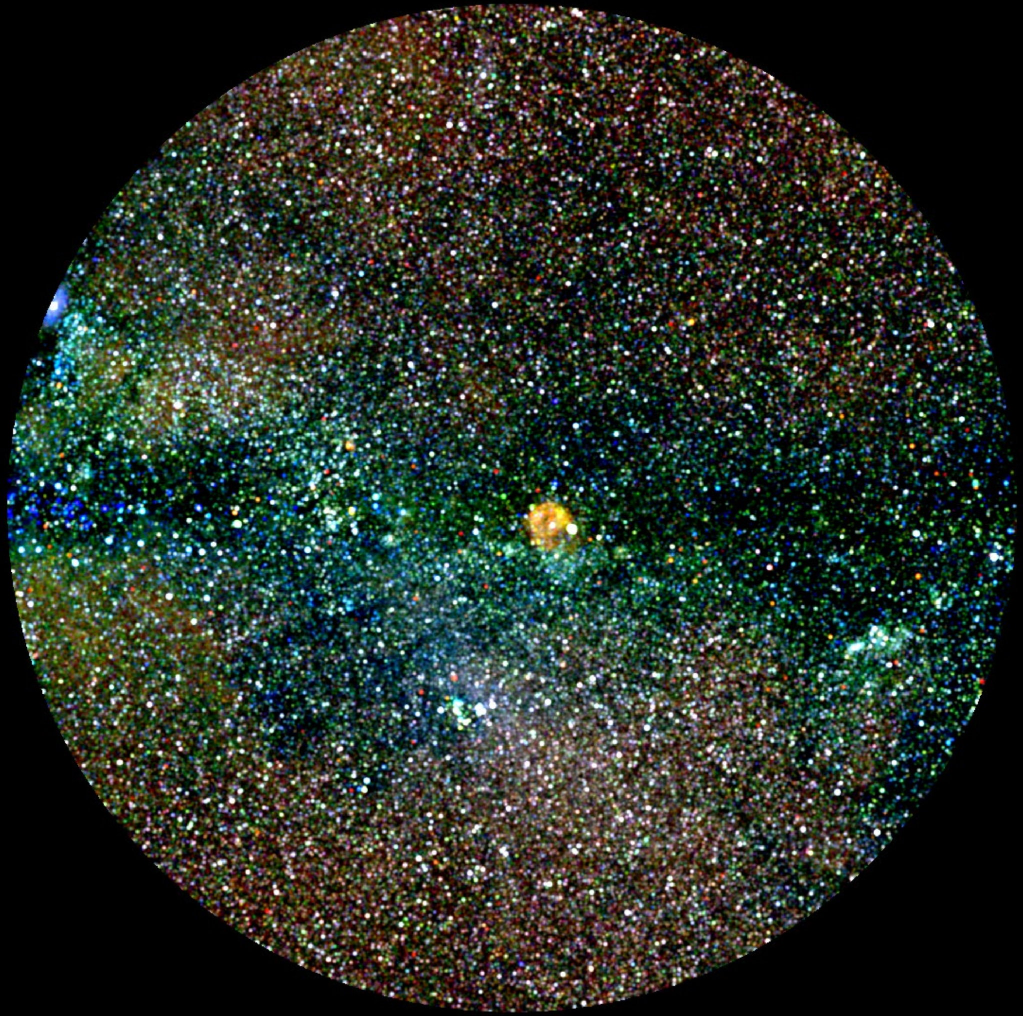
Bulbul+ (2024); Kluge+ (2024)



Ghirardini et al. (2024)



eRASS1 Point sources subtracted map



eRASS1 Point sources map

Credit: J. Sanders, MPE

First results from the SRG/eROSITA All-sky Survey From Stars to Cosmology

RESEARCH CAMPUS, GARCHING, GERMANY

September 15-20, 2024

For information and registration see:

https://events.mpe.mpg.de/event/

Abstract Submission Deadline: May 15, 2024

Conclusions

X-ray astronomy is a key contributor to our exploration of the Universe, as it reveals both fundamental and exotic phenomena

The field has reached a high level of maturity and is well diversified

eROSITA on SRG is the most powerful wide-field X-ray telescope to date. It has been in operation since Q3 2019, for more than 2 years, having completed 4.4 all-sky surveys

Thanks to its large Grasp, stable background and observing cadence eROSITA opens up new parameter space for X-ray astronomy

eRASS1 marks the coming of age of clusters cosmology as a Stage IV experiment

Numerous science highlights from DR1!

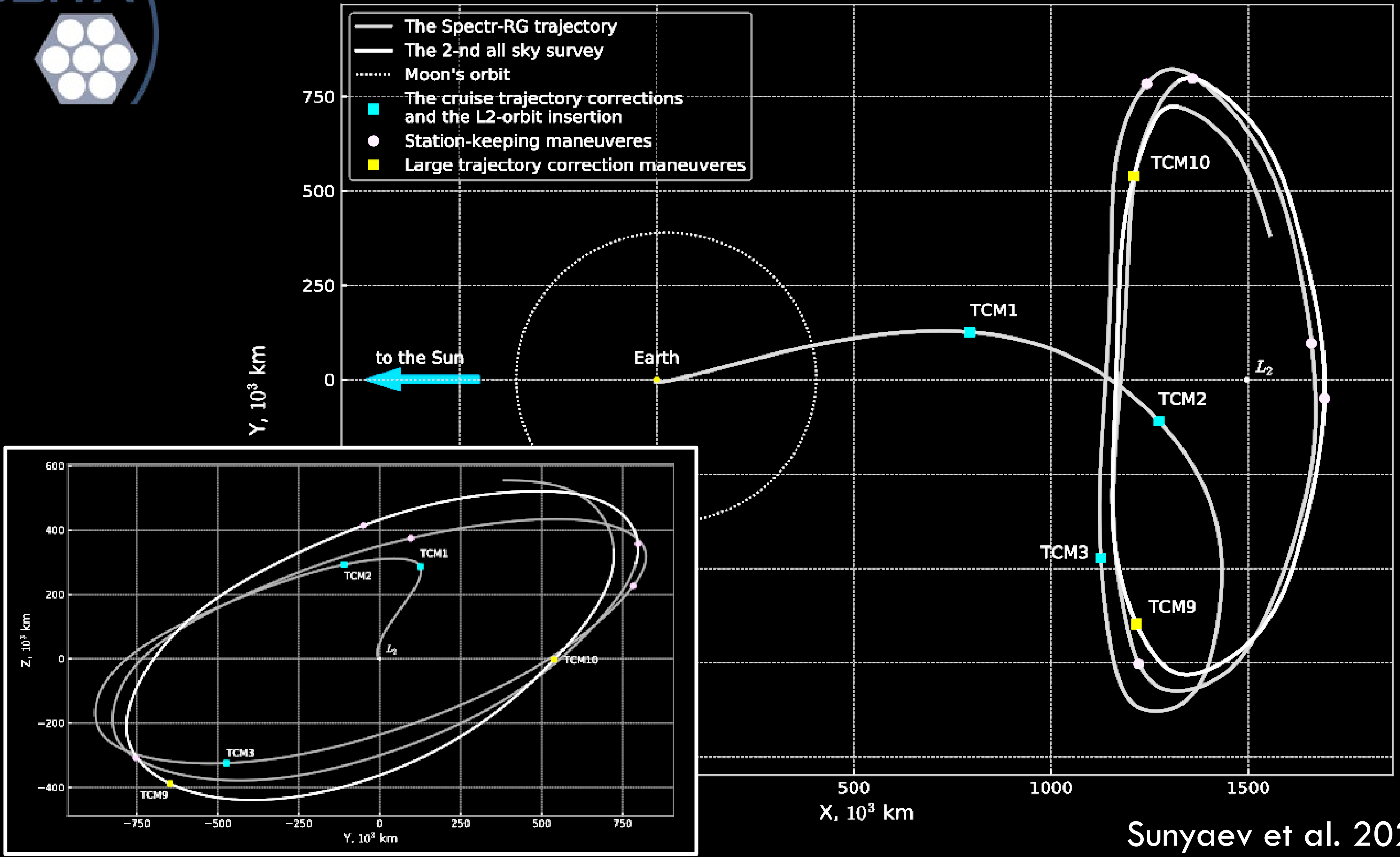
eRASS1 is now fully public! https://erosita.mpe.mpg.de/dr1/

www.mpe.mpg.de/eROSITA

Thank you

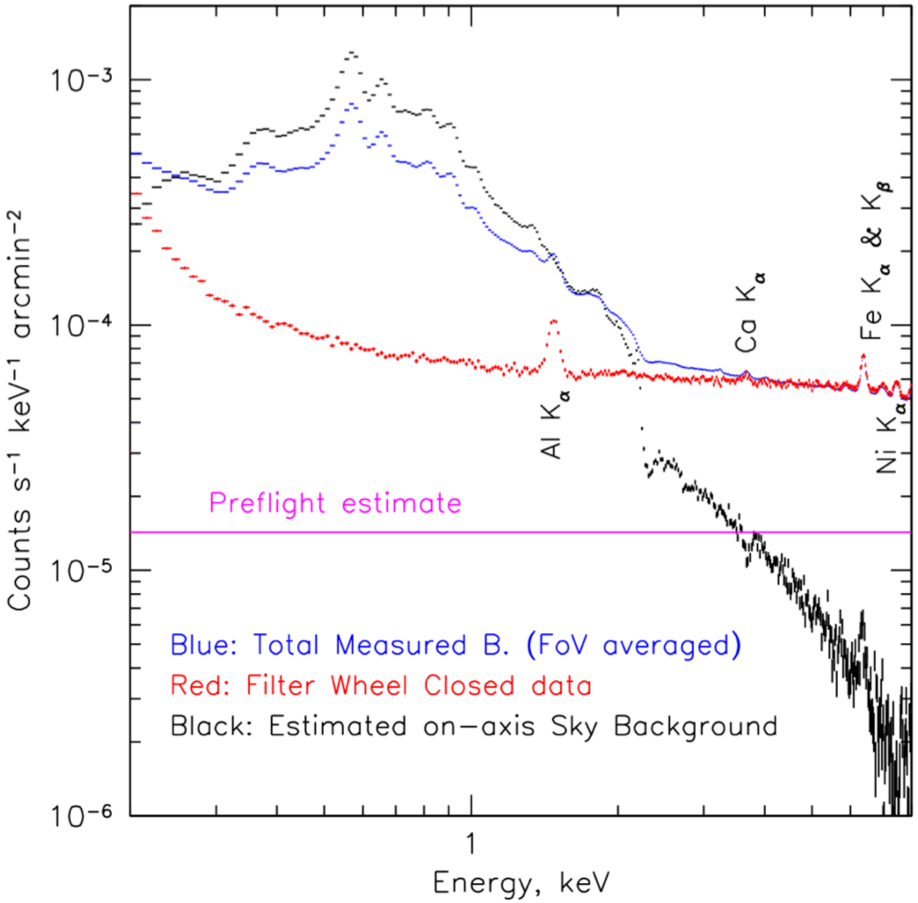
Extra Slides

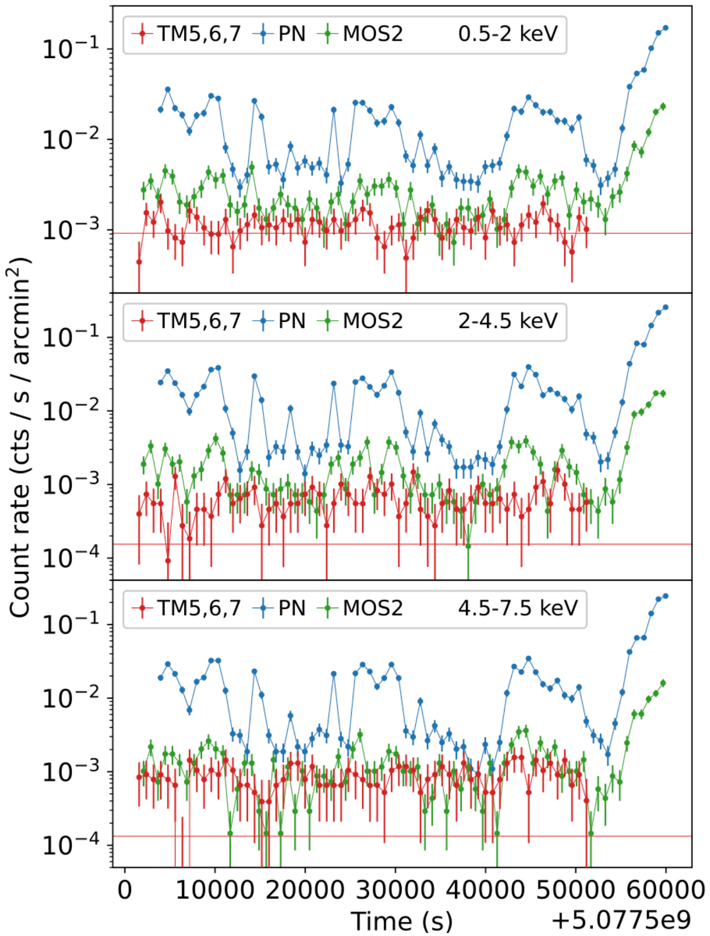
A large Halo L2 orbit



Sunyaev et al. 2021

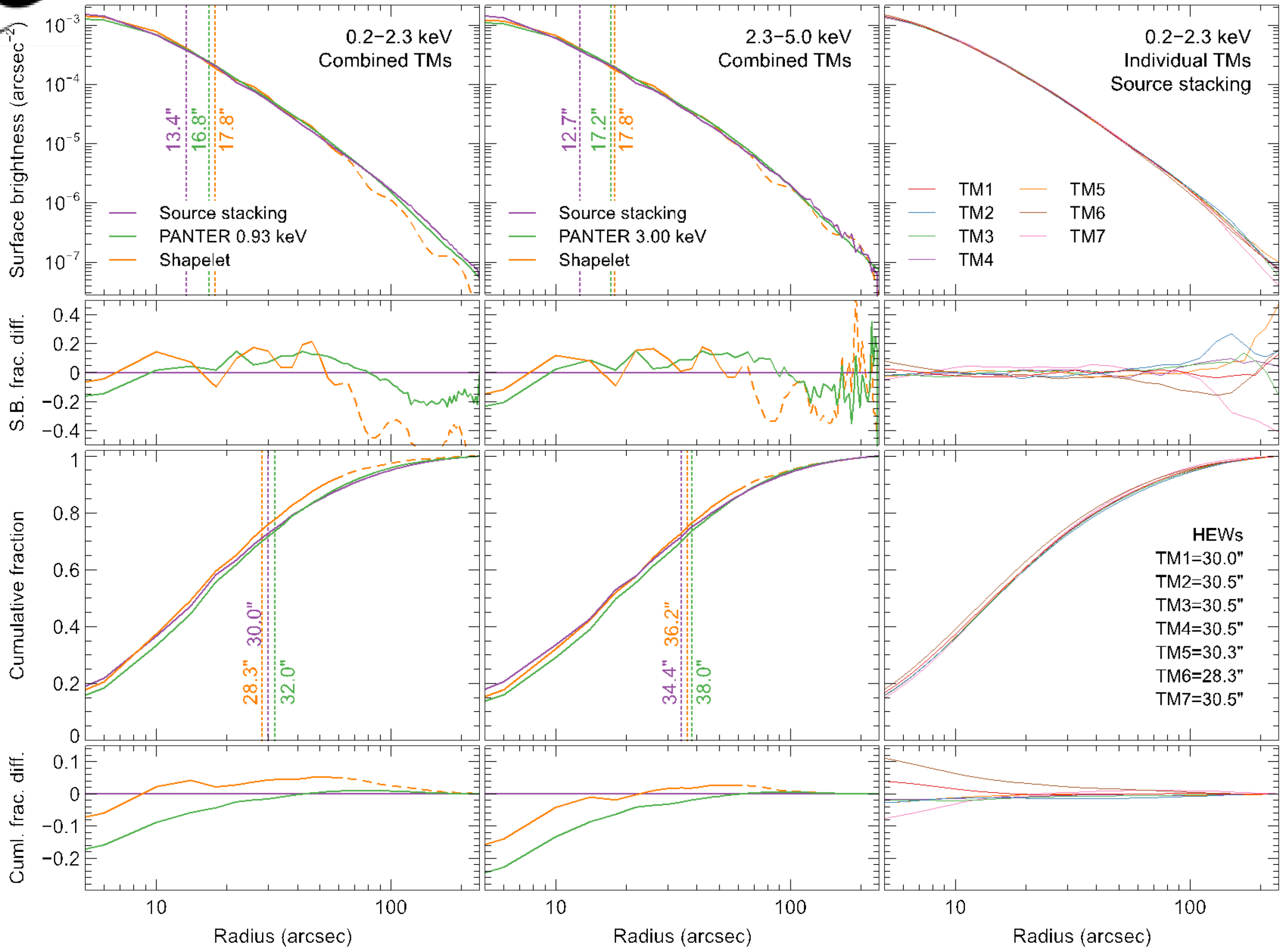
X-ray Background @ L2





1) Background much less variable than in the XMM and Chandra data
2) A factor of ~3 higher particle bkgnd than predicted in the White Book
3) Less fluorescence lines than EPICpn due to graded shields
4) But: iron line (+others) likely from impurities in the graded shield itself

Calibration: PSF

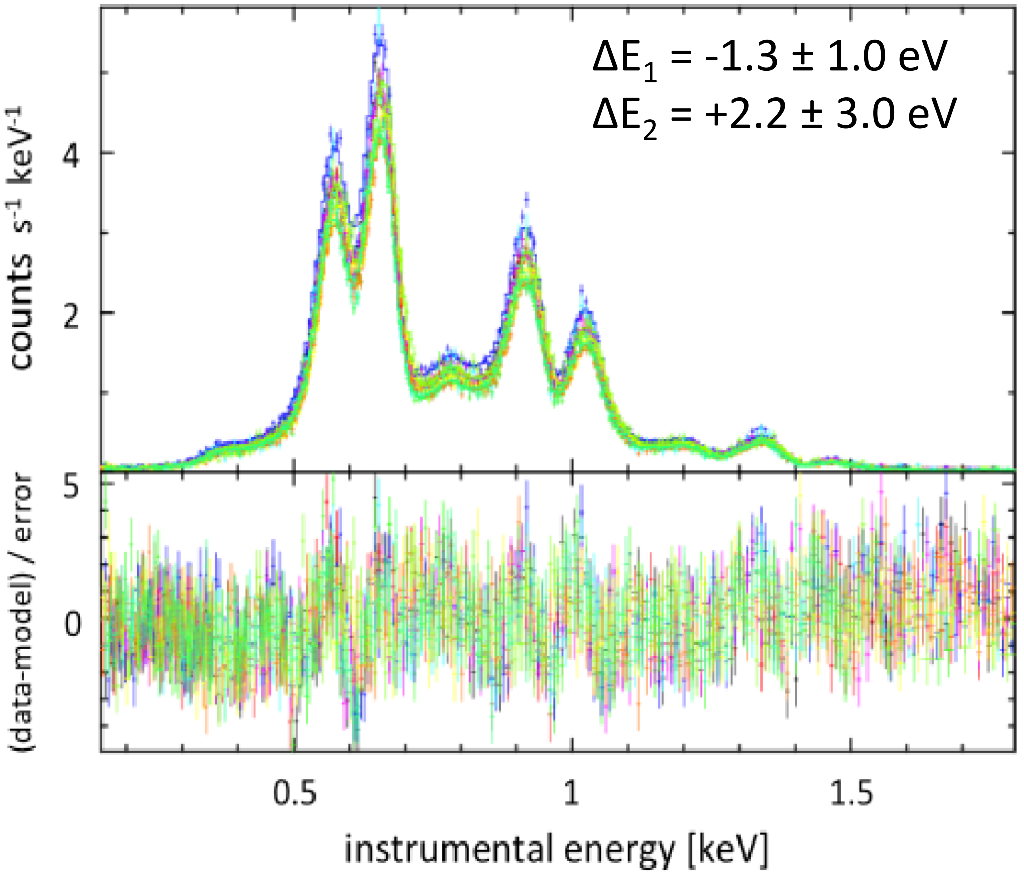


Survey HEW ~30” [0.2-2.3 keV]

Merloni et al. 2024

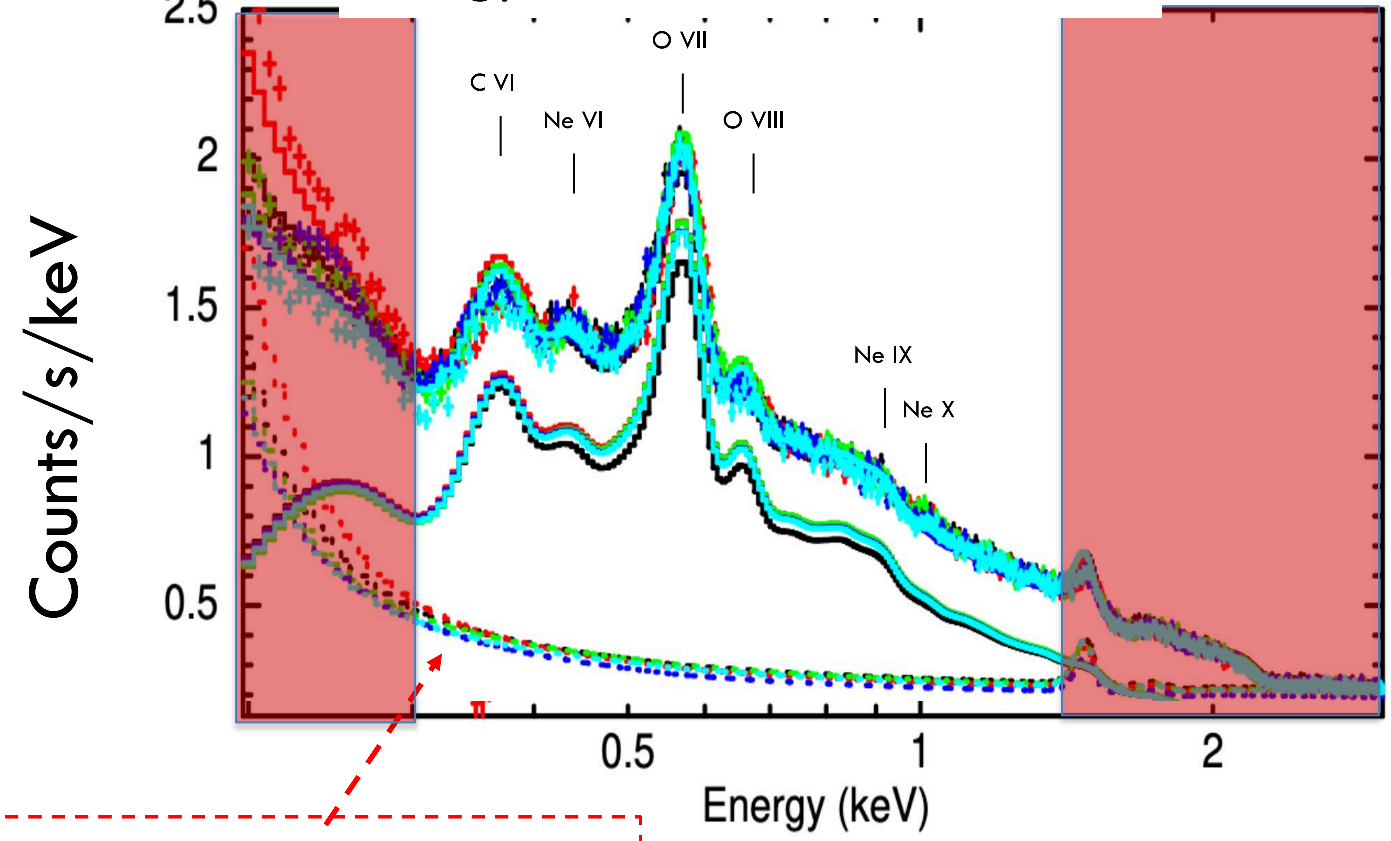
Calibration: Energy scale

eROSITA spectrum of SNR 1E 0102-7219



Merloni et al. 2024

eROSITA spectrum of eFEDS
Energy scale shift factor <3eV



G. Ponti, X. Zheng et al. (2022)

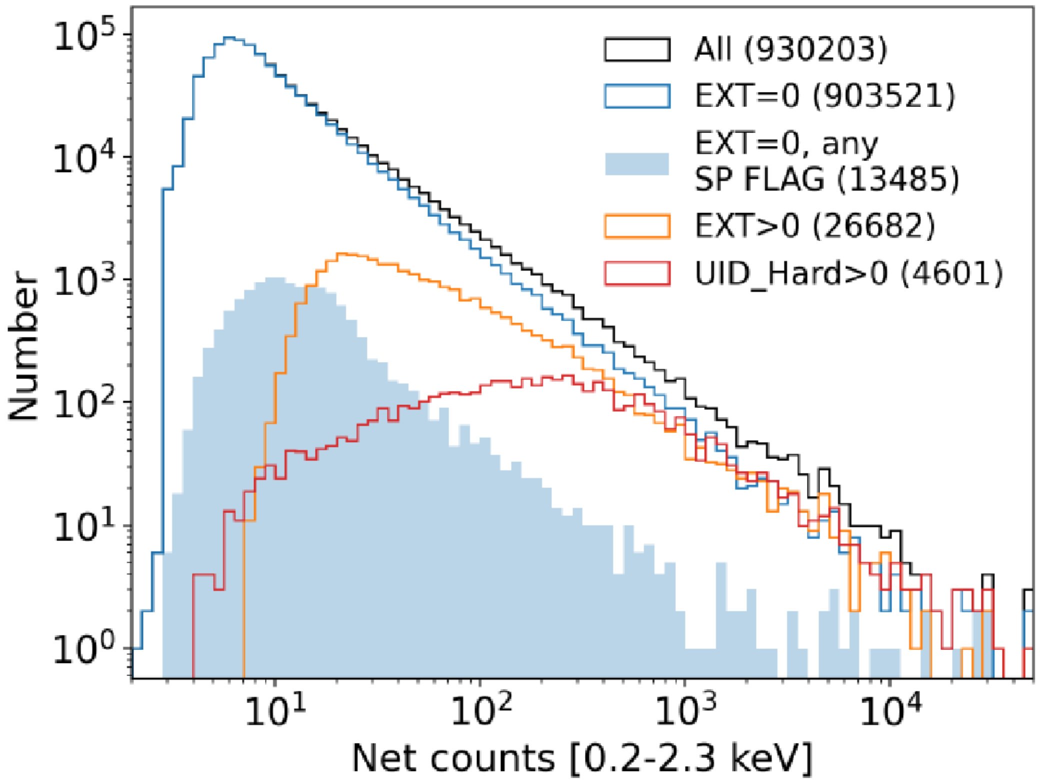
eRASS1 Catalogues

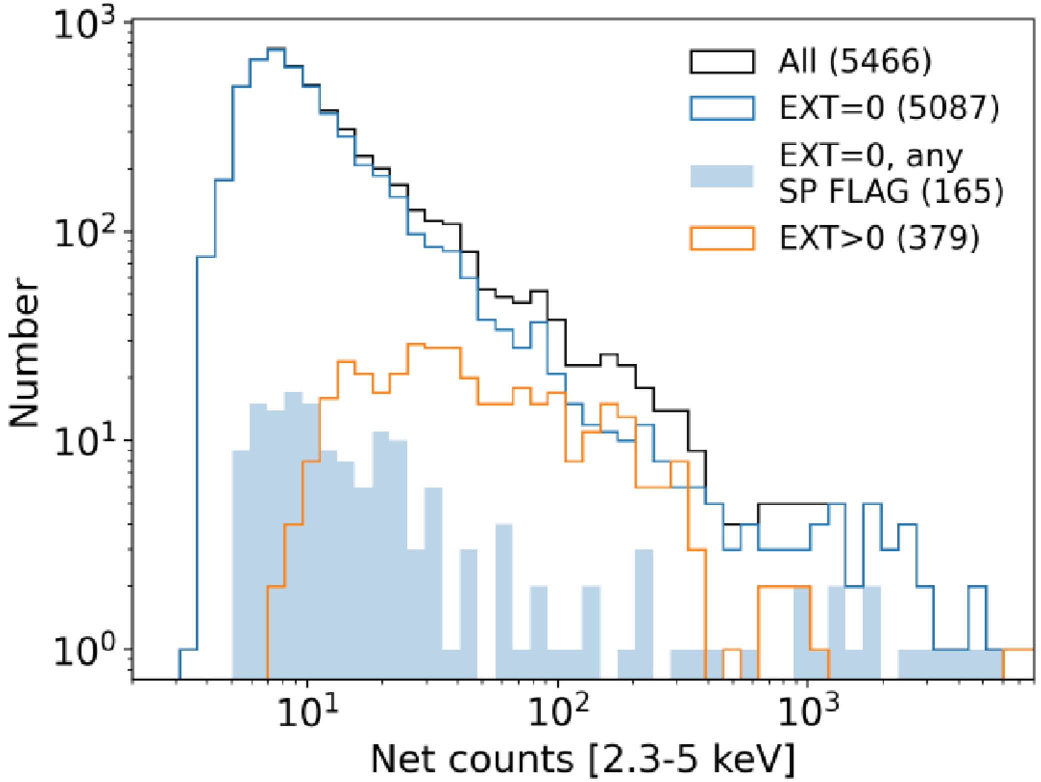
Soft band 0.2-2.3 keV, Point sources: 903k

Soft band 0.2-2.3 keV, extended: 26.6k (of which 12k optically confimred clusters)

Hard band 2.3-5 keV, Point Sources: 5k

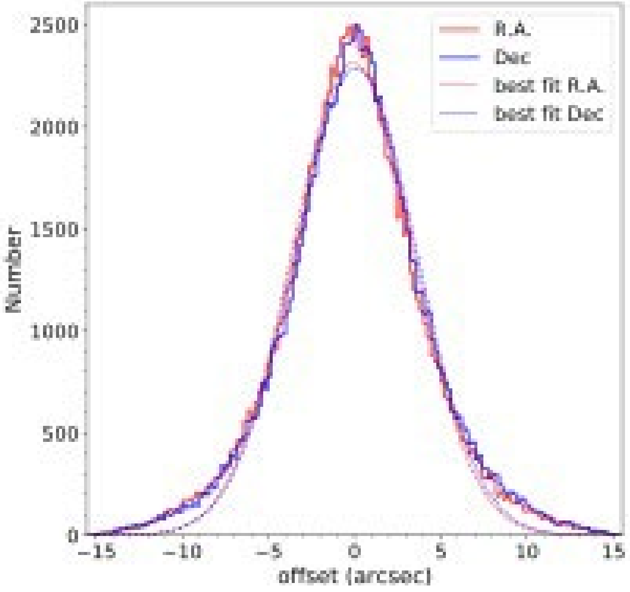
Hard band 2.3-5 keV, Extended: 380

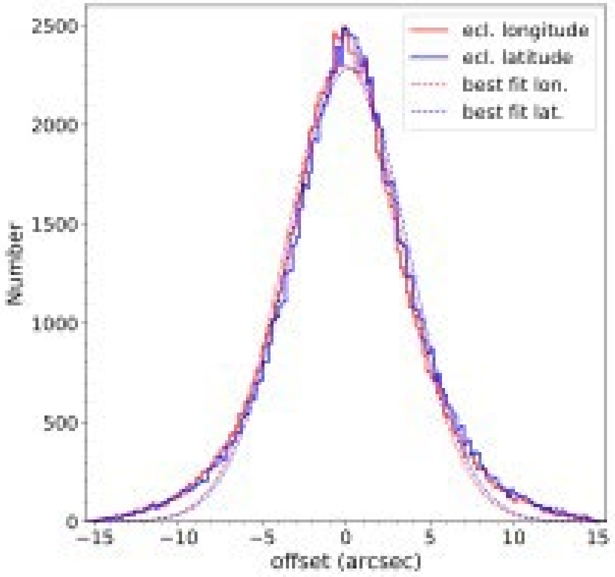




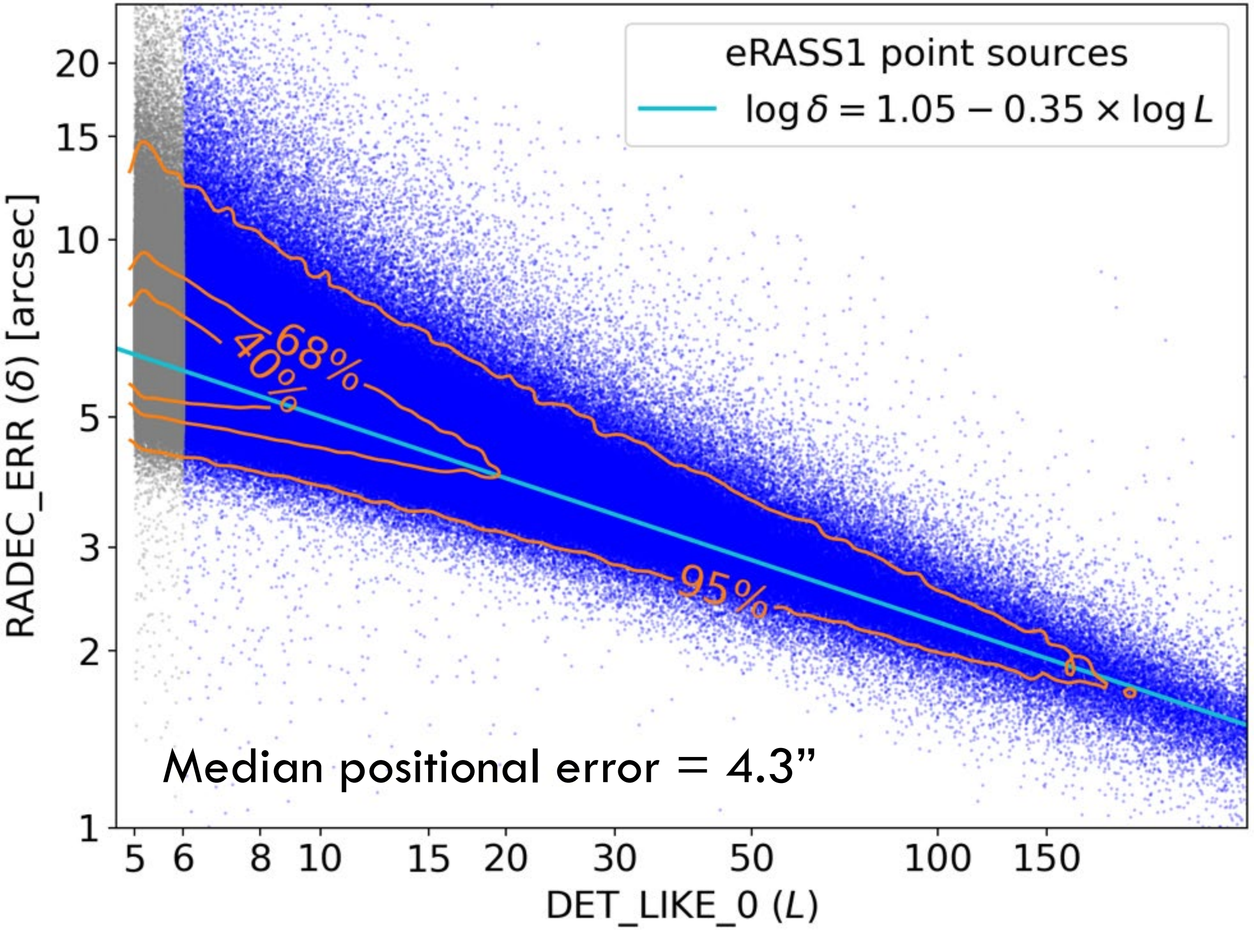
Merloni et al. (2024)

eRASS1 'Main' Catalogue: Astrometry





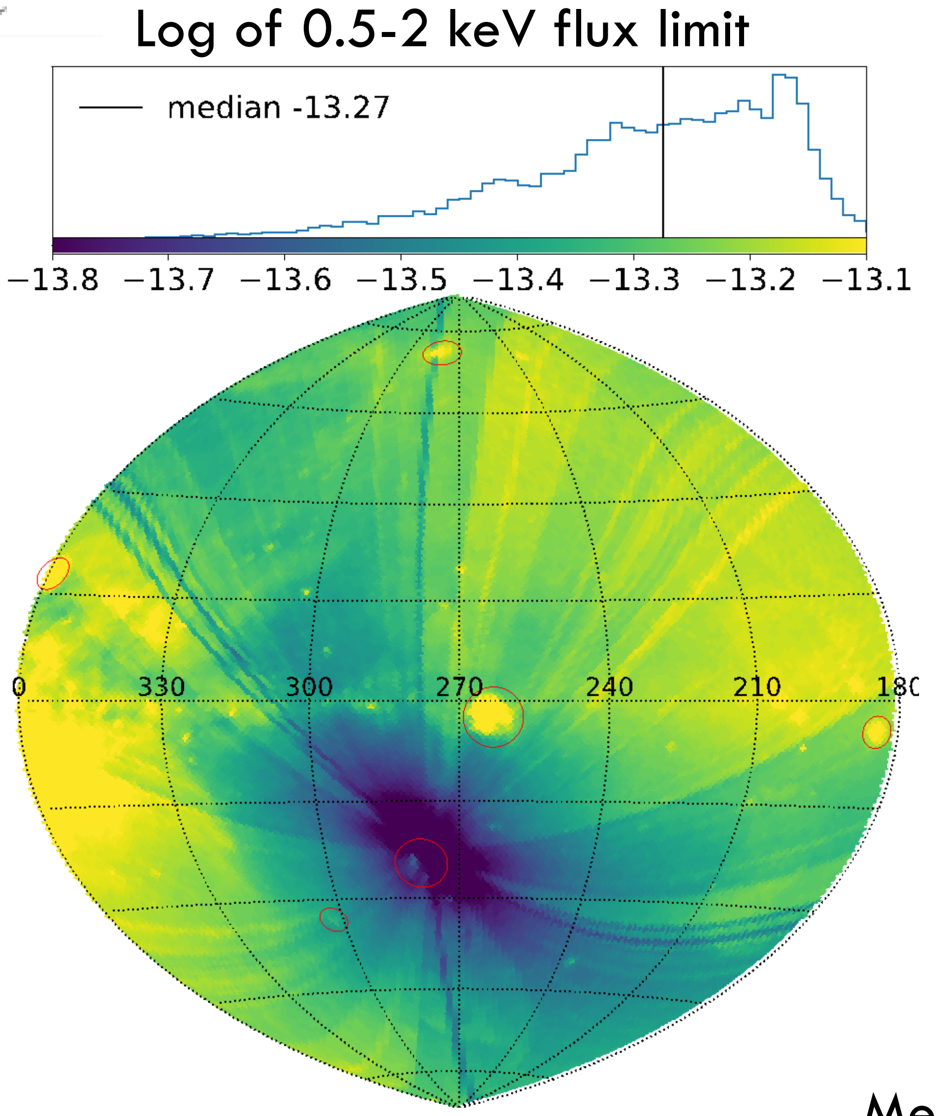
Point sources astrometric accuracy

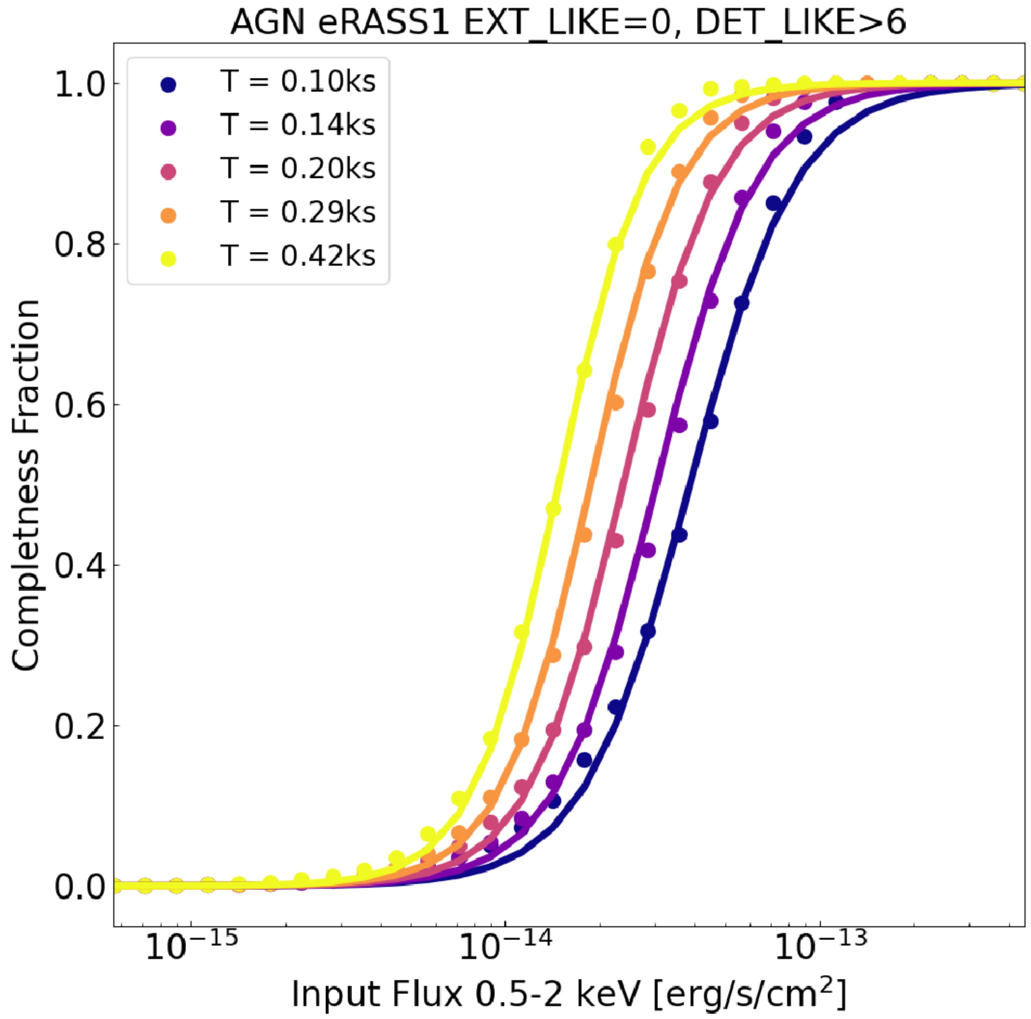


Median positional error = 4.3"

Merloni et al., A&A, in press

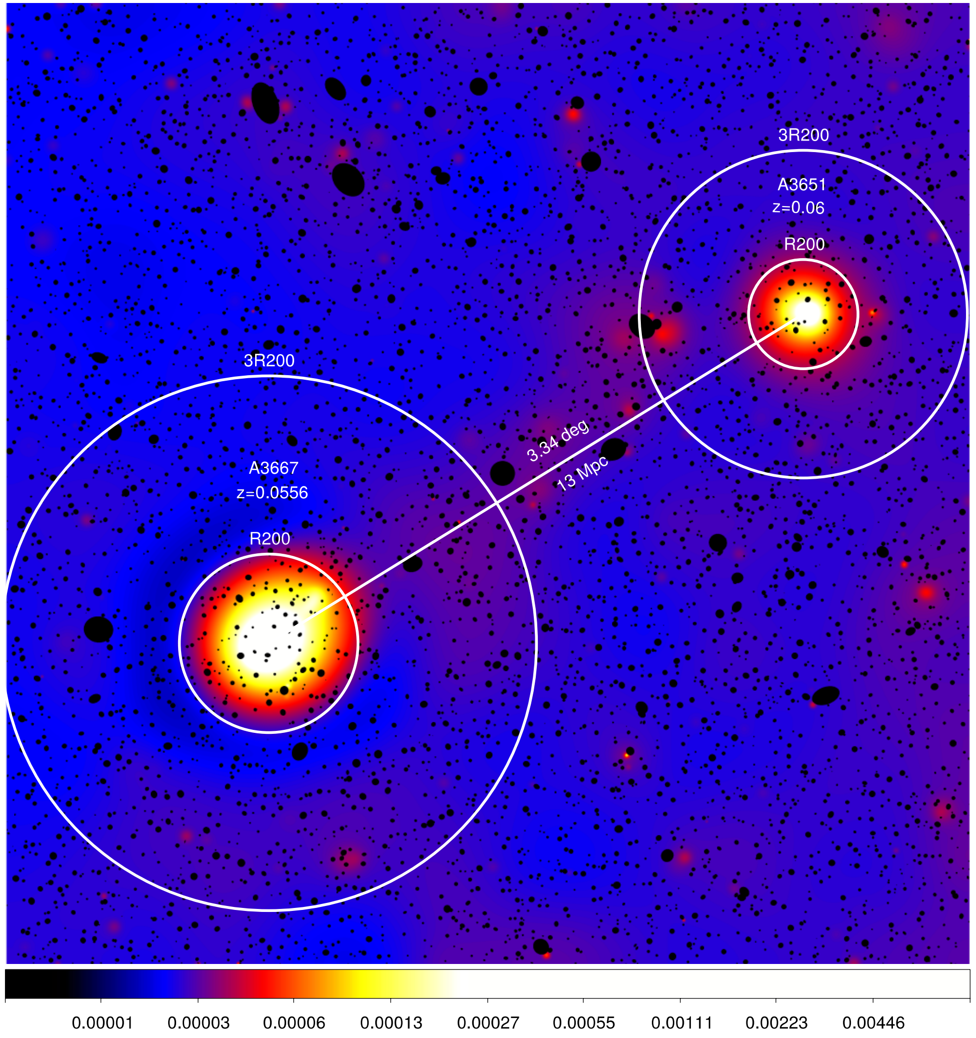
eRASS1 Main Catalogue: flux limit

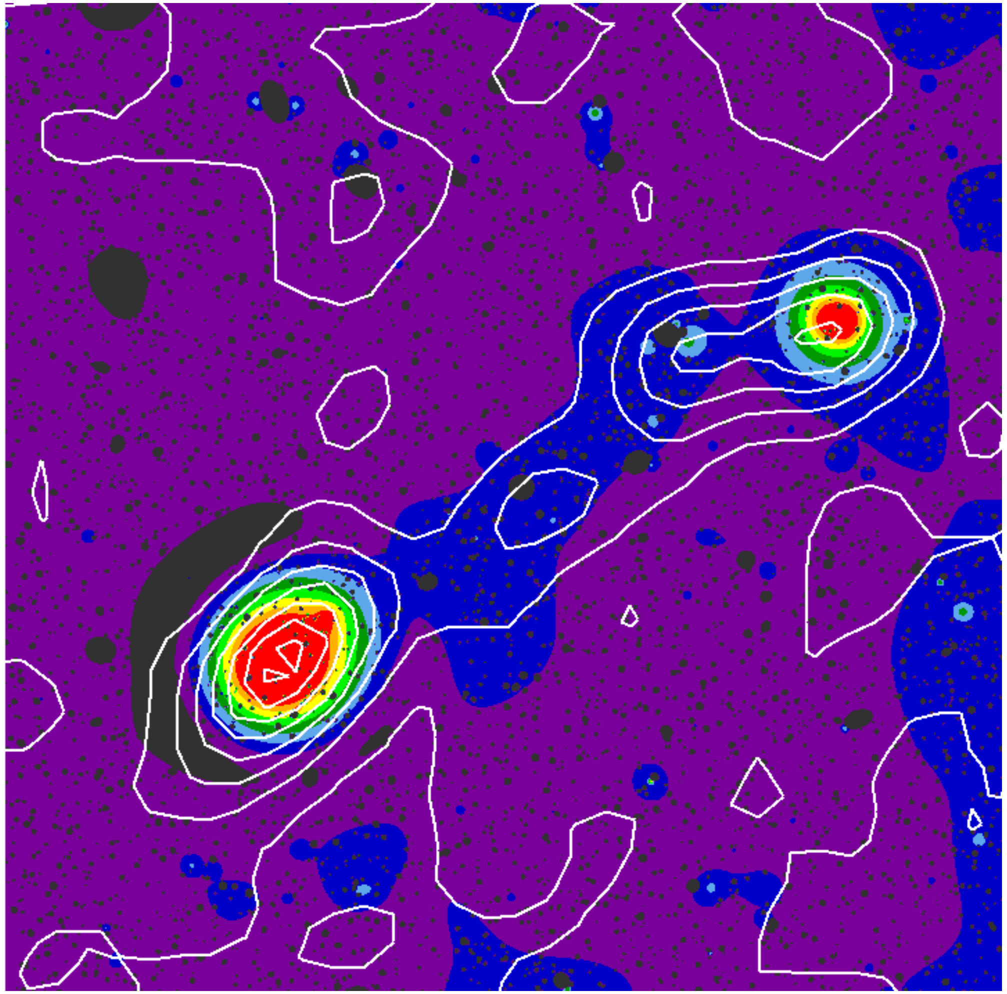




Merloni et al., A&A, in press

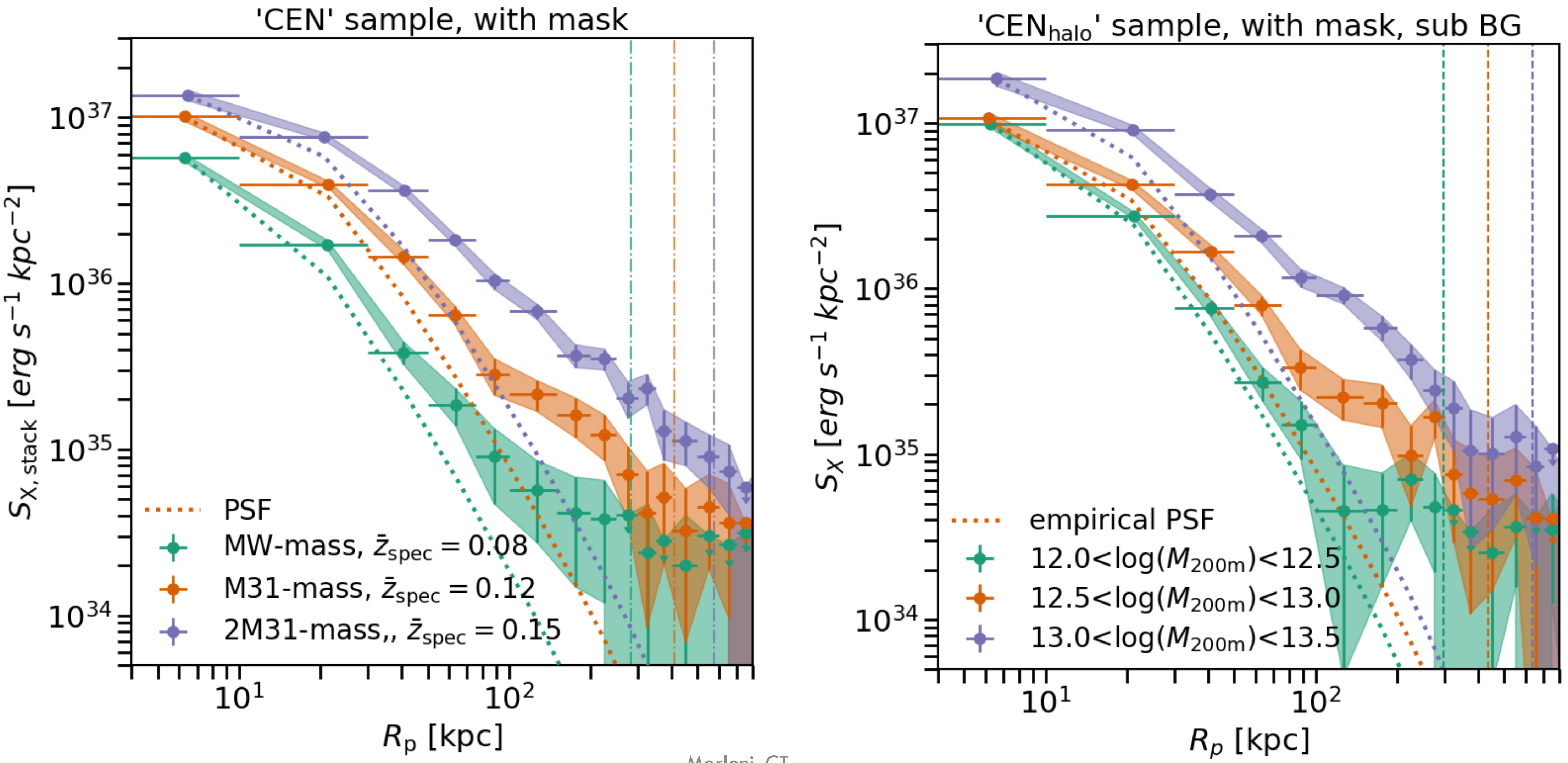
Discovery of a >13 Mpc long X-ray filament between two galaxy clusters beyond three times their virial radii (Dietl et al.)



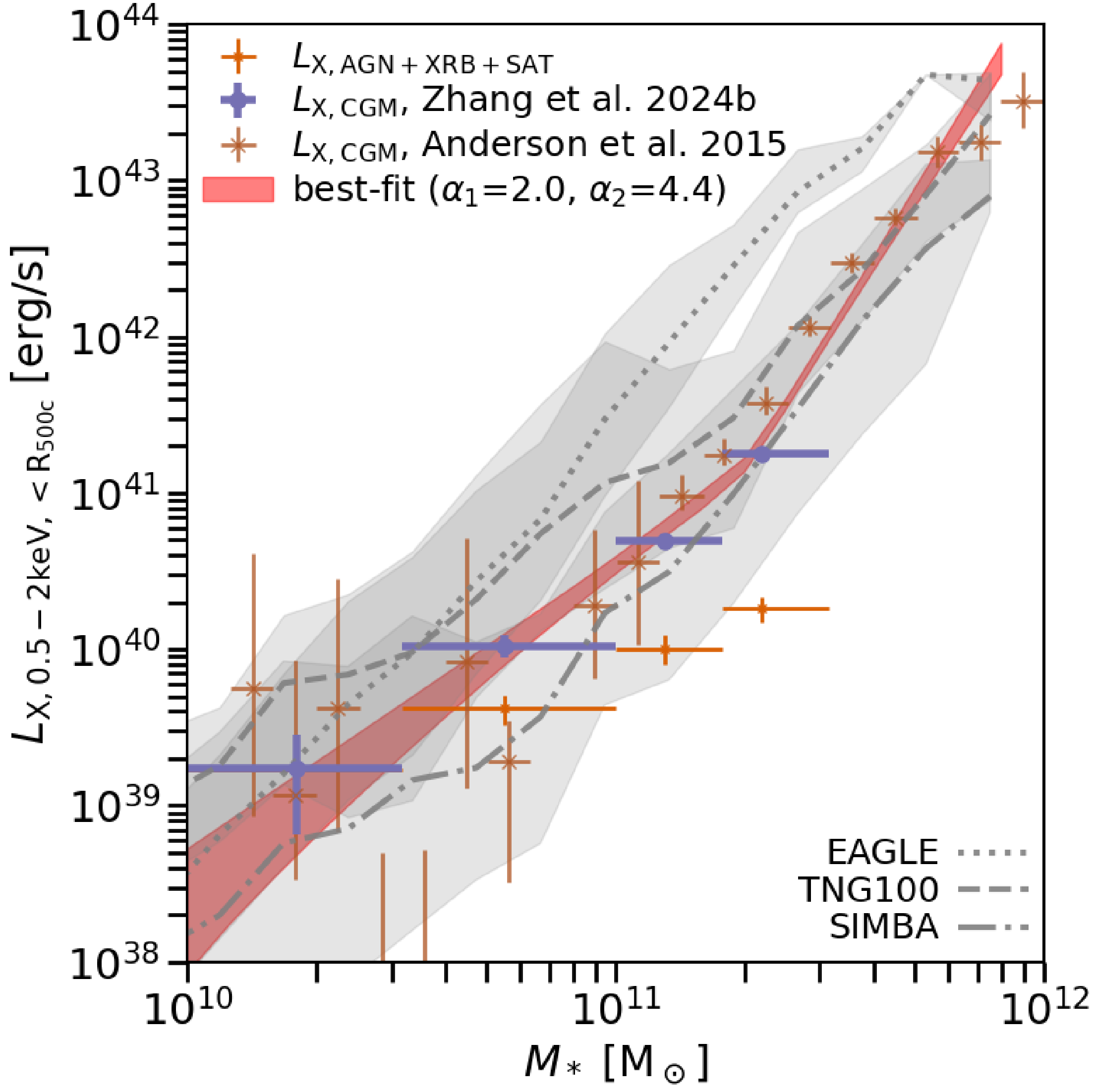


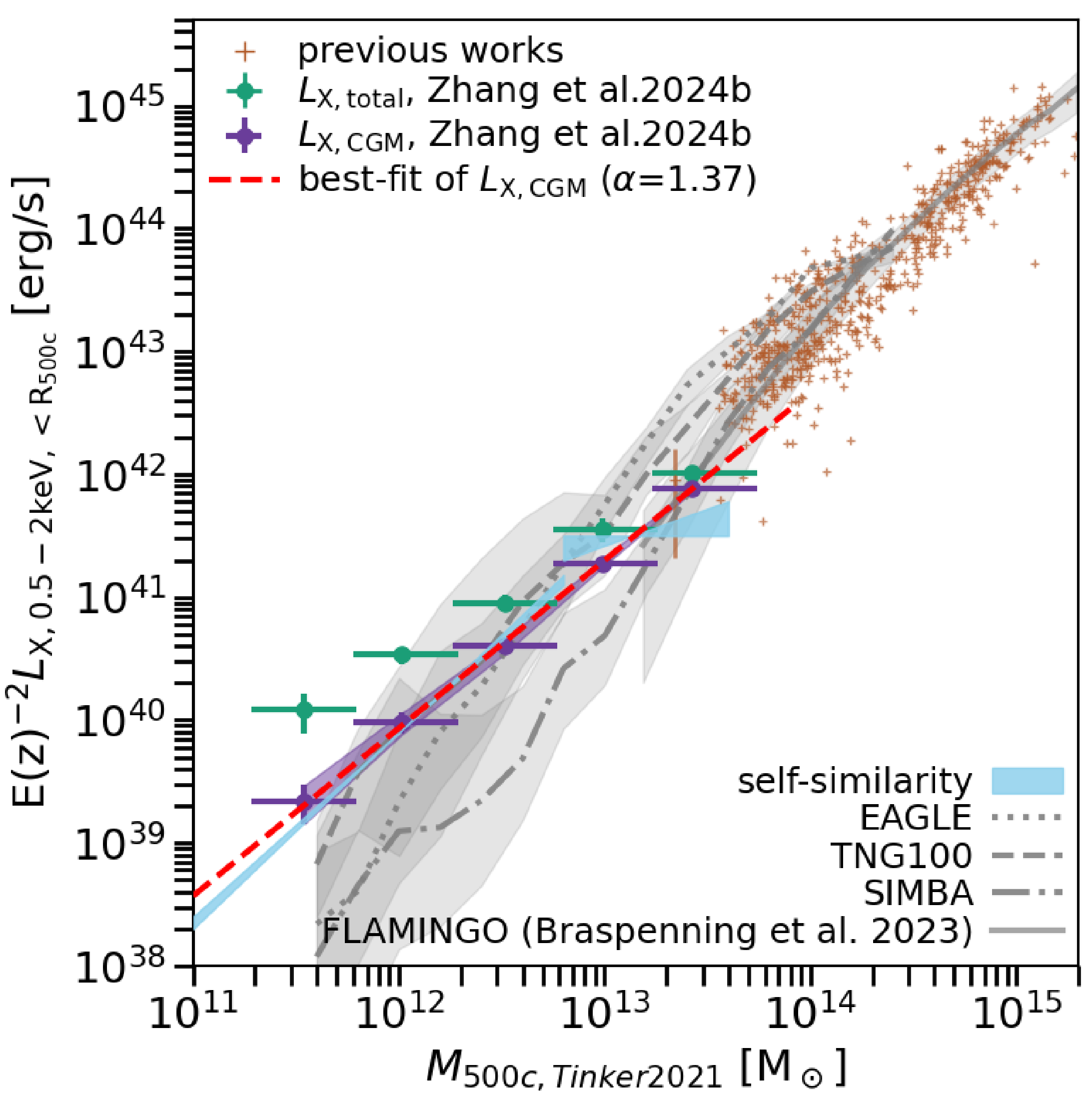
X-ray intensity (wavelt filtered, color) with galaxies overdensity contours (white)

The hot CGM in eRASS1: I. X-ray brightness profiles (Yi et al.)



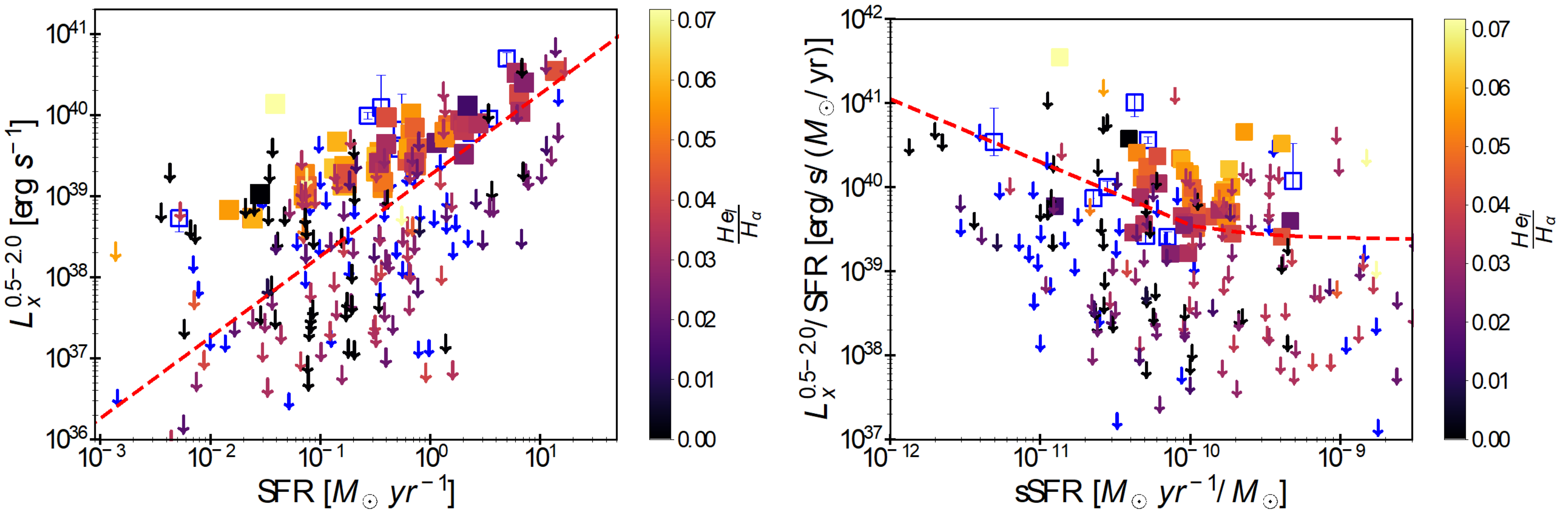
The hot CGM in eRASS1: II. Scaling Relations (Yi et al.)



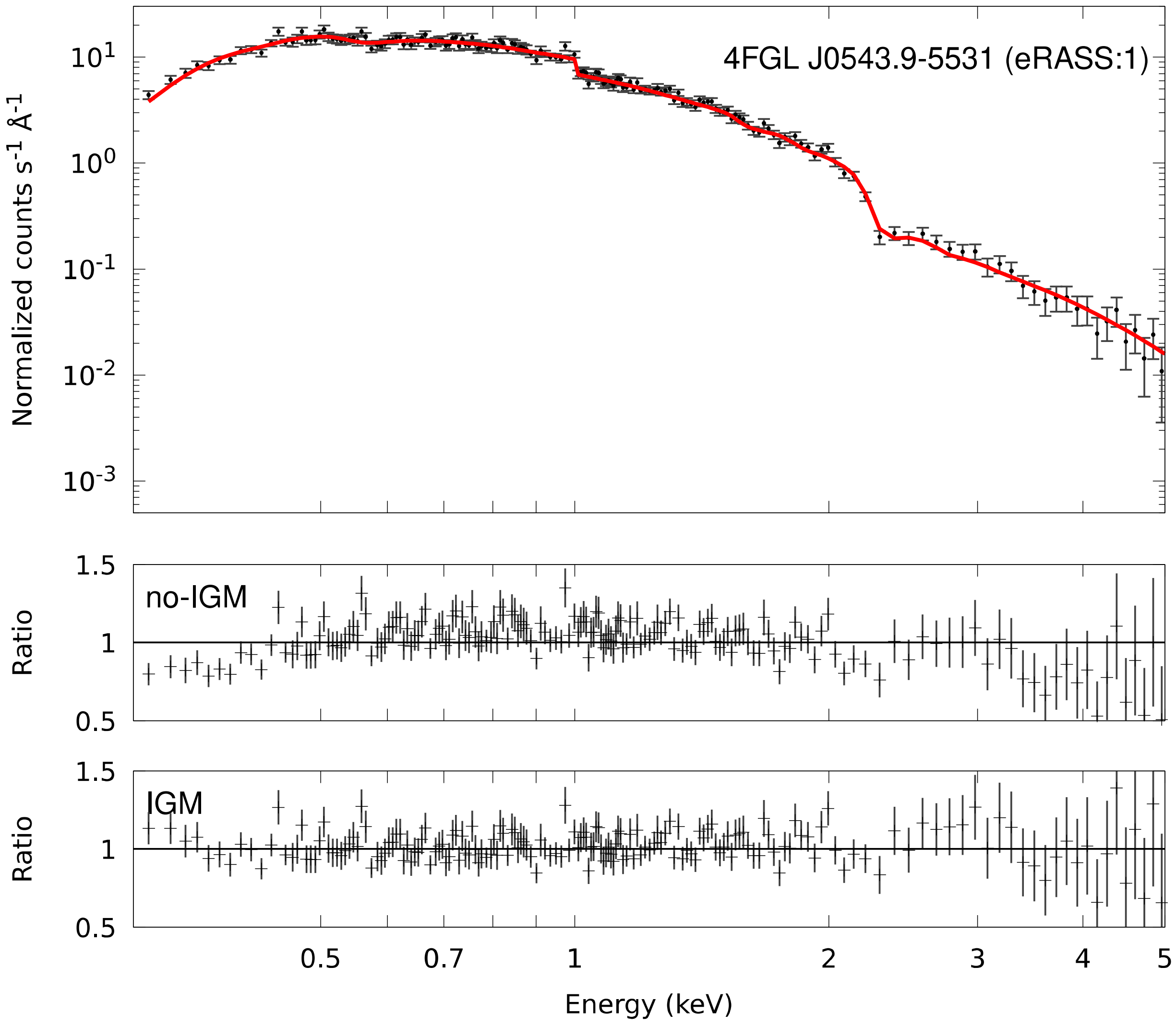


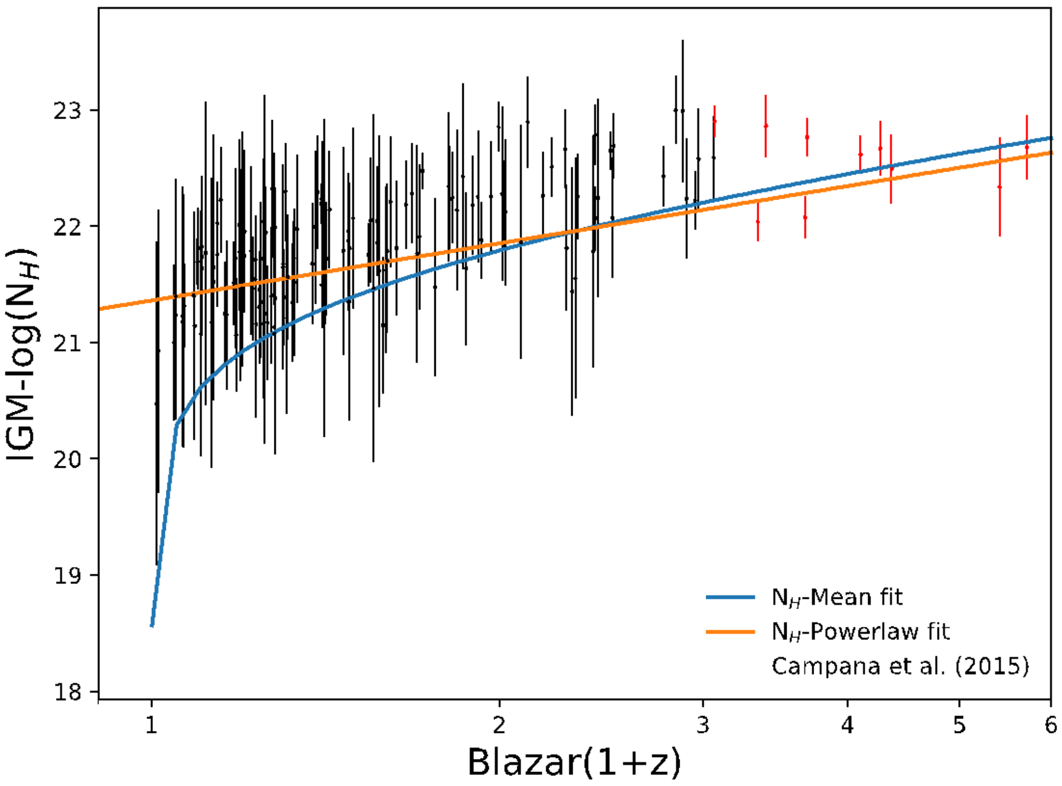
AC

The first all-sky survey of star-forming galaxies with SRG/eROSITA: Scaling relations and populations of X-ray luminous starbursts (Kyritsis et al.)

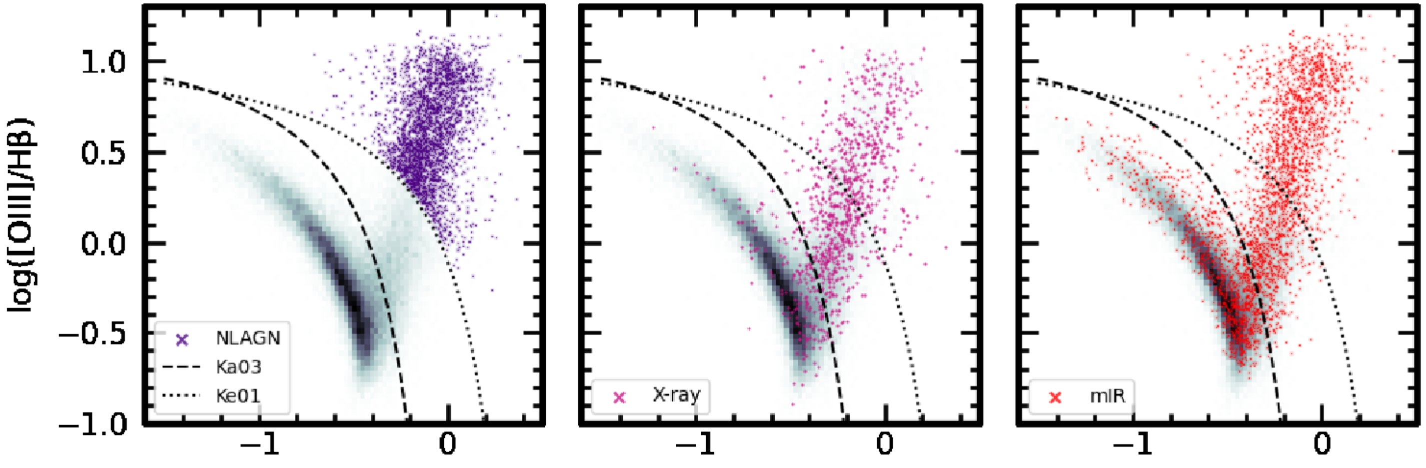


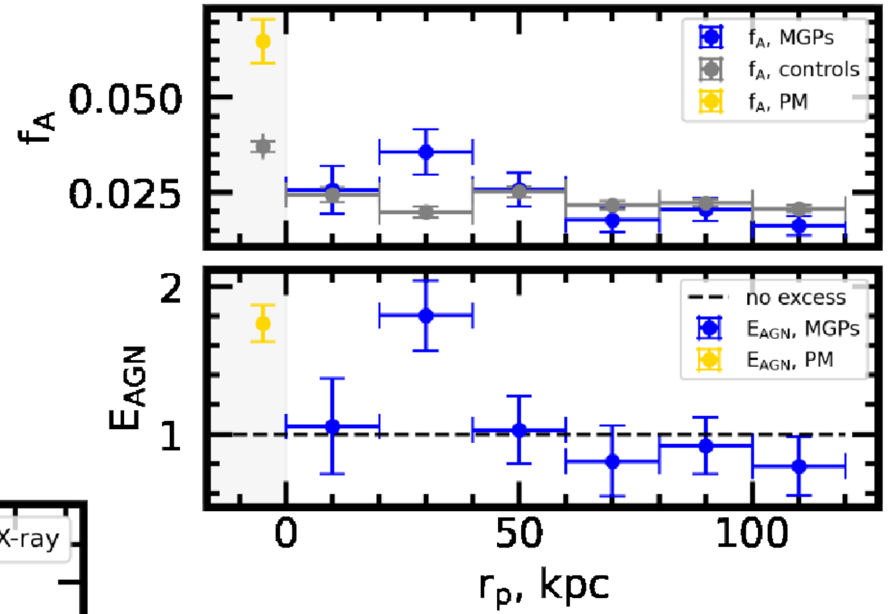
Probing the physical properties of the IGM using SRG/eROSITA spectra from blazars (Gatuzz et al.)

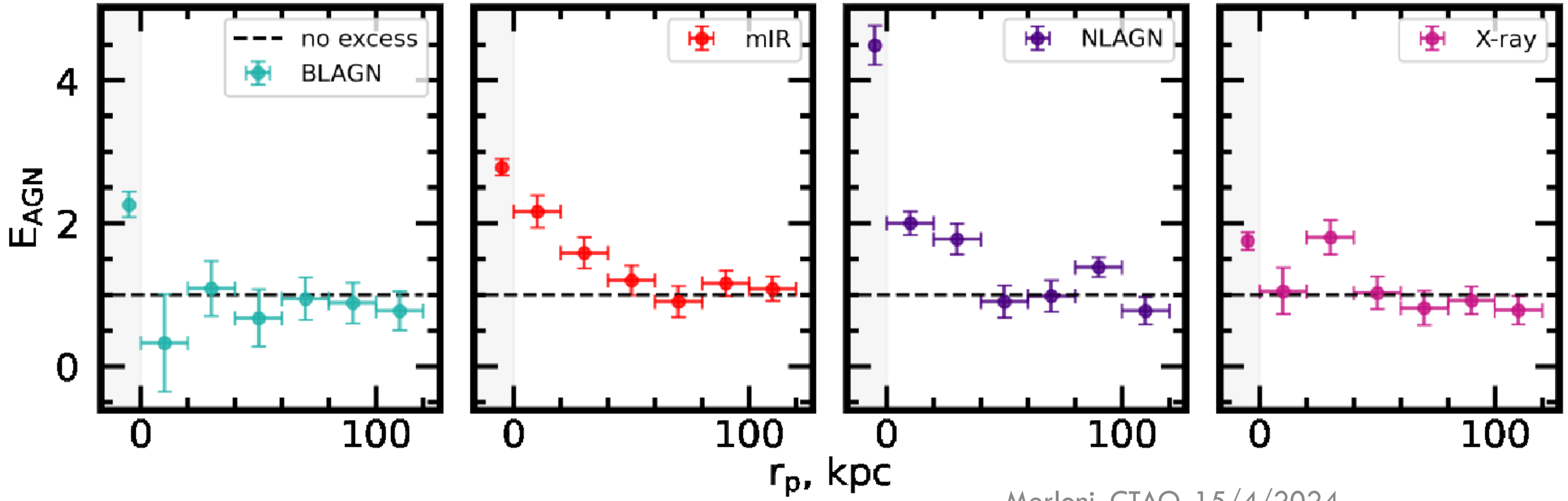




X-ray AGNs with SRG/eROSITA: Multi-wavelength observations reveal merger triggering and post-coalescence circumnuclear blowout (Bickley et al.)







First Study of the SNR Population in the LMC with eROSITA (Zangrandi et al.)