eROSITA on SRG

Peter Predehl

AXRO Prague 2019

13.07.2019, 17:31

credit: Roscosmos

Спектр–Рентген-Гамма

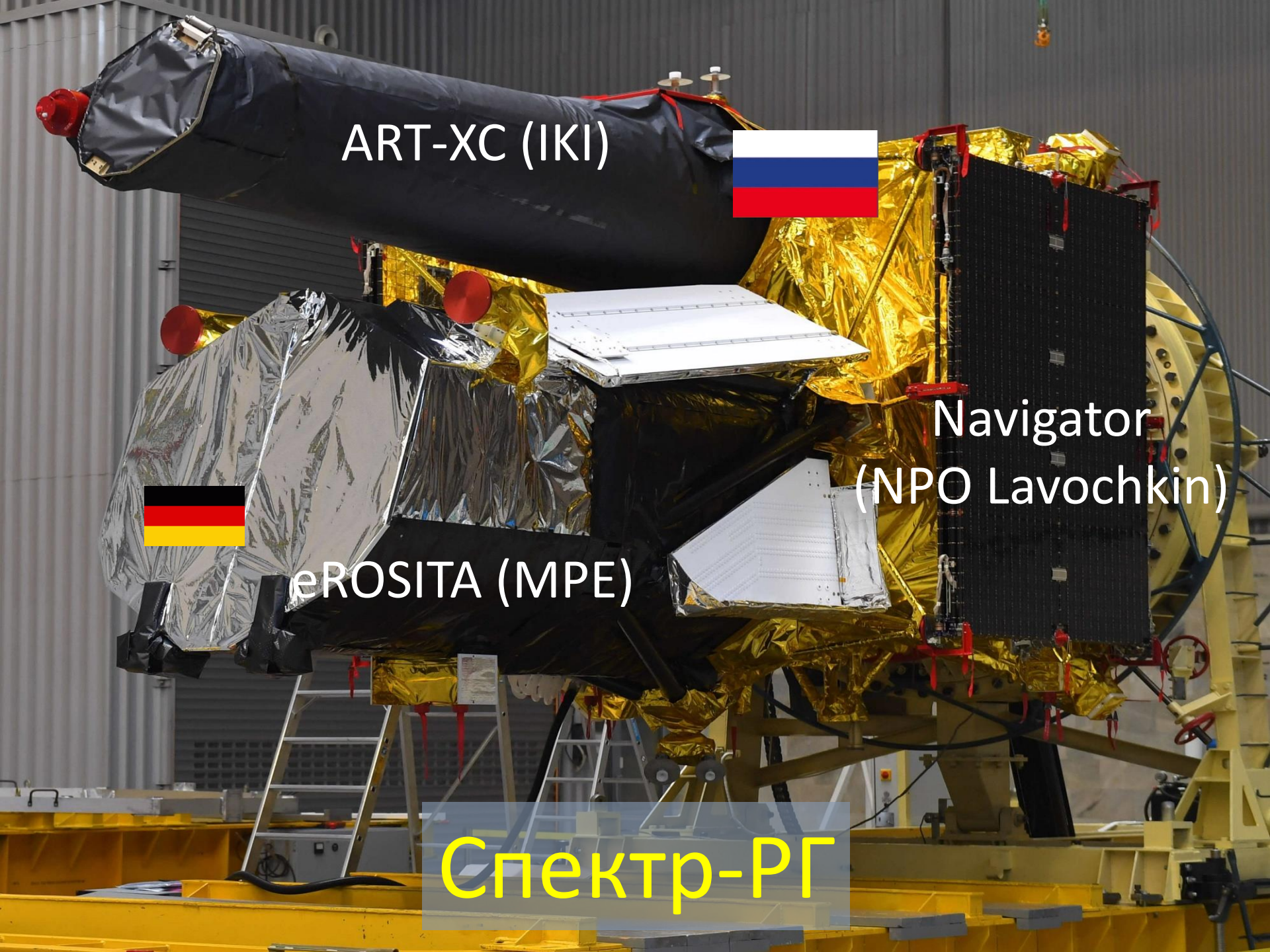
Спектр–РГ

Spectrum-Roentgen-Gamma

SRG

ART-XC — Астрономический рентгеновский телескоп концентратор рентгеновских лучей

eROSITA — **E**xtenden **RO**entgen **S**urvey with an **I**maging **T**elescope **A**rray


ART-XC (IKI)
Navigator
(NPO Lavochkin)
eROSITA (MPE)
Спектр-РГ

eROSITA Collaboration

Core Institutes (DLR funding):
MPE, Garching
Universität Erlangen-Nürnberg
IAAT (Universität Tübingen)
SB (Universität Hamburg)
Leibniz-Institut für Astrophysik Potsdam

Associated Institutes:
USM (LMU München)
AIFA (Universität Bonn)

Russian Partner Institute:
IKI, Moscow

Industry:

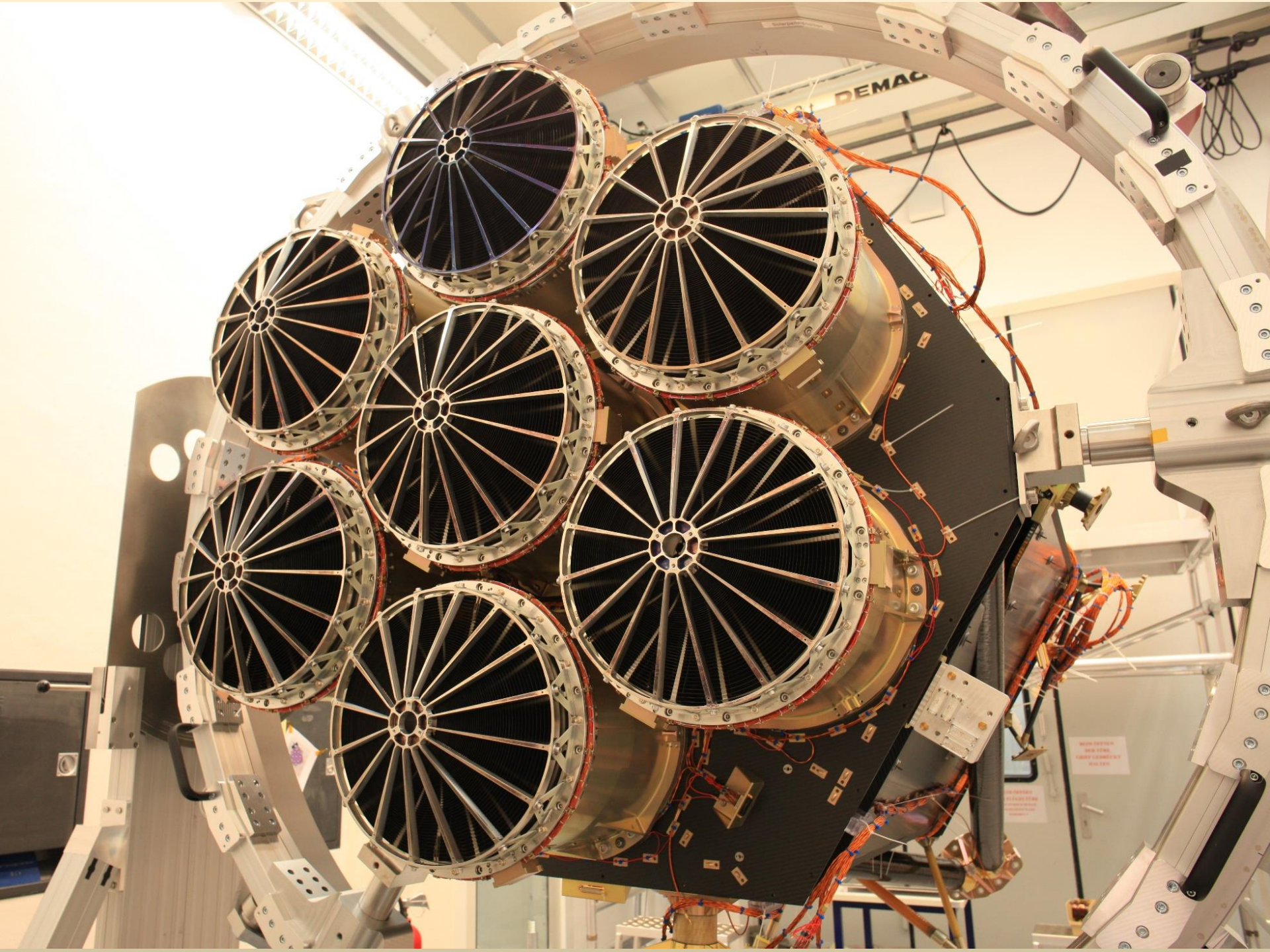
Media Lario/I	Mirrors, Mandrels
Tecnotron/D	PCBs
Kayser-Threde/D	Mirror Structures
Carl Zeiss/D	ABRIXAS-Mandrels
Invent/D	Telescope Structure
pnSensor/D	CCDs
IberEspacio/E	Heatpipes
RUAG/A	Mechanism
HPS/D,P	MLI

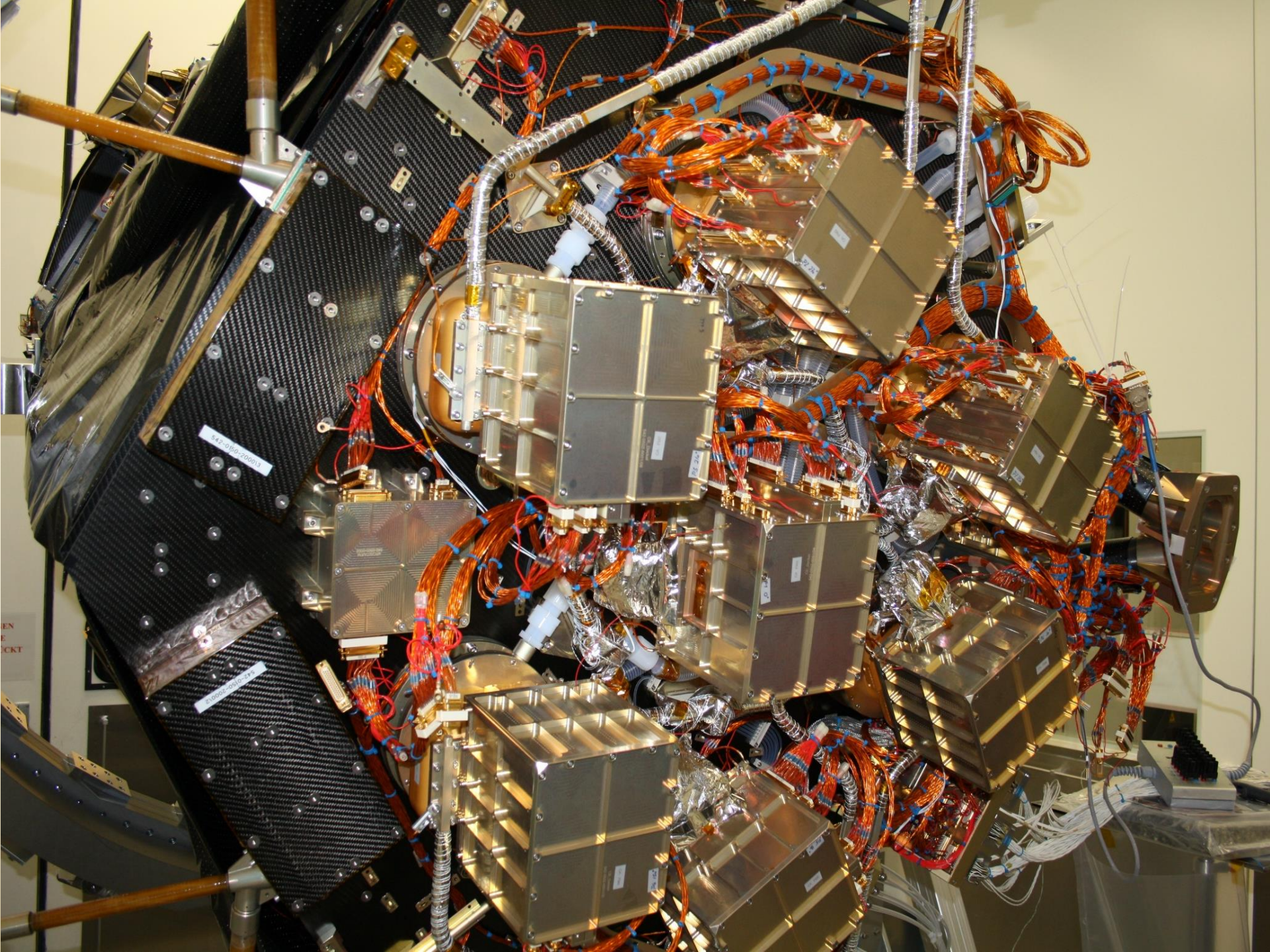
+ many small companies

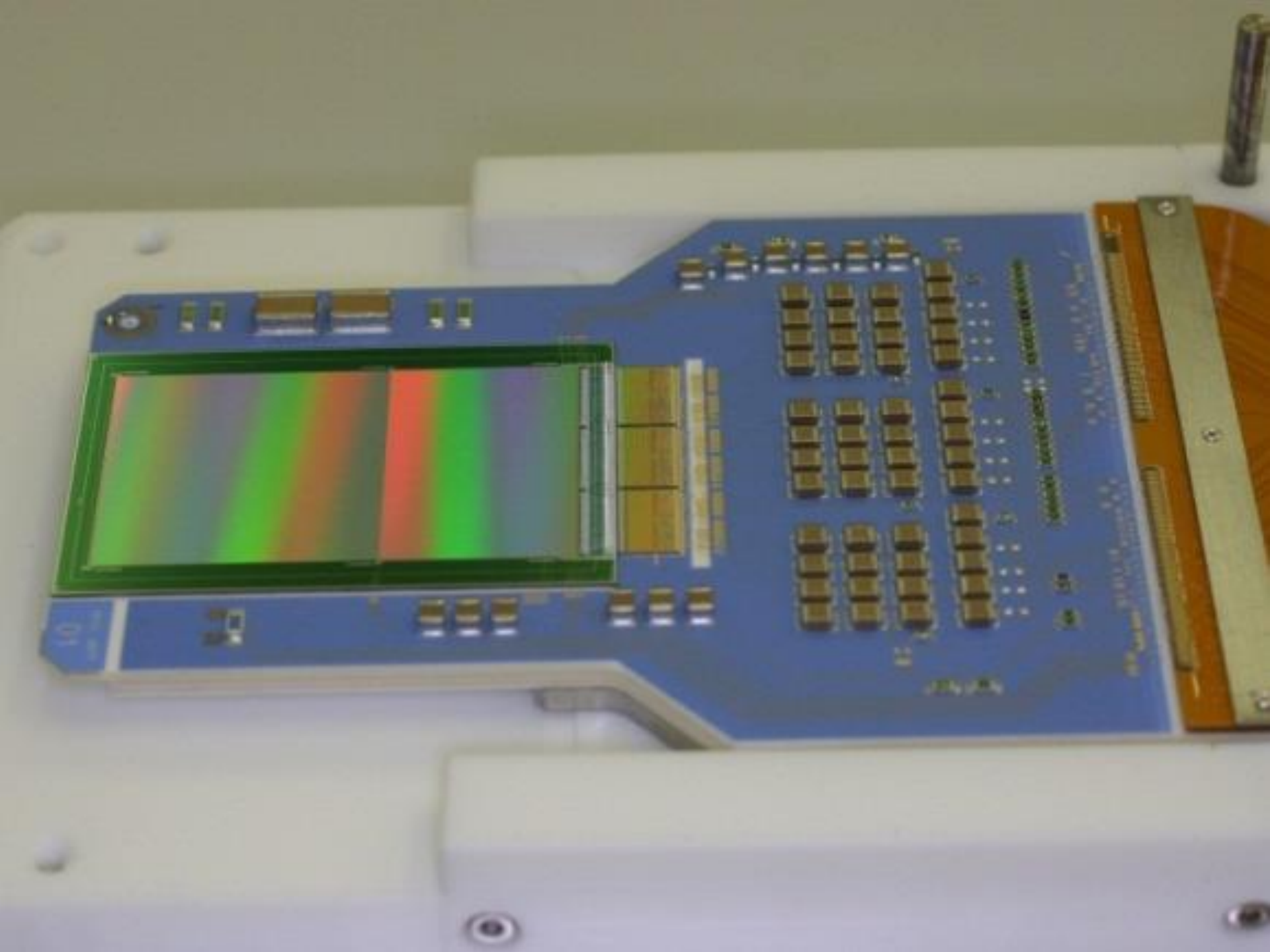
NPOL – Lavochkin Association

MPE: Scientific Lead Institute (PI), Project Managment
Instrument Design, Manufacturing, Integration & Test
Data Handling & Processing, Archive etc.


IABG
IABG
nittylift.com
IABG







eROSITA Fact Sheet

Instrument

Size	1,9m Ø x 3.5m
Weight	810kg
Power	522W
Data volume	600MB/day
lifetime	> 7 years
Launcher	PROTON-M/DM-03
Launch	July 13, 2019
Mission	Orbit around L2

7 Mirror Assemblies

Wolter-I + X-ray Baffle + Electr. Div.

Diameter of outer shell	358mm
Number of shells	54
focal length	1600mm
PSF/HEW on axis (1.5keV)	16 arcsec
HEW average FoV	26 arcsec
Effective Area (1.5keV)	350 cm^2

7 Camera Assemblies

pnCCD + Filterwheel + E-Box

3 x 3 cm^2, pixelsize 75µm x 75µm

Field of View	1.1° Ø
Time Resolution	50msec
Energy Resolution (1keV)	~ 70eV
Quantum Efficiency (1keV)	~ 95%

Performance

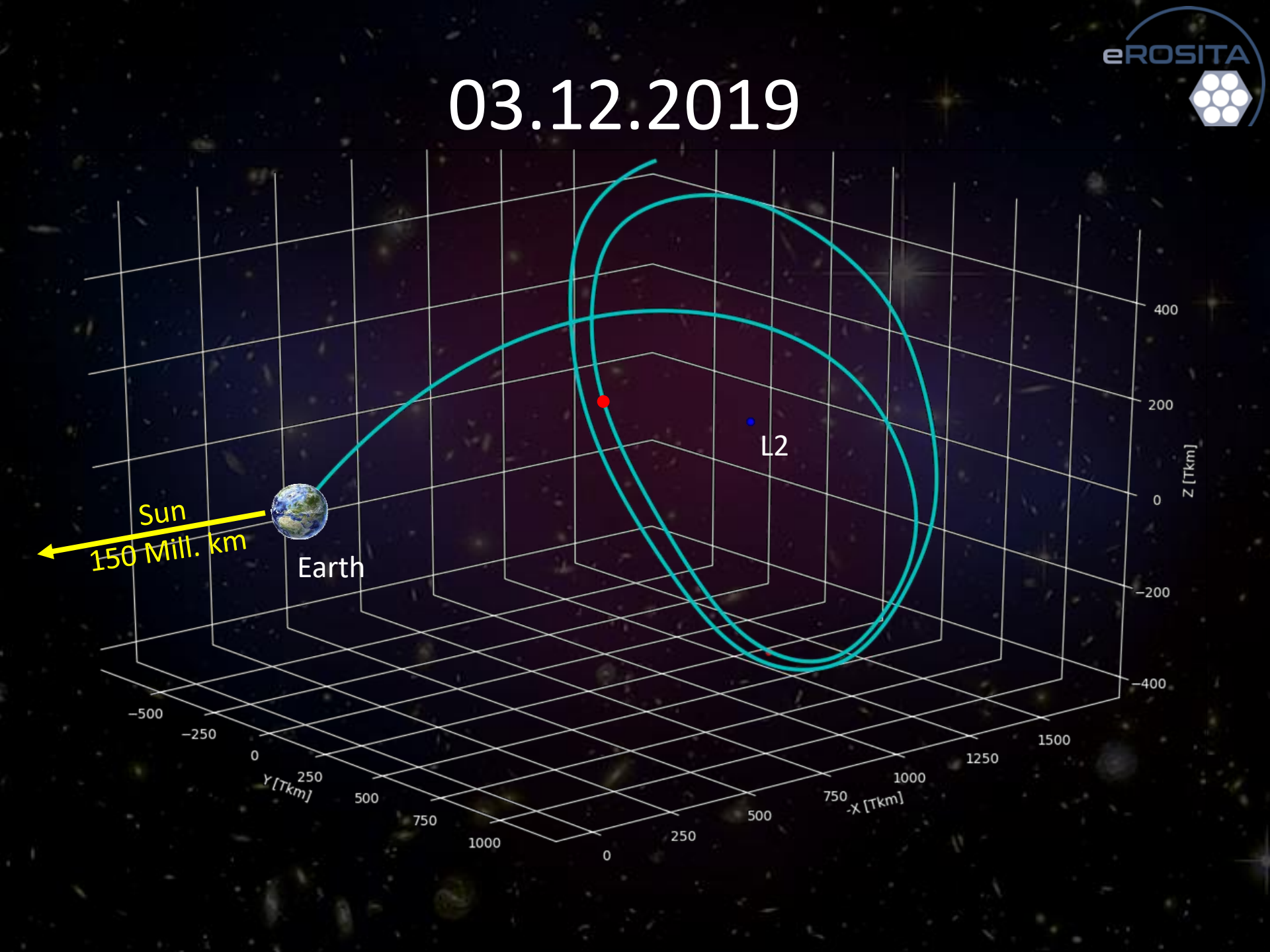
Energy Range	0.3-7keV
Point Source Sensitivity	1.2E-14
P.S. Sensitivity at poles	2.9E-15
Extended Source Sens	3.4E-14
ES. Sensitivity at poles	1.0E-14

eROSITA_DE

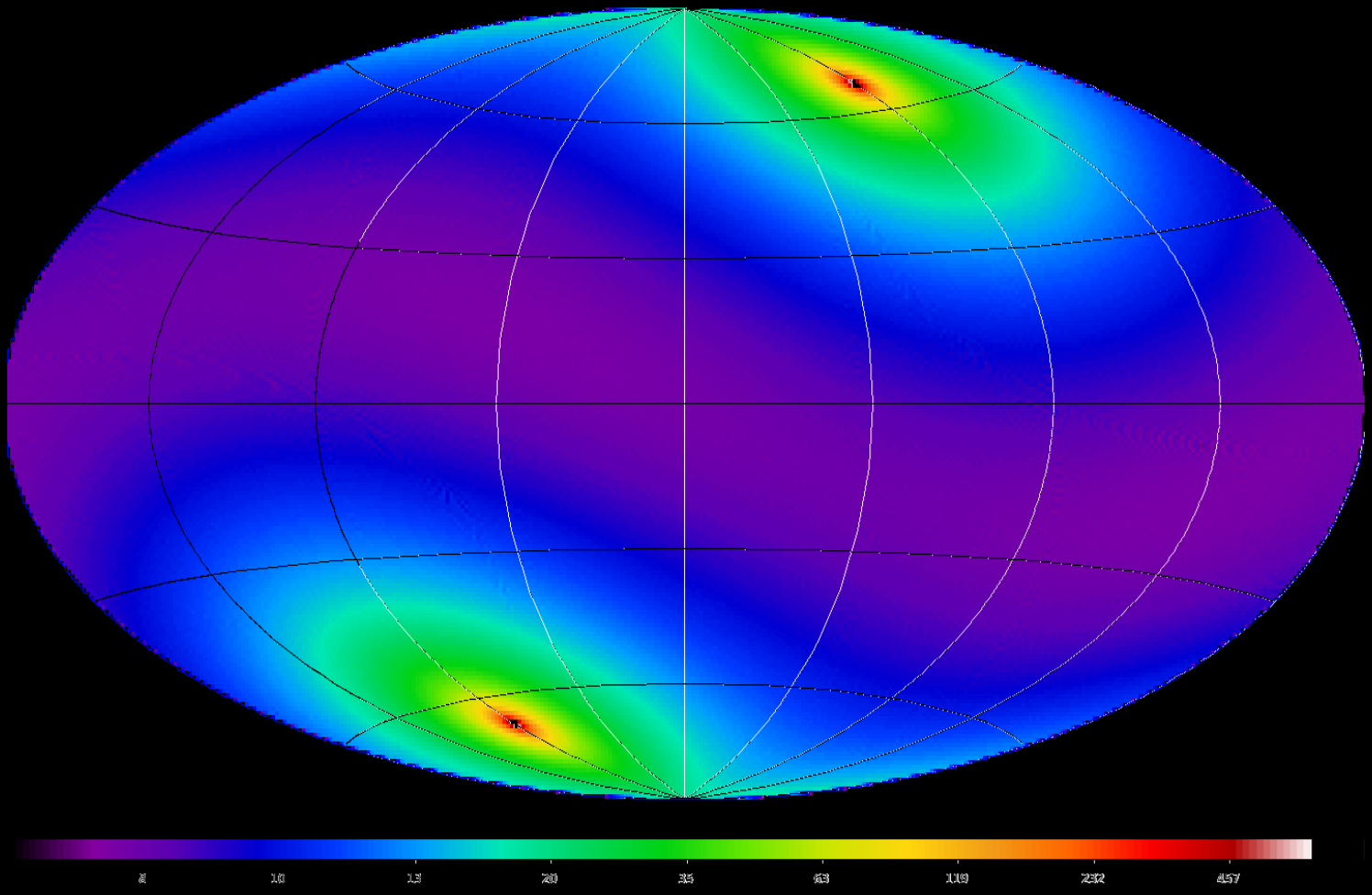
12 working Groups, 151 Members

+ External Collaborators

03.12.2019

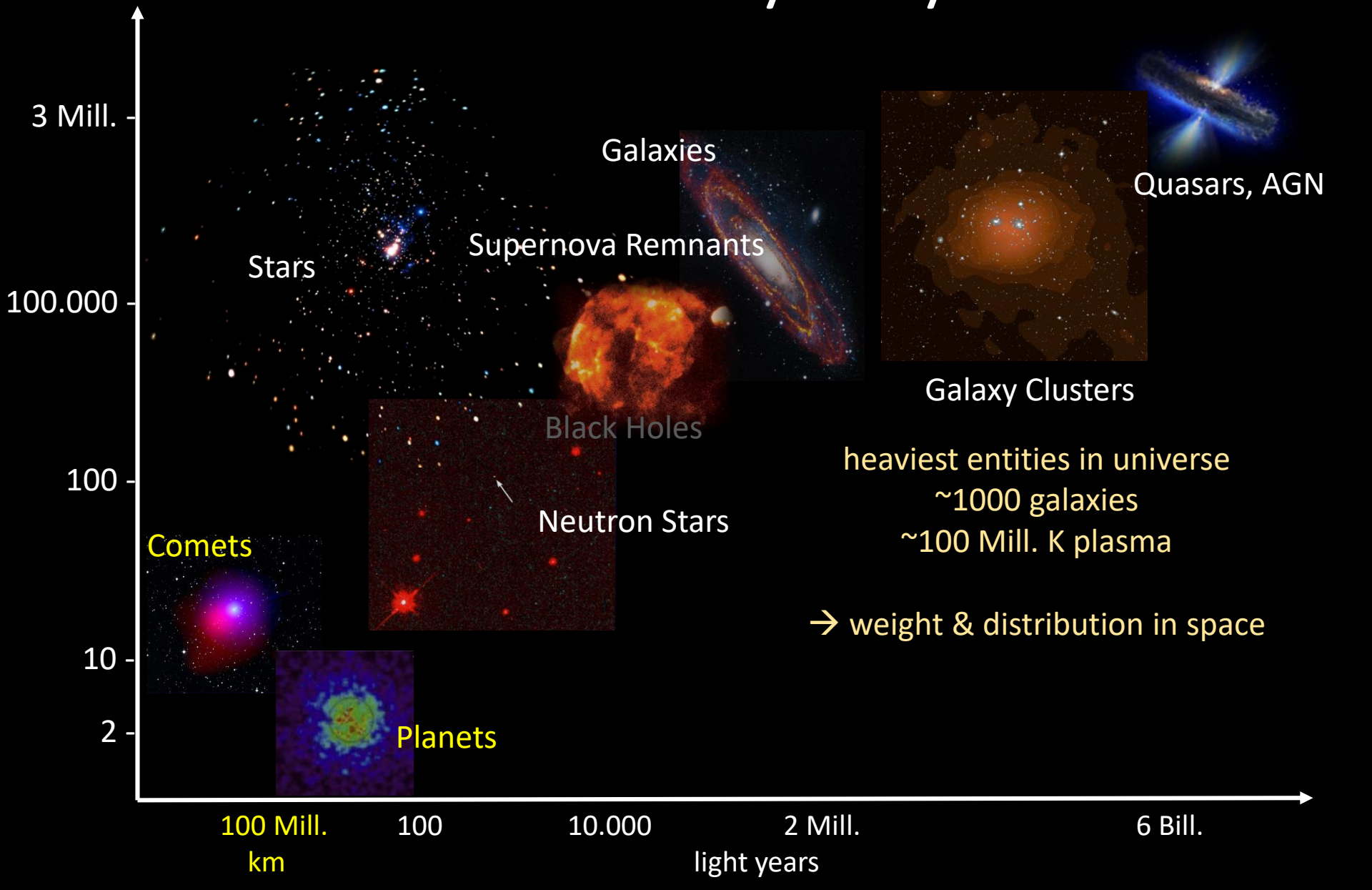

eROSITA
Sun
150 Mill. km
Earth
L2
400
200
0
−200
−400
Z [Tkm]
−500
−250
0
250
500
750
1000
Y [Tkm]
0
250
500
750
1000
1250
1500
-X [Tkm]

eROSITA Cadence Map



# of daily eROSITA visits over 4yrs

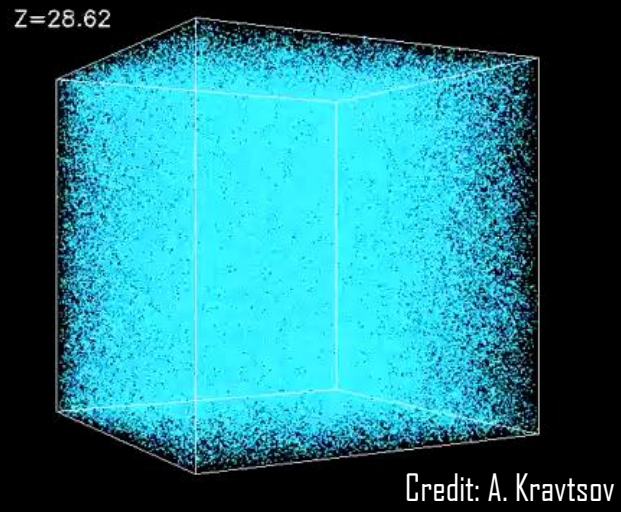
The X-ray Sky


3 Mill.
100.000
100
10
2
Stars
Galaxies
Supernova Remnants
Black Holes
Neutron Stars
Comets
Planets
Quasars, AGN
Galaxy Clusters
heaviest entities in universe
~1000 galaxies
~100 Mill. K plasma
→ weight & distribution in space
100 Mill. km
100
10.000
2 Mill.
6 Bill.
light years

eROSITA and the Dark Energy

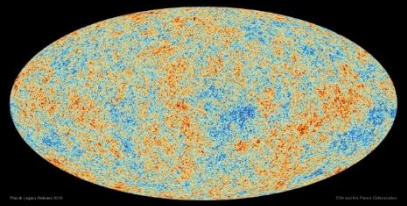
and also Dark Matter

today

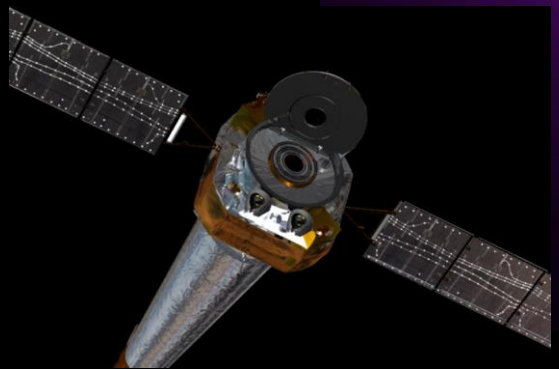


Credit: A. Kravtsov

structure formation
expansion of the universe



13.8 billion years ago



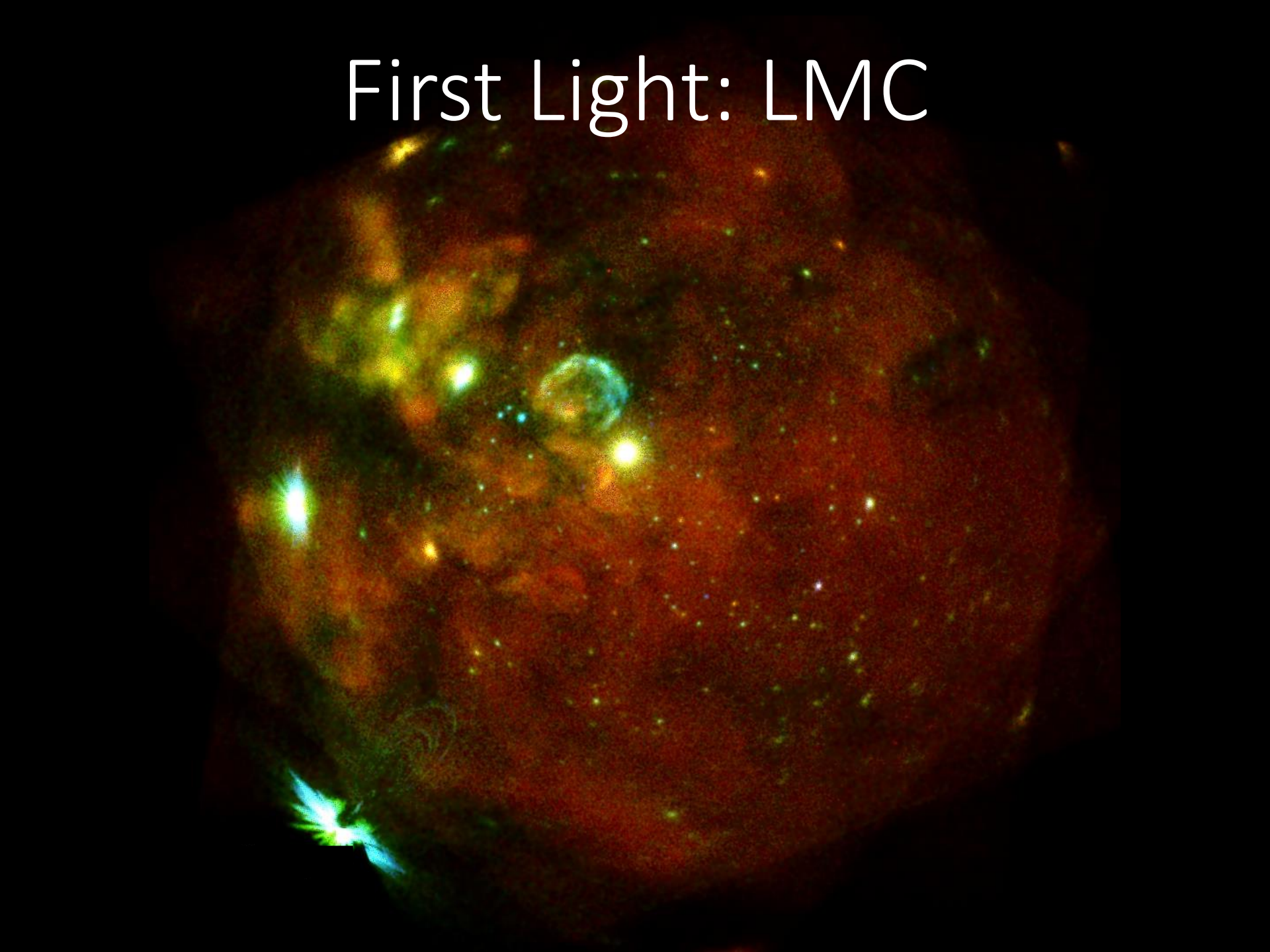
A1689, Chandra

Credit: NASA/CXC

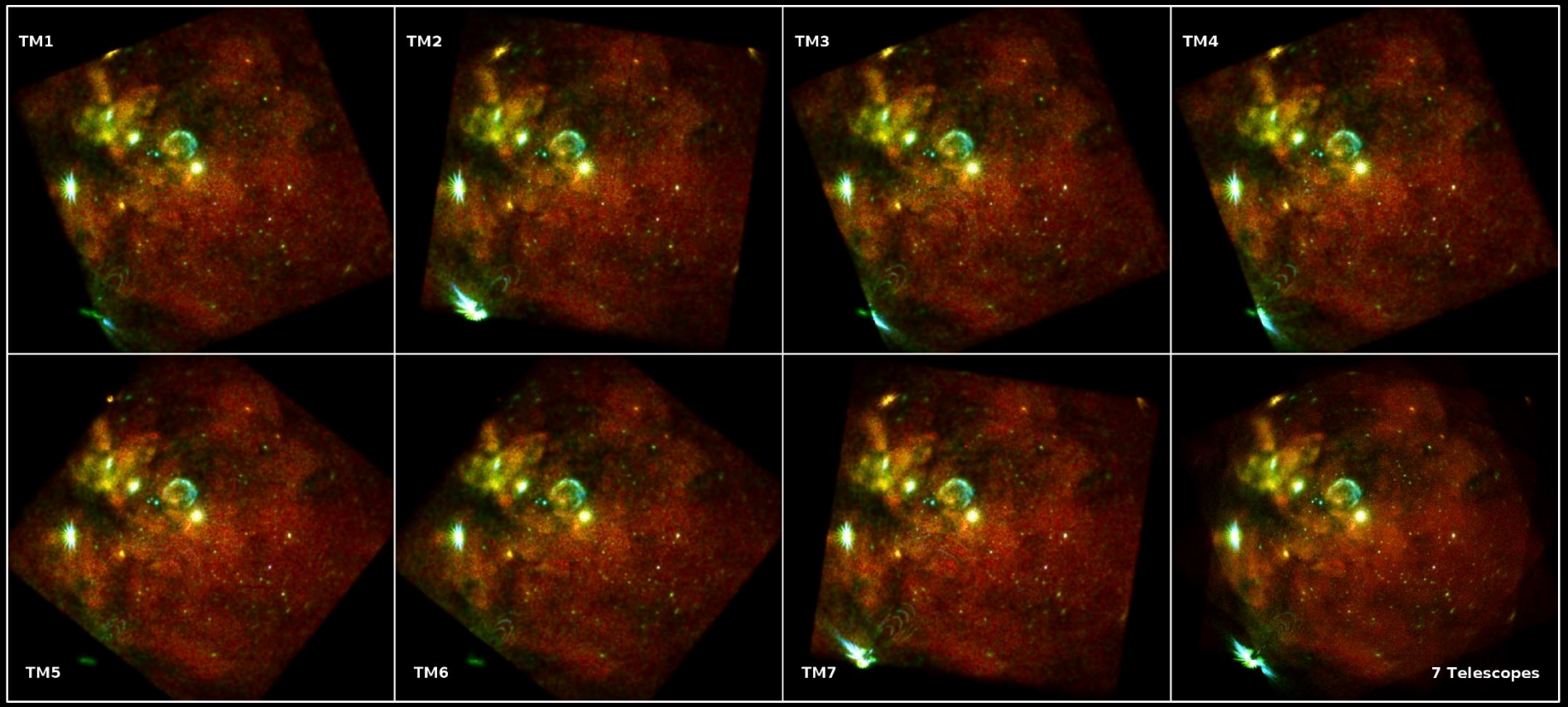
The Growth of Galaxy Clusters depends on the Dark Energy and Dark Matter Mixture.

Credit: NASA/CXC

First Light: LMC



SRG/eROSITA (0.2-4.5 keV)

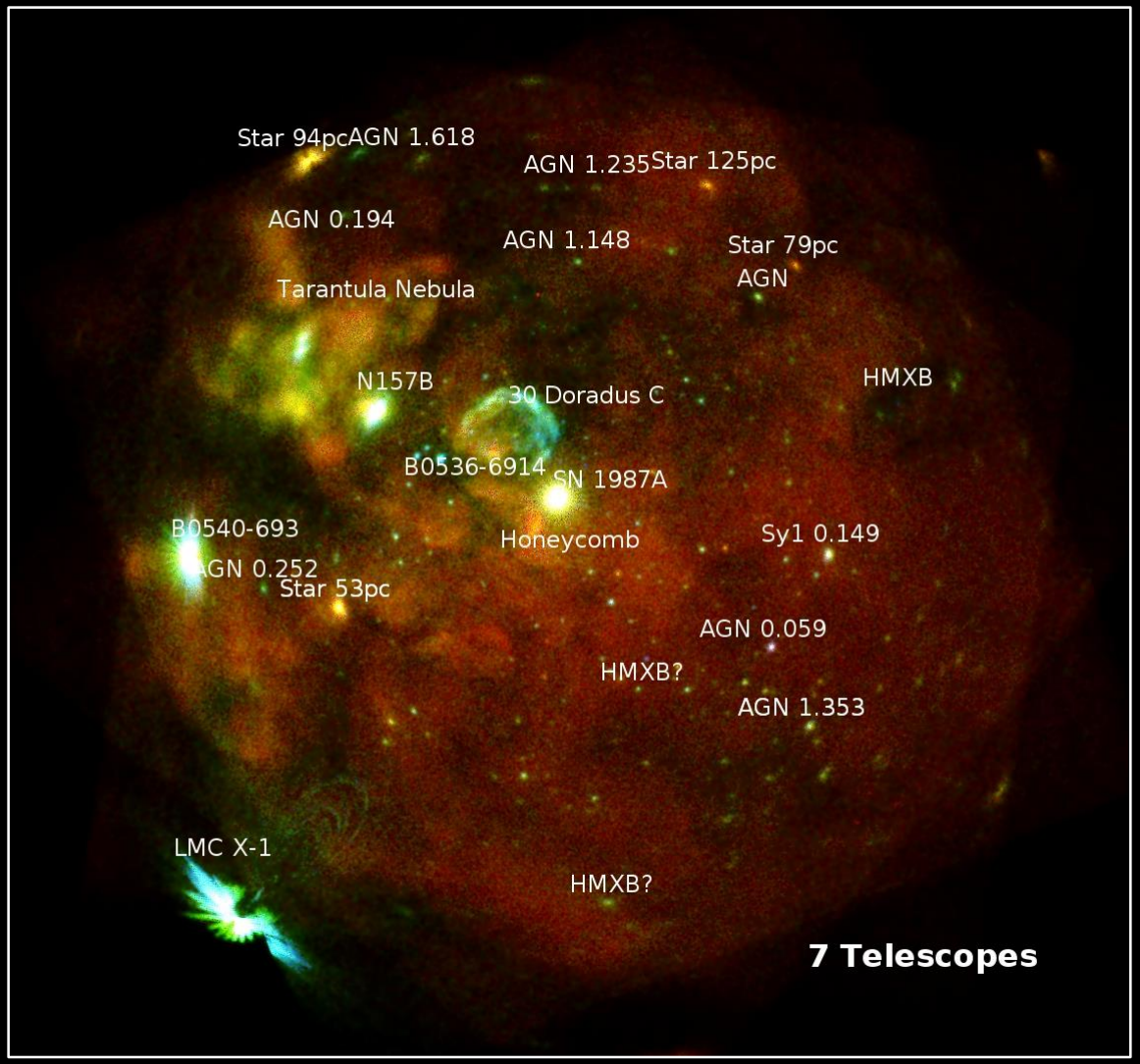


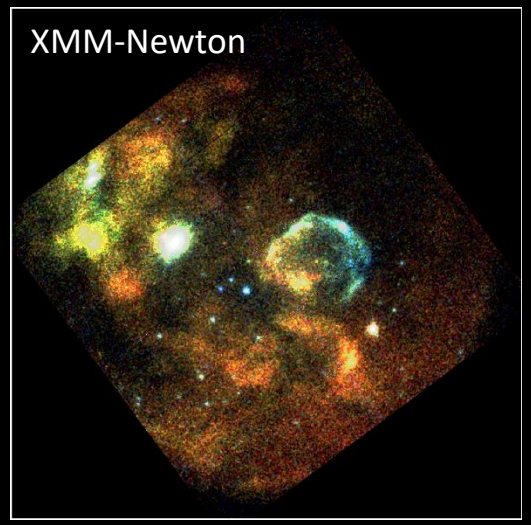
LMC/SN1987A

MPE/IKI

Credit: F. Haberl, M. Freyberg, C. Maitra

SRG/eROSITA





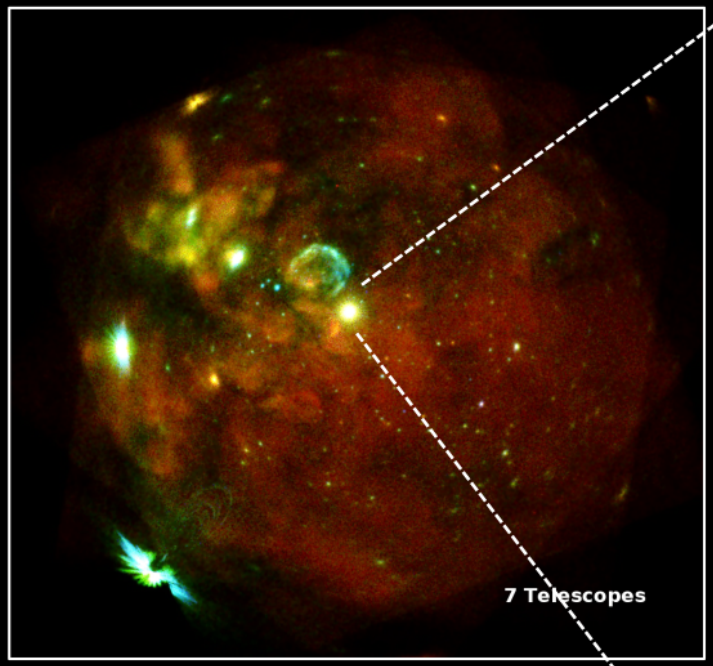
EPIC-PN FL
Dennerl et al. 2001

MPE/IKI

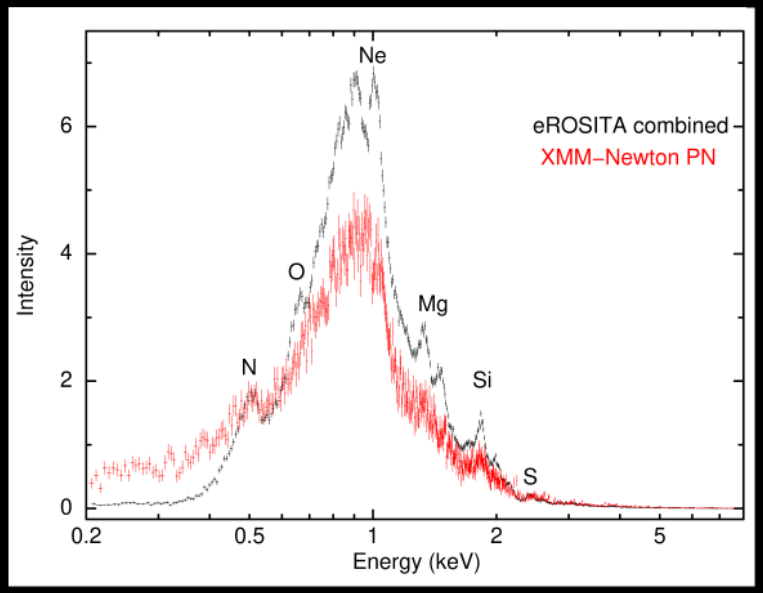
Credit: F. Haberl, M. Freyberg, C. Maitra

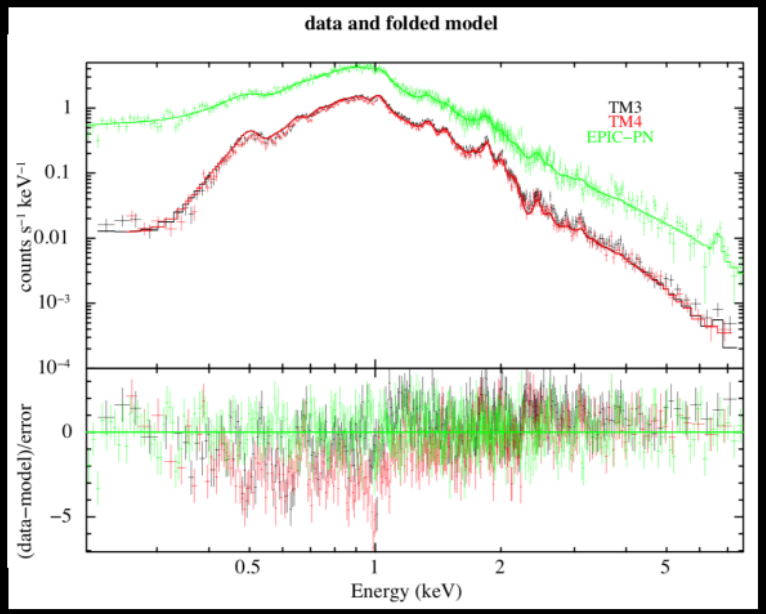
SN 1987A in the LMC

SRG/eROSITA



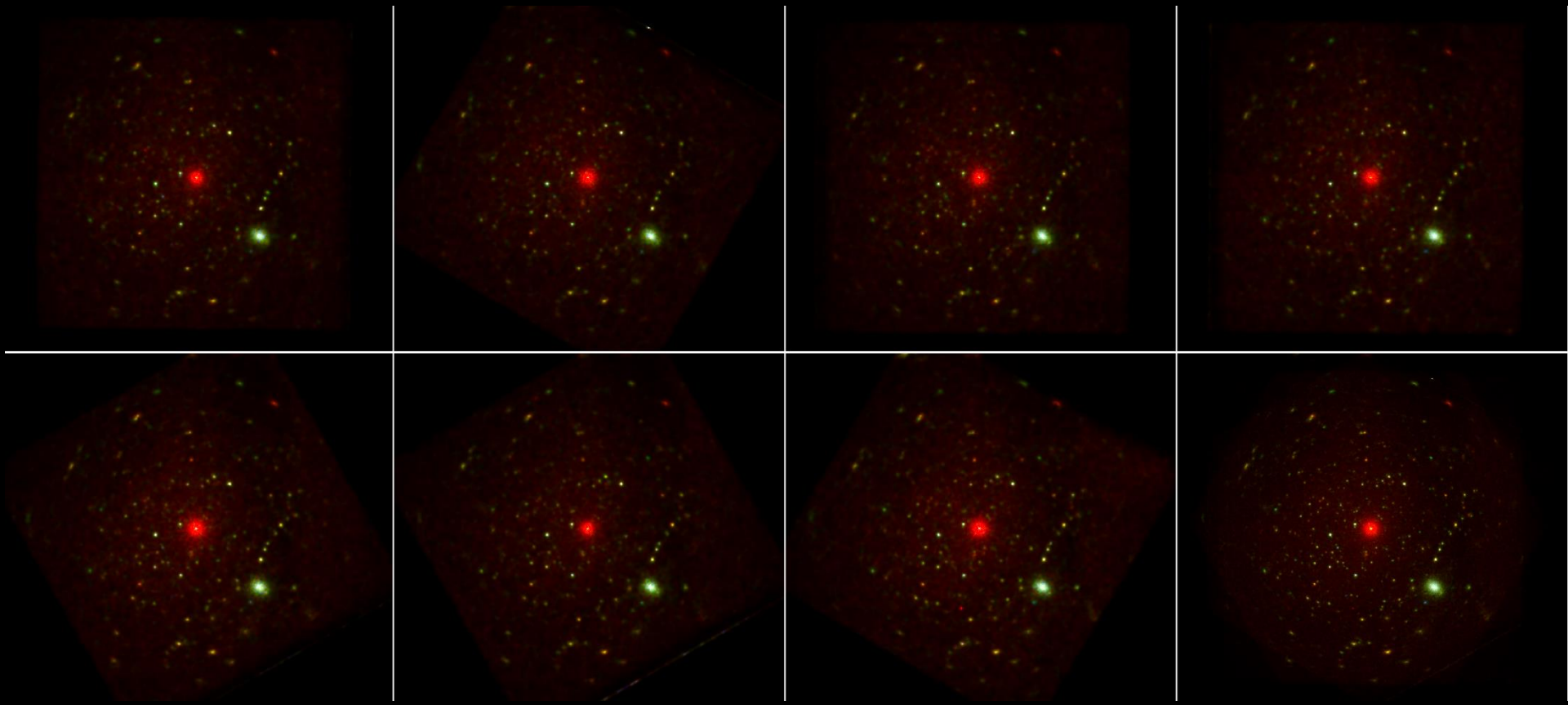
	Chandra	XMM-Newton	eROSITA
0.3 keV	-	100 eV	47 eV
1.5 keV	95 eV	110 eV	77 eV
6 keV	150 eV	150 eV	136 eV





Credits:F. Haberl, C. Maitra, M. Freyberg

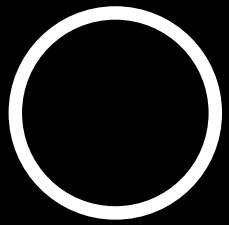
ISN: RXJ1856



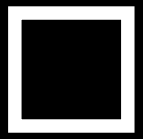
SRG ability to observe large areas

Moon diameter
30 arcmin

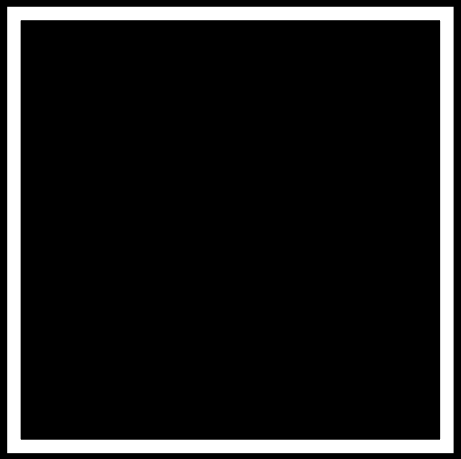
XMM-Newton
Field of view ~ 30 arcmin



Chandra
Field of view ~ 17 arcmin



eROSITA
Field of view ~ 62 arcmin



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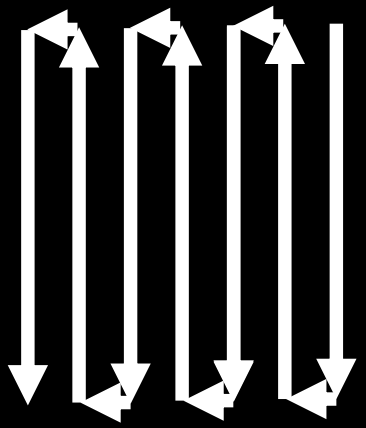
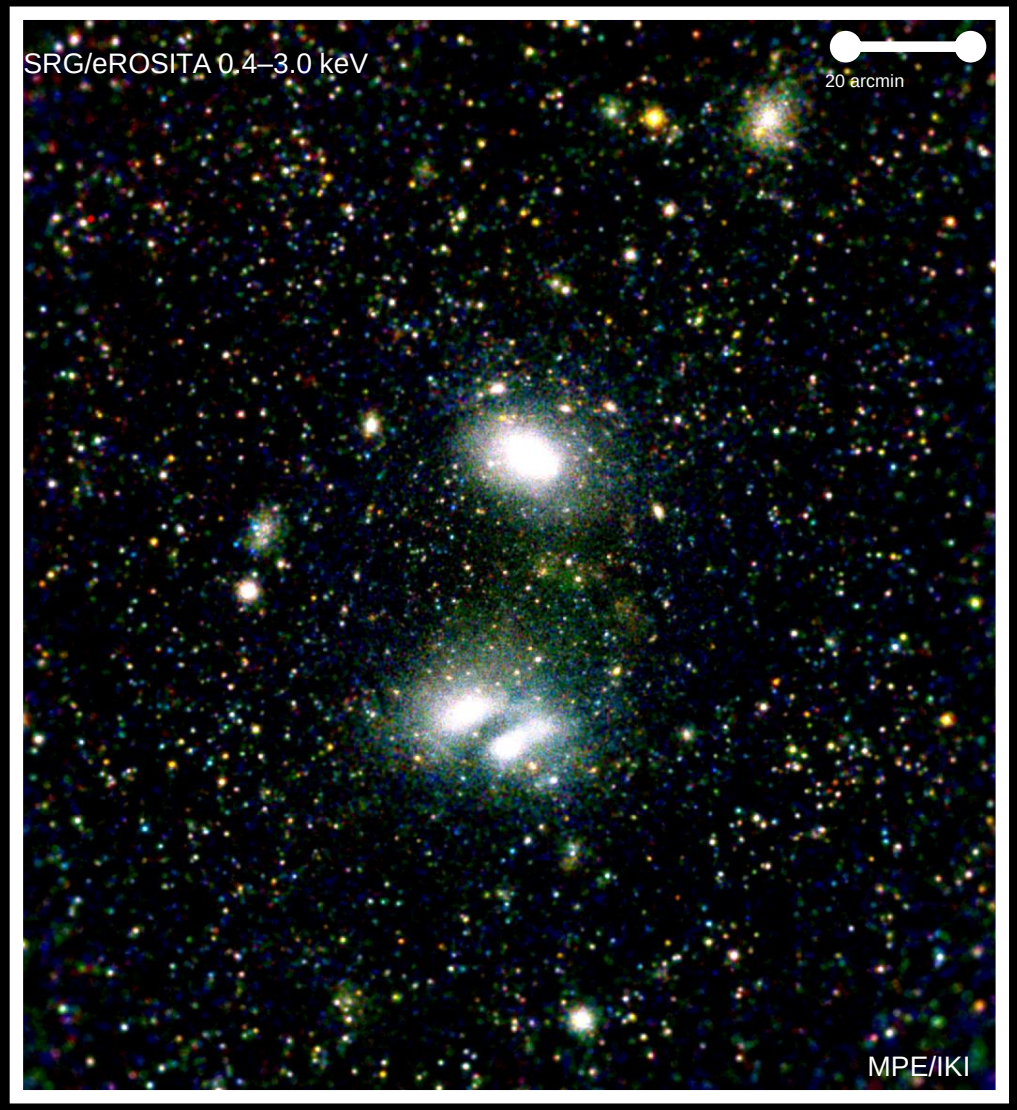


Scanning feature

A3391/A3395



0.4–0.8 keV: red
0.8–1.5 keV: green
1.5–3.0 keV: blue

Top-hat adaptive smoothing (raise floor)

T Reiprich, M Ramos-Ceja, F Pacaud, N Ota,
J Sanders, D Eckert, E Bulbul, V Ghirardini

All-sky surveys instruments

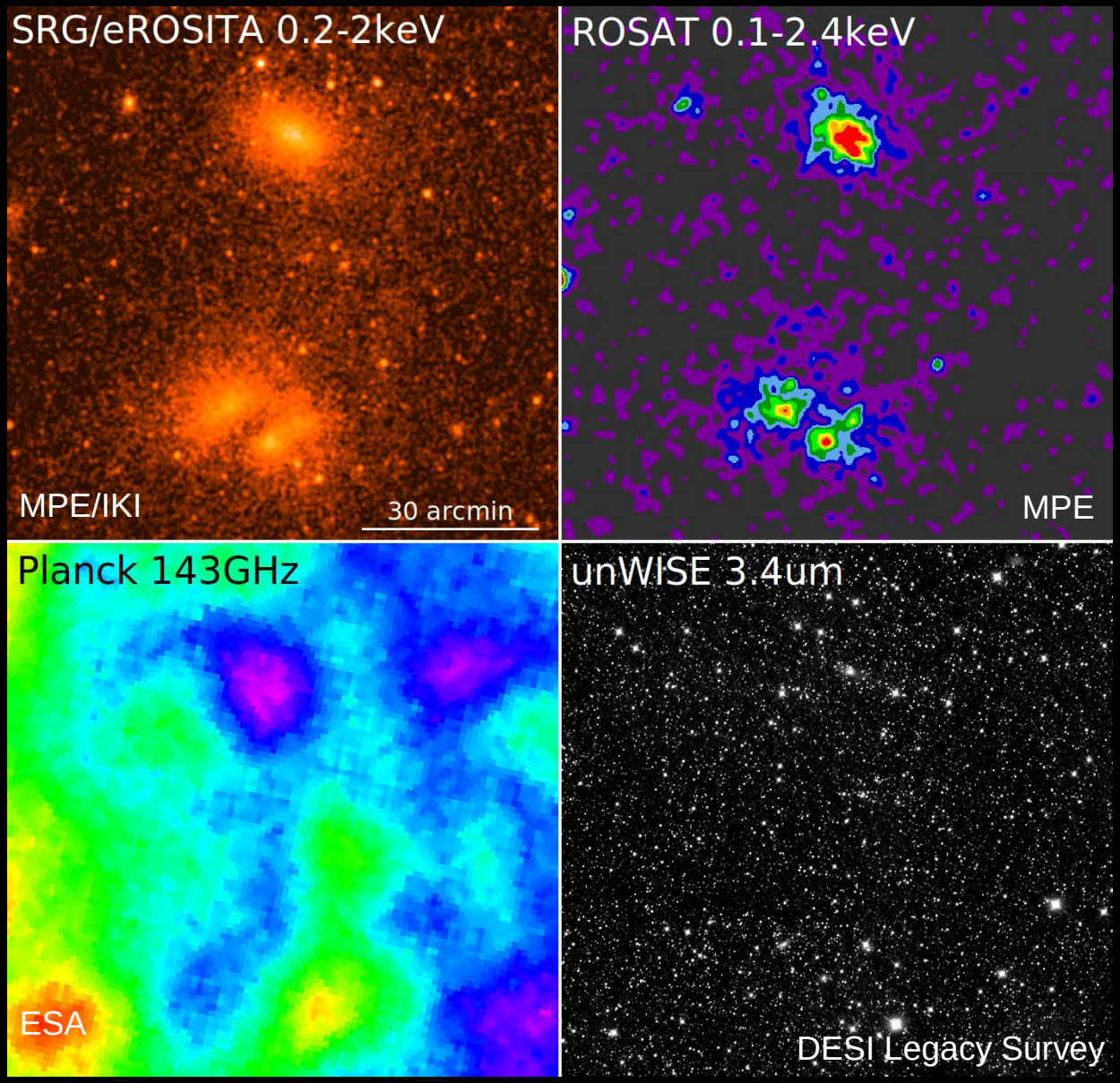
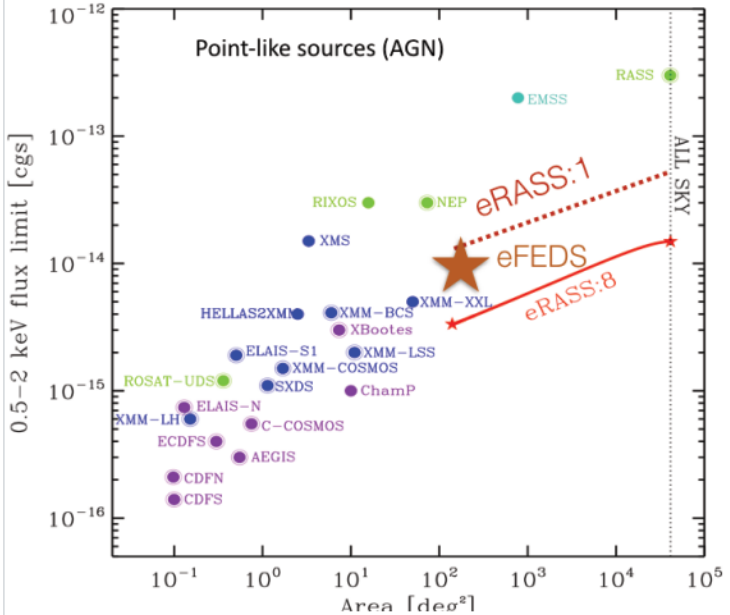


Image credit: T. Dwelly TDAstro & MPE

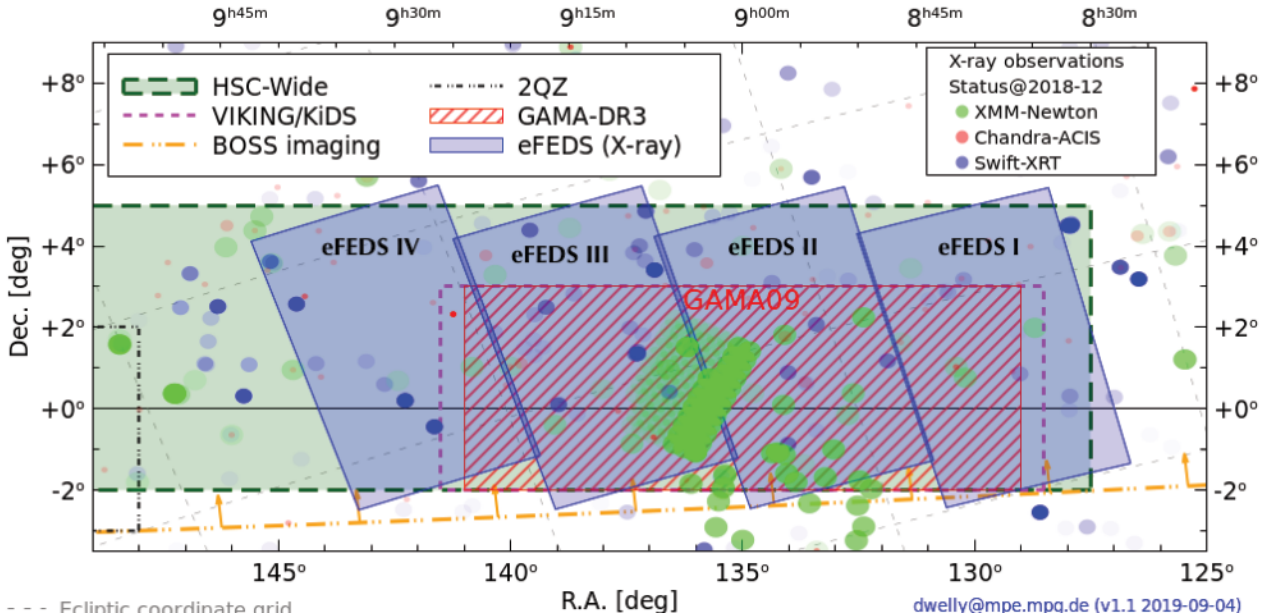
eFEDS: eROSITA Full Equatorial-Depth Survey
(done by middle Nov. 2019)

PIs: Georgakakis Bulbul

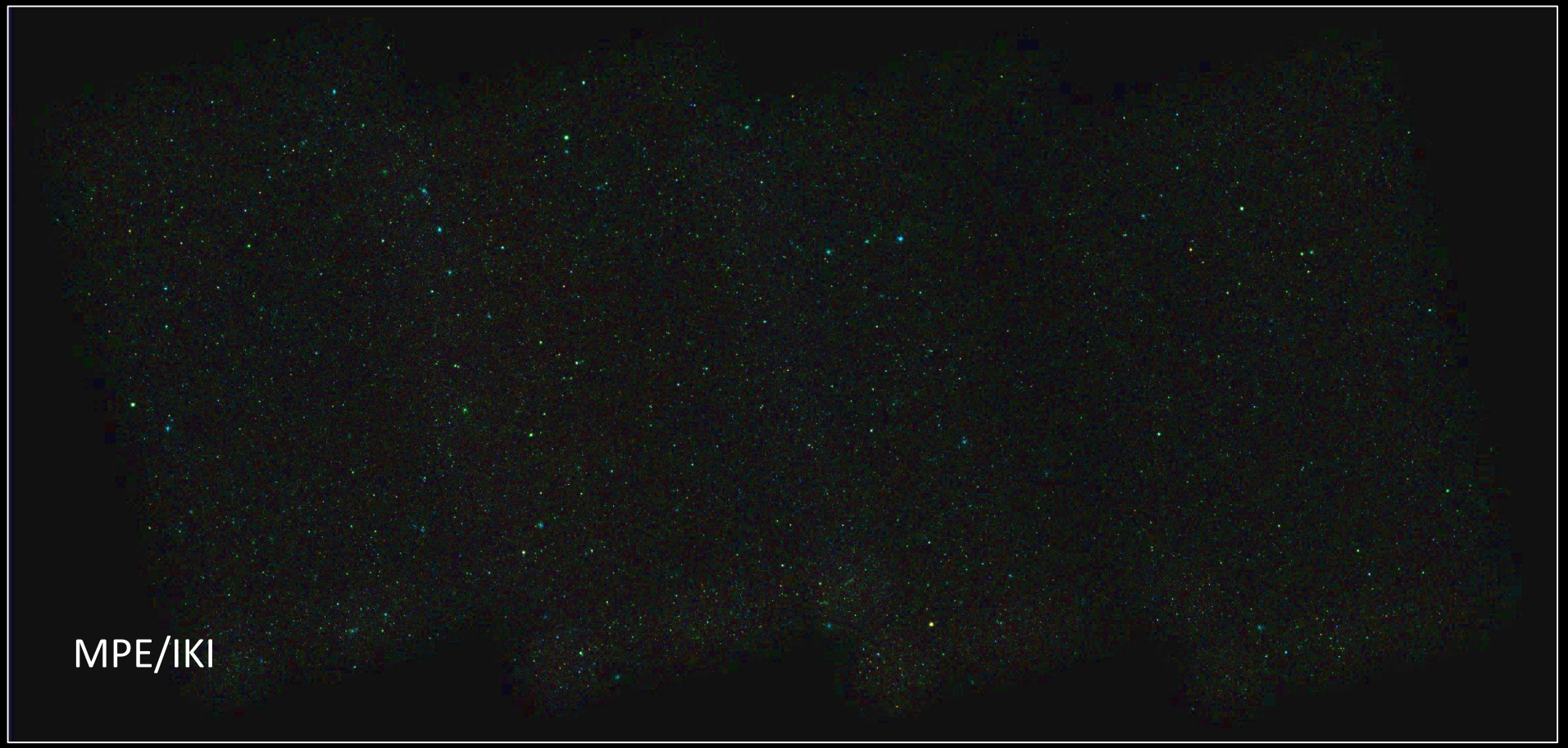


- Main goals:
  - Cluster Mass Calibration (HSC lensing, dynamics)
  - AGN evolution, luminous AGN host properties

- Ancillary data:
  - Subaru HSC, Viking, DeCALS, unWISE, Kids
  - GAMA, 2dF, and more spectroscopy
  - By March spectroscopy from dedicated SDSS-IV plates

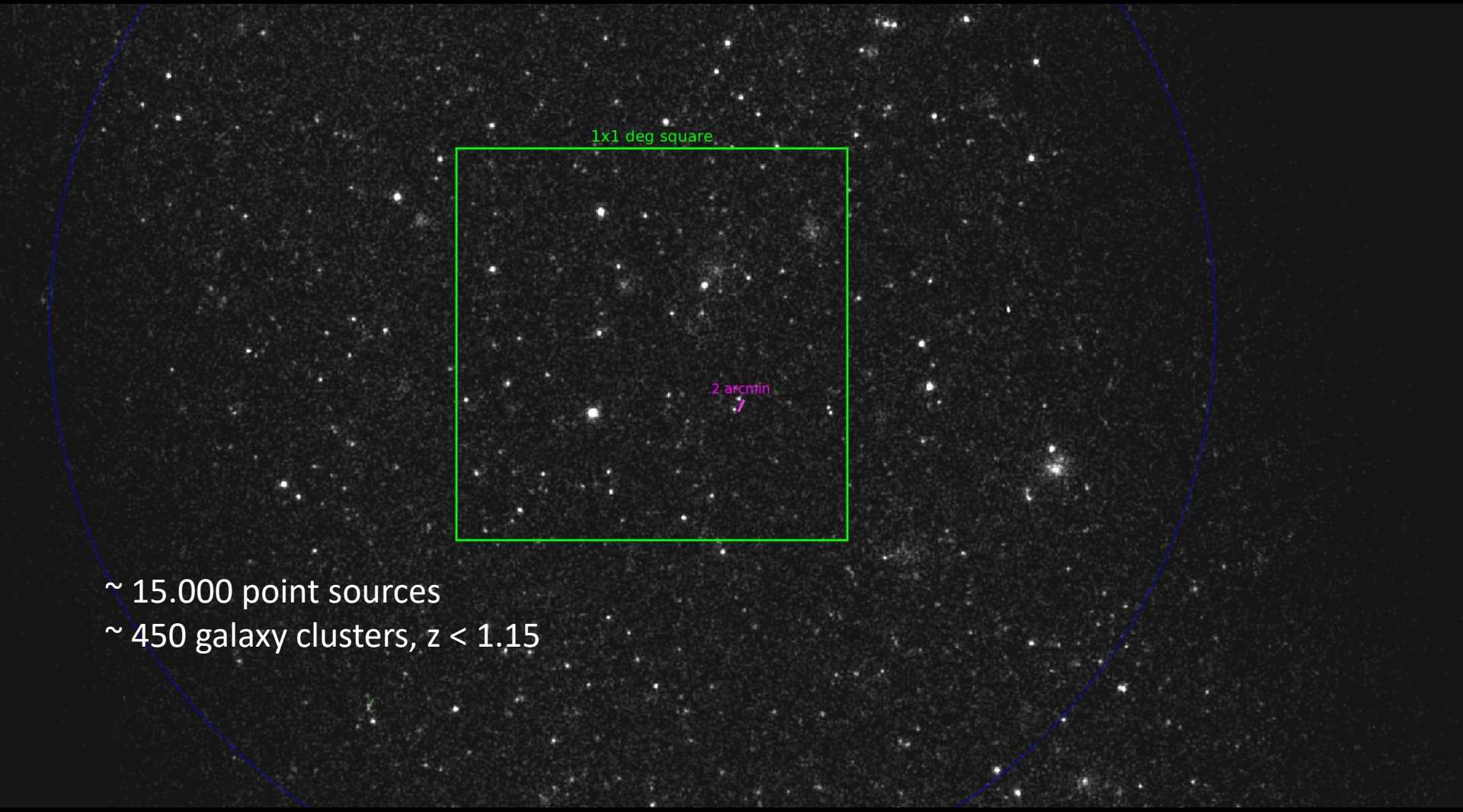


Equatorial Field Depth Survey Field (PV Phase)



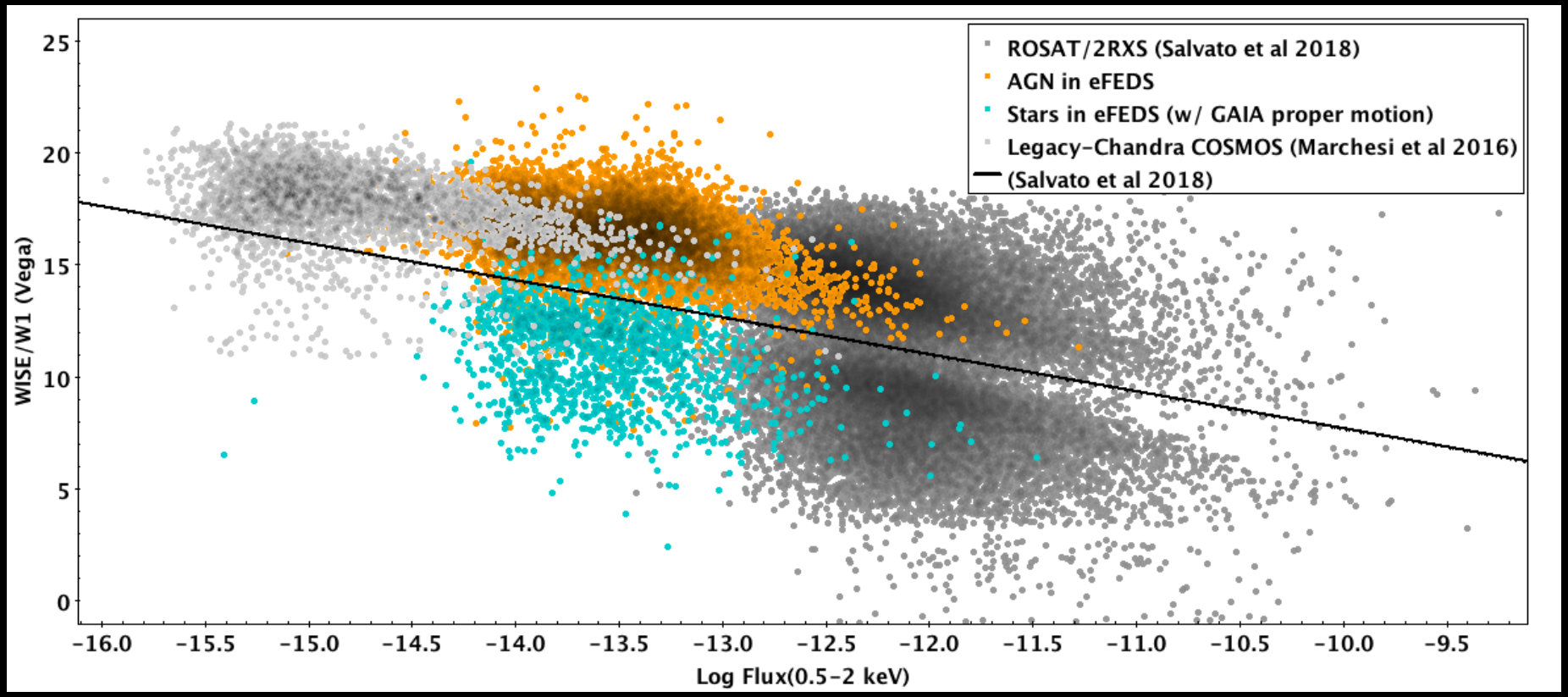
exposure time & vignetting corrected
exposure ~1.2ksec

Equatorial Field Depth Survey Field (PV Phase)



~ 15.000 point sources
~ 450 galaxy clusters, z < 1.15

Credits: Vittorio Ghirardini , Mara Salvato et al.



10% of all point sources are stars, 90% AGN

Photo: V. Burwitz (MPE)

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Thank you!