

eROSITA



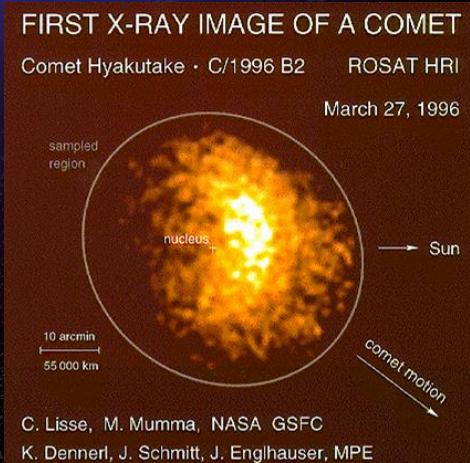
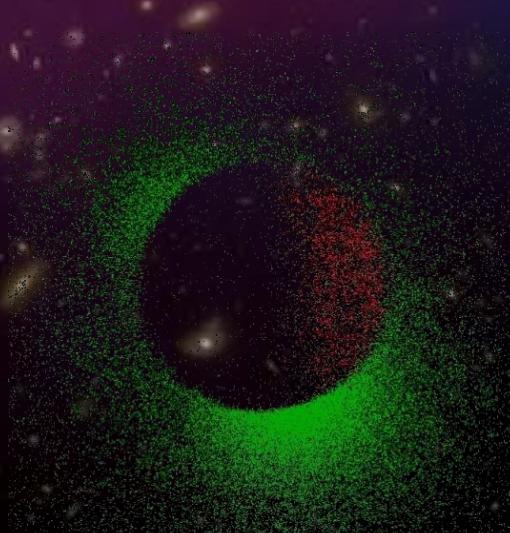
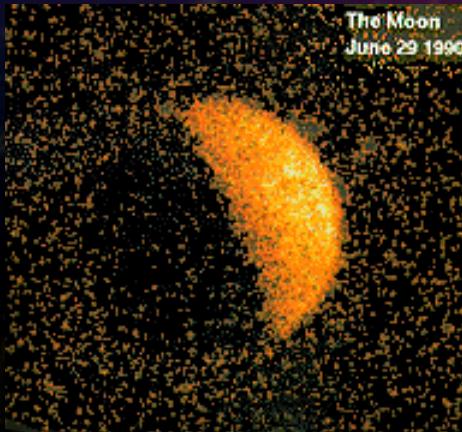
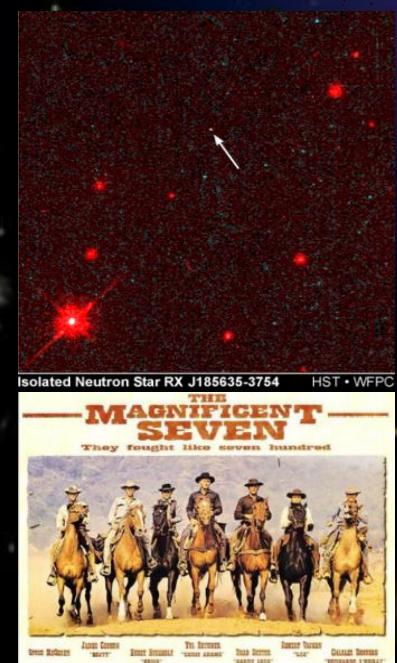
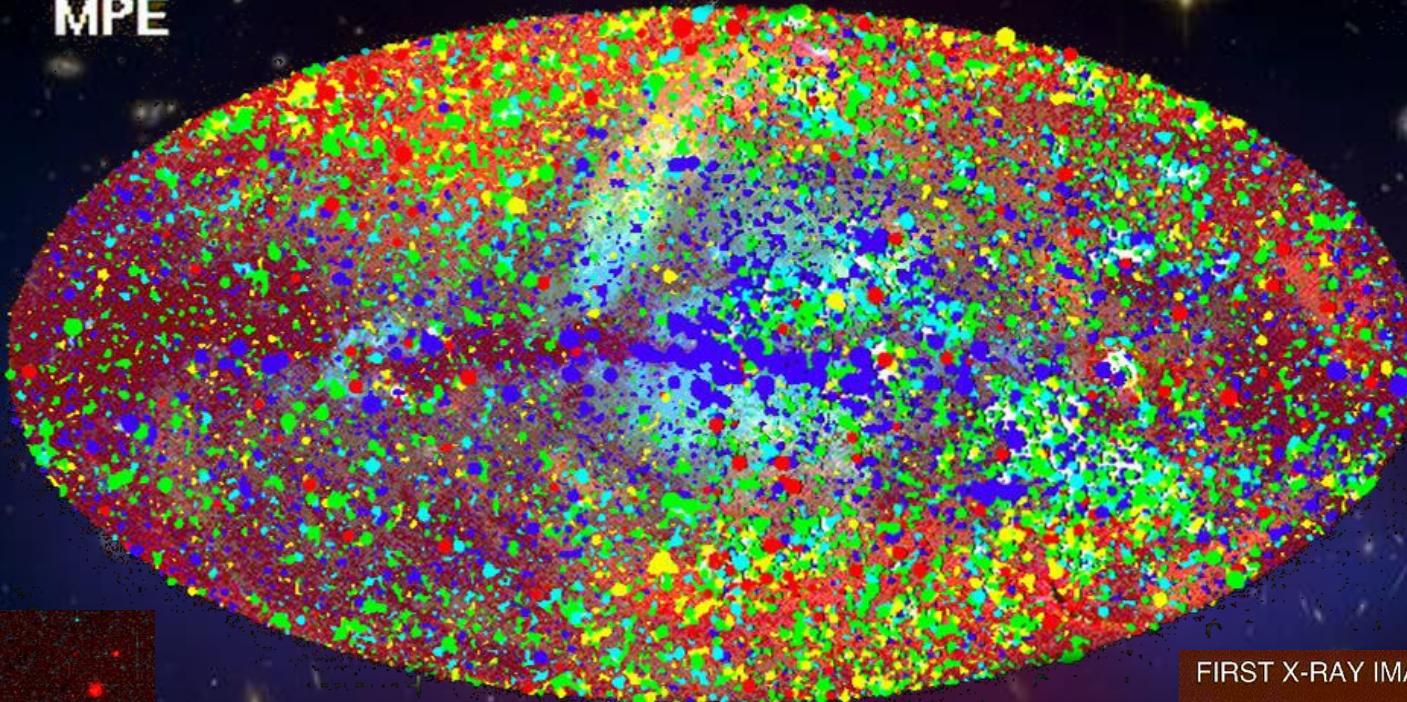
Peter Predehl

Max-Planck-Institut für extraterrestrische Physik

**ROSAT PSPC
MPE**

All-Sky Survey

Multispectral



August 2009
Detailed Agreement
DLR and Roscosmos



January 2017
eROSITA Arrival in Russia



Spectrum Roentgen Gamma Mission Scenario

Sun

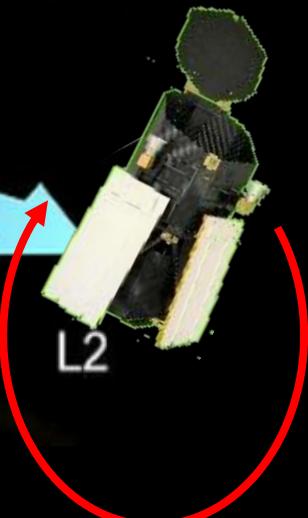
150 million km

Earth

Moon

1.5 million km

L2



Launch with PROTON/BLOK-DM from Baikonur

3 months, commissioning & CalPV (Cruise to Lagrange 2)

4 years survey, continuous rotation (~4hr)

3 years pointed observations

eROSITA Collaboration

Core Institutes (DLR/BMWi 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

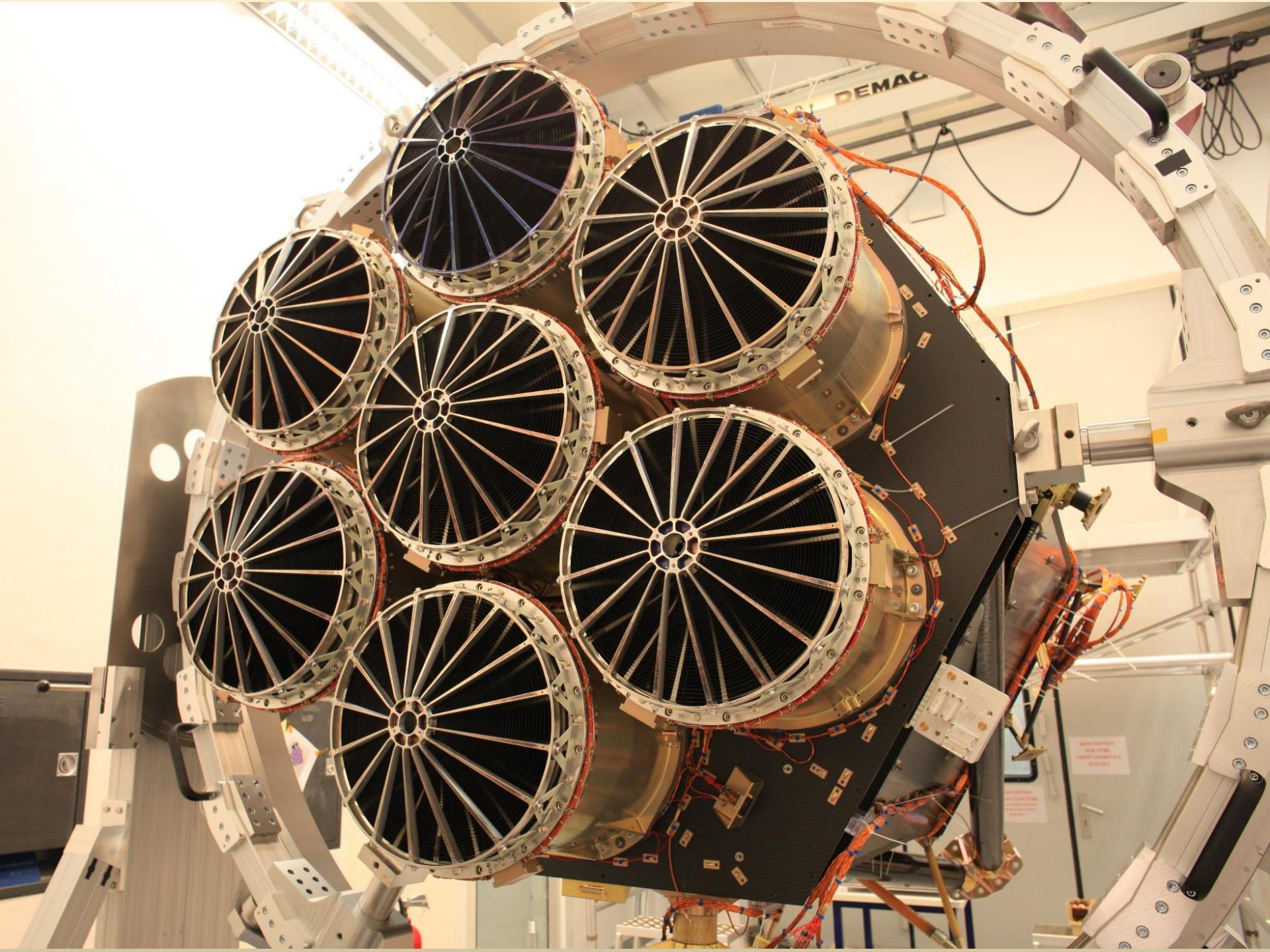
Industry:

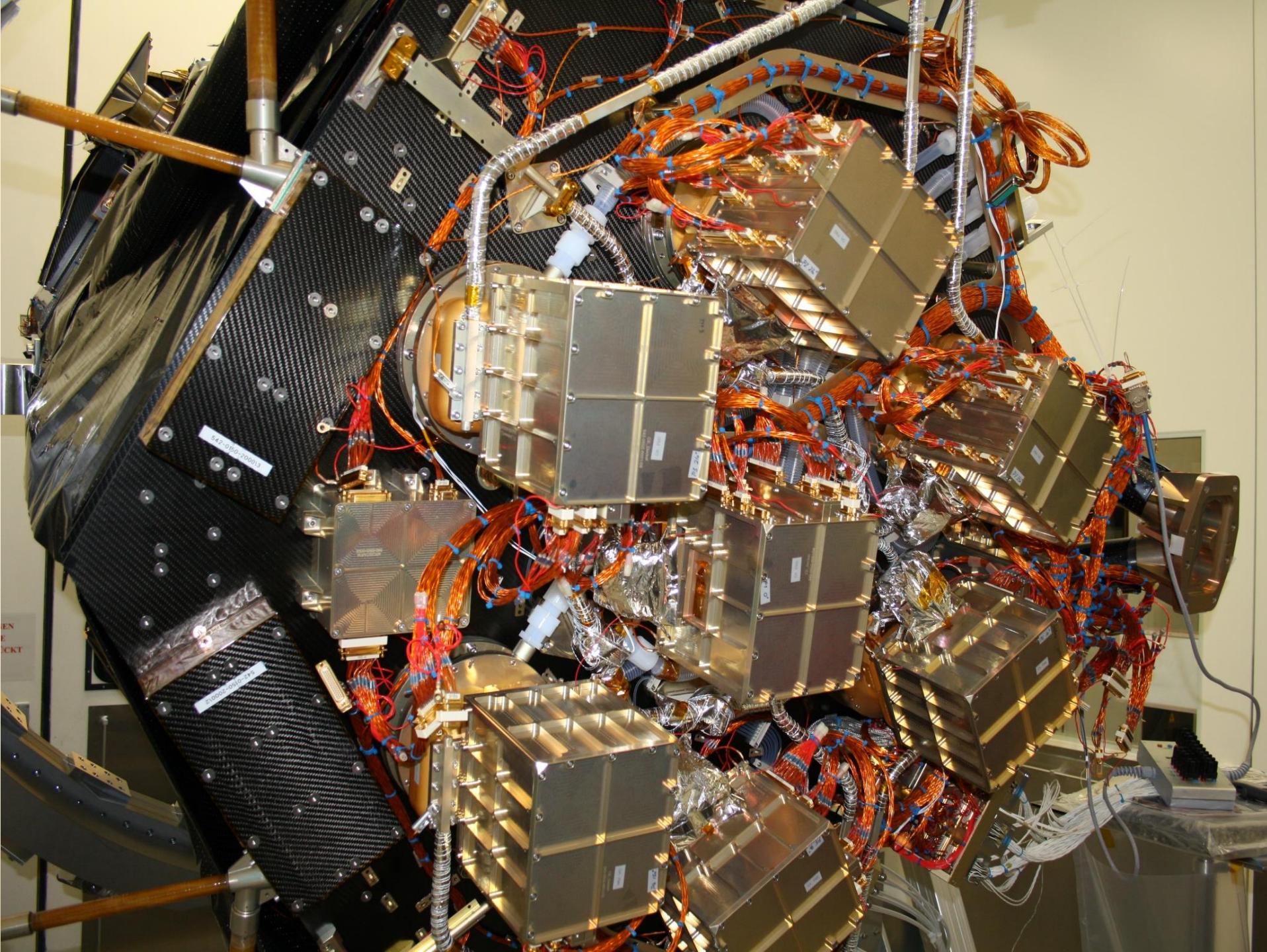
Media Lario/I	Mirrors, Mandrels
Tecnotron/D	PCBs
Kayser-Threde/D	Mirror Structures
Carl Zeiss/D	ABRIXAS-Mandrels
Invent/D	Telescope Structure
pnSensor/D	CCDs
IberEspacio/E	Heatpipes
RUAG/A	Mechanism
MBM/D	Container
HPS/D,P	MLI
IABG/D	Tests
+ many small companies	

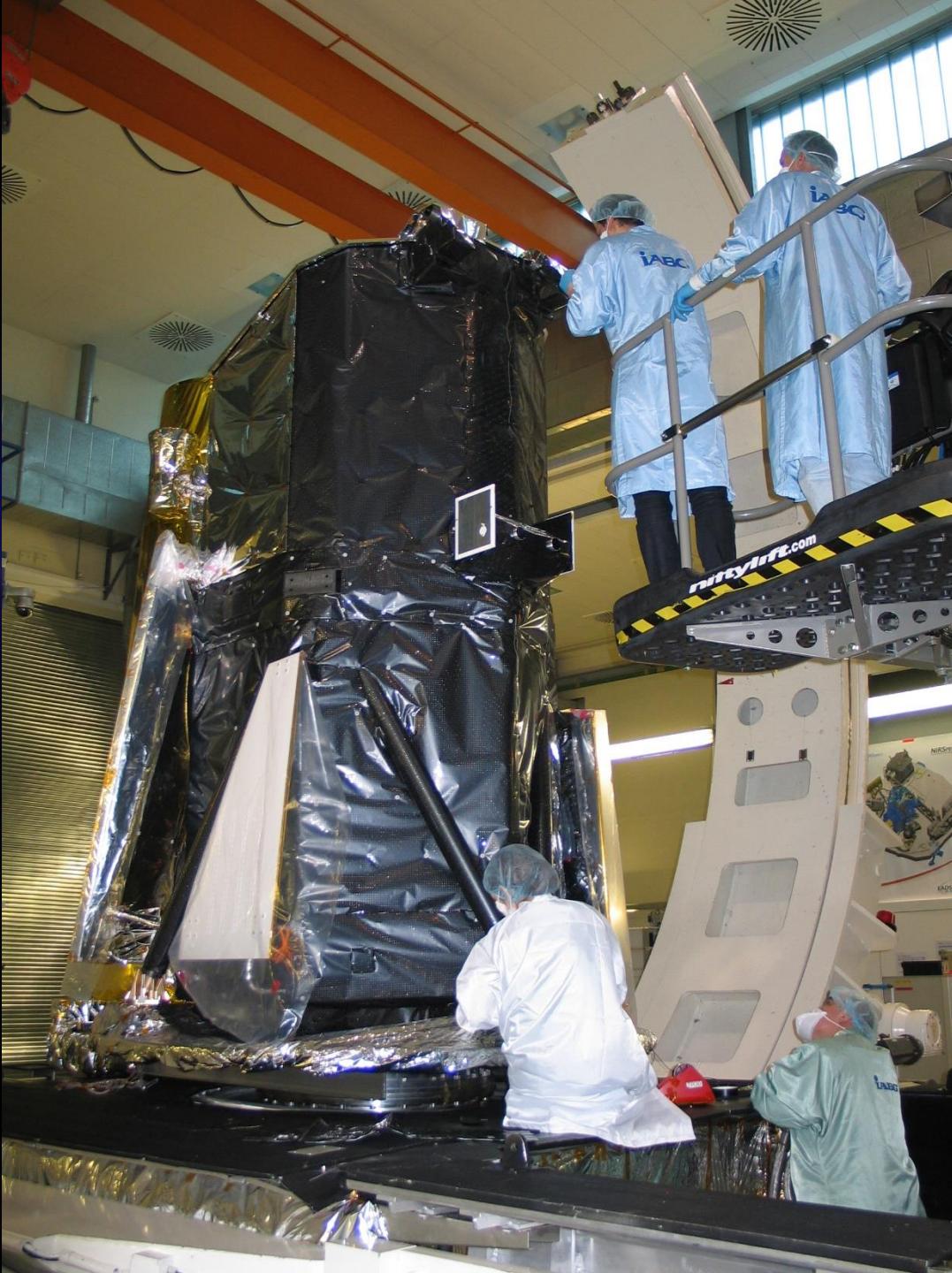
MPE: Scientific Lead Institute, Project Management

Instrument Design, Manufacturing, Integration & Test
Data Handling & Processing, Archive etc.

Funding: DLR ~45%, MPG ~55%







eROSITA Fact Sheet

Instrument

Size	1,9m Ø x 3.5m
Weight	810kg
Power	522W
Data volume	600MB/day
lifetime	> 7 years
Launcher	PROTON/BLOK-DM
Launch	March 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)	18 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	
Time Resolution	50msec
Energy Resolution (1keV)	~ 70eV
Quantum Efficiency (1keV)	~ 95%

Performance

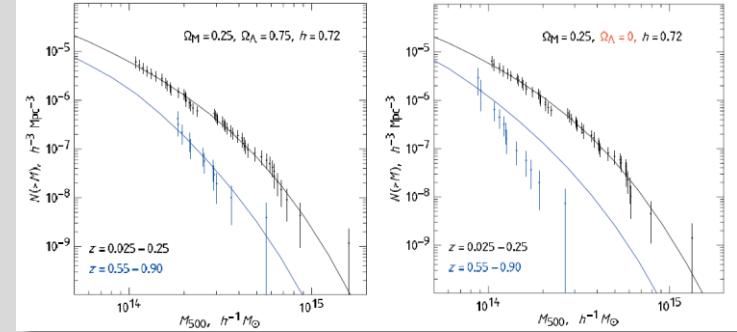
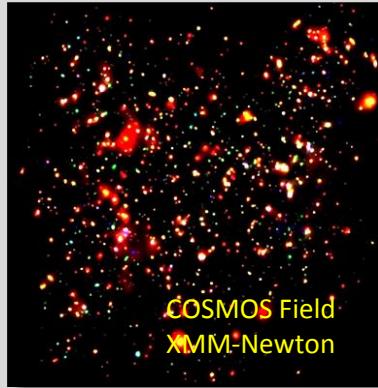
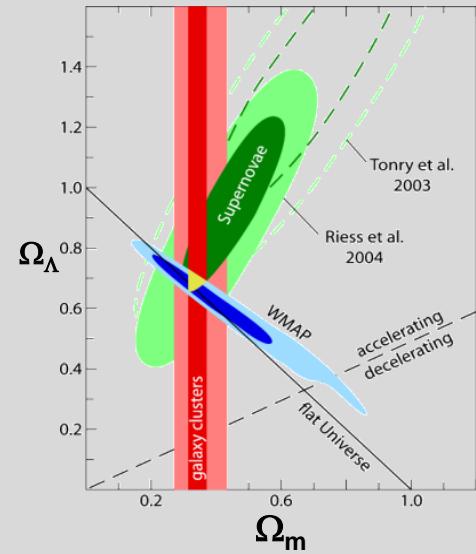
Energy Range	0.3-7keV
Point Source Sensitivity	1.2E-14
P.S. Sensitivity at poles	2.9E-15
Extended Source Sens	3.4E-14
ES. Sensitivity at poles	1.0E-14

eROSITA_DE

12 working Groups
135 Members
+ External Collaborators

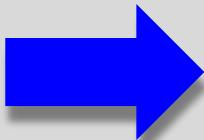
“Design Driving Science”

Cluster Cosmology



Vikhlinin et al., 2009

Clusters of galaxies are the largest gravitationally bound entities in the universe.



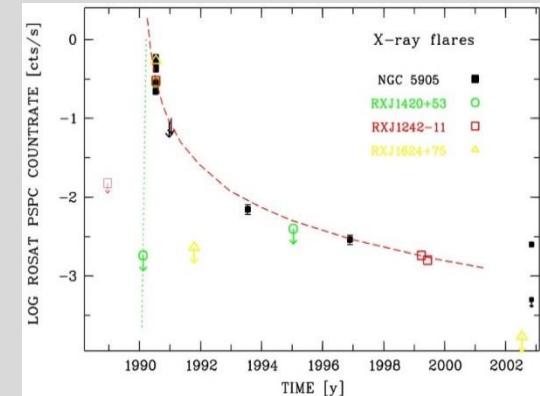
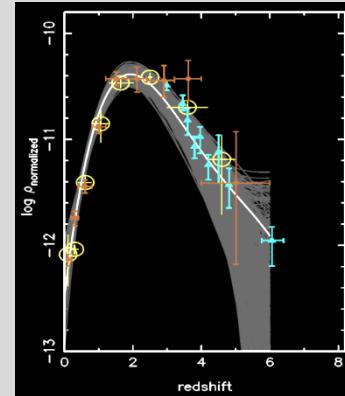
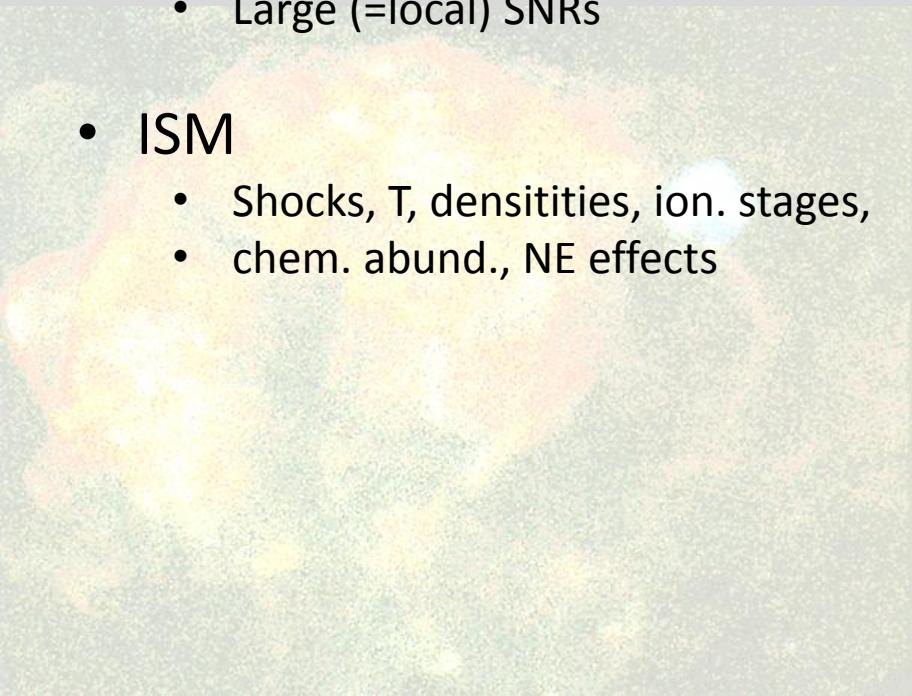
In X-rays we see clusters as one continuous entity.

Detectability of 100.000 Clusters of Galaxies, $z < 1.5$:

- All-sky survey with sensitivity $6 \times 10^{-14} \text{ erg cm}^{-2} \text{s}^{-1}$
- Deep survey field(s) ($\sim 100 \text{ sqdeg}$) with $1 \times 10^{-14} \text{ erg cm}^{-2} \text{s}^{-1}$
- Individual pointed observations
- Moderate angular resolution (< 28 arcsec, aver. over FoV)
- Large collecting area ($> 2000 \text{ cm}^2$ @ 1keV)
- Large FoV ($1^\circ \emptyset$)
- Long duration (survey 4 years $\leftarrow \rightarrow$ 1/2 year (ROSAT))

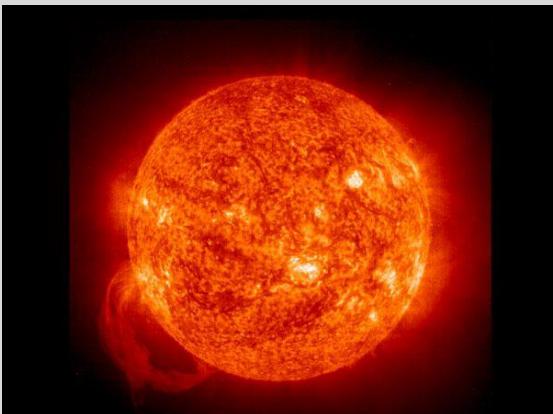
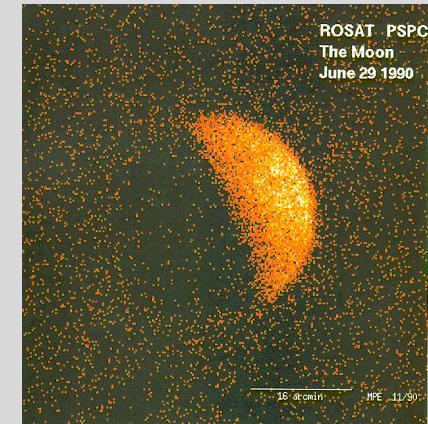
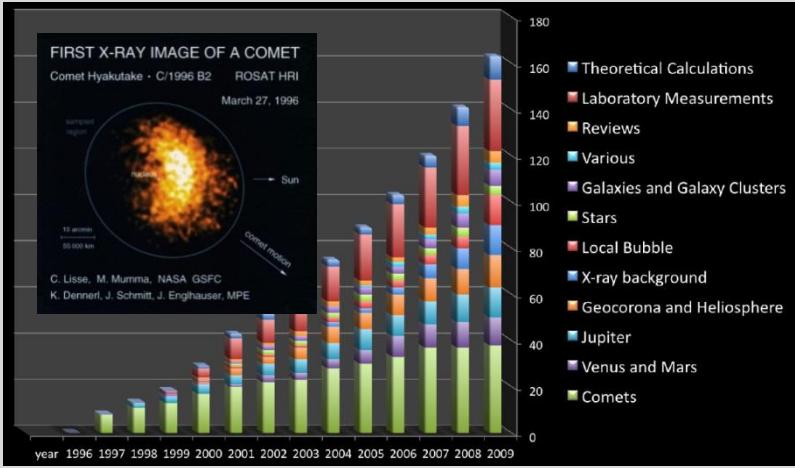
eROSITA & Hot Universe

- 0.7 Mill. Stars
 - O, B, WR, wind shocks
 - stellar pop. studies
 - SFR / galactic structure
- SNR
 - search radio quiet/absorbed
 - Large (=local) SNRs
- ISM
 - Shocks, T, densities, ion. stages,
 - chem. abund., NE effects
- Compact Objects
 - > 100 INS?
 - Pulsars (spin down)
 - Accretion
 - Magnetic fields, Magnetars
 - Cyclotron line features
 -
- 3 Mill. AGN $z < 6$
 - XLF, Accretion History
 - Variability, e.g. Tidal Disruption
 - Spectra (iron lines)



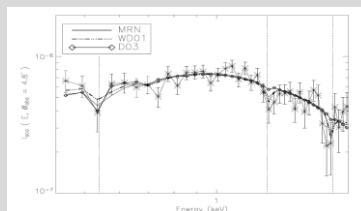
eROSITA & Cold Universe

Charge Exchange

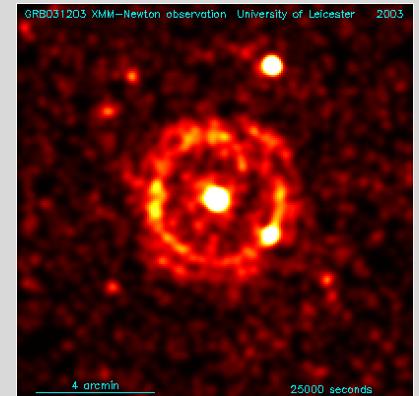


Cool Stars
magnetic activity
coronae

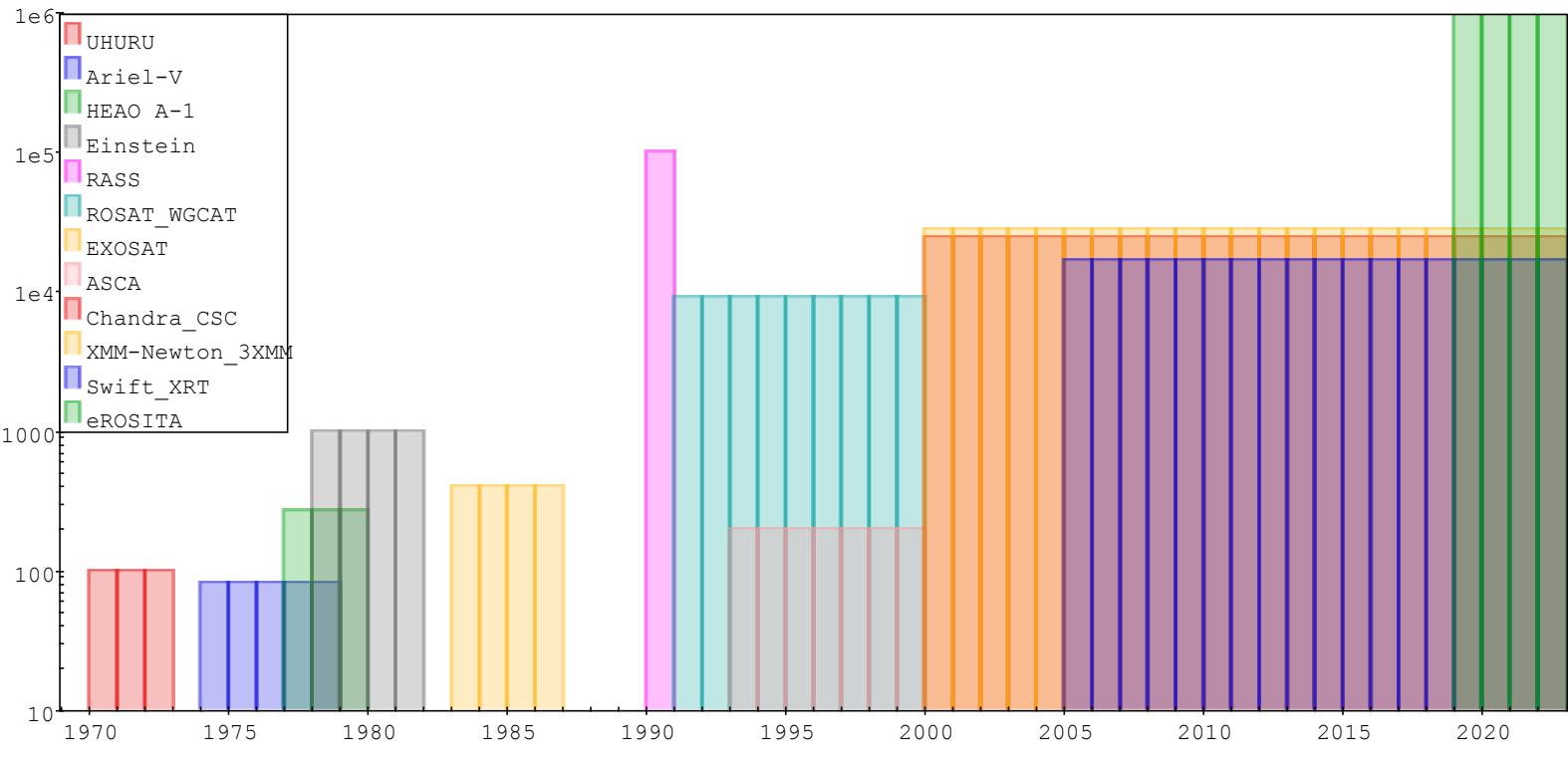
Interstellar Dust
scattering
spectroscopy
chemistry



Costantini et al., 2005

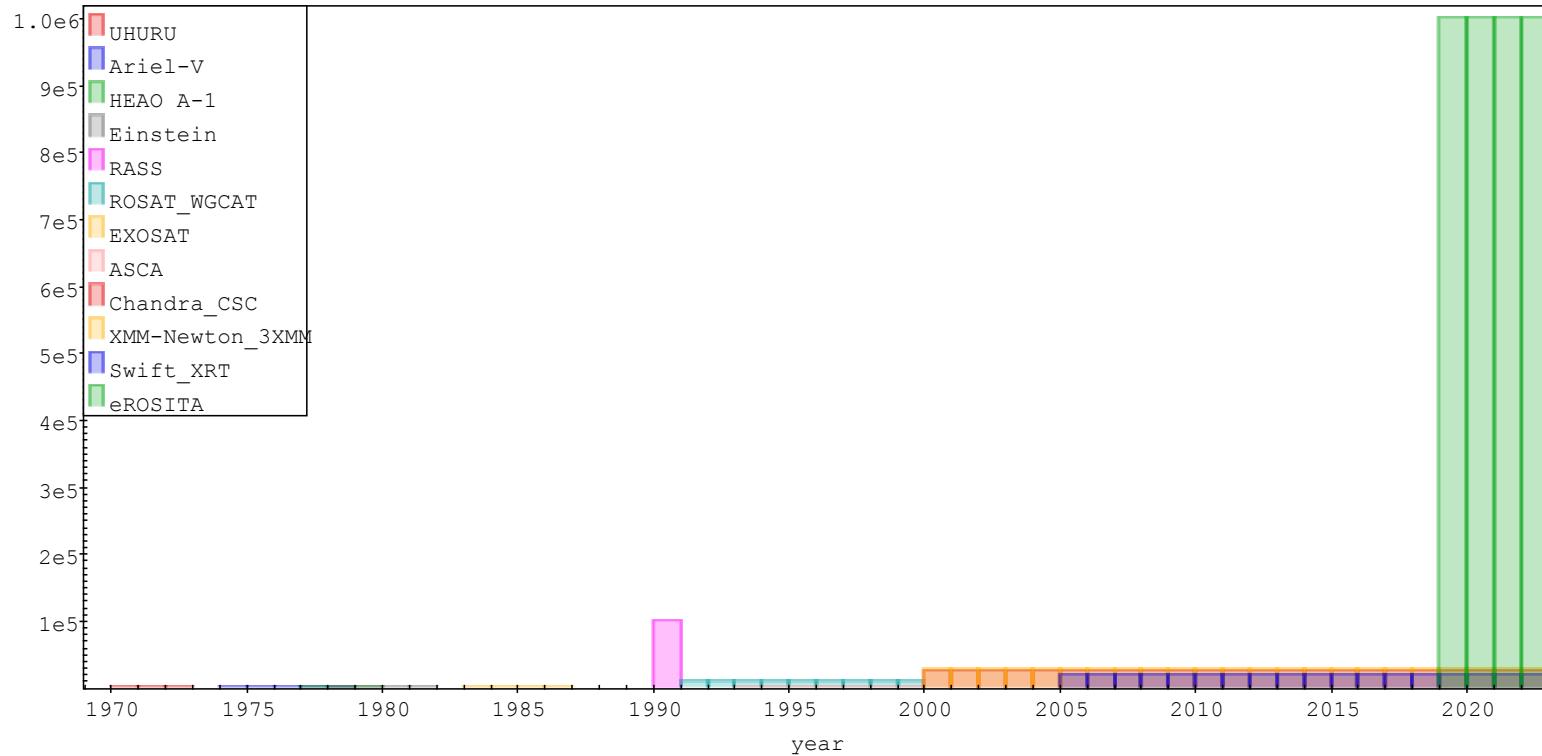


eROSITA surveys in context



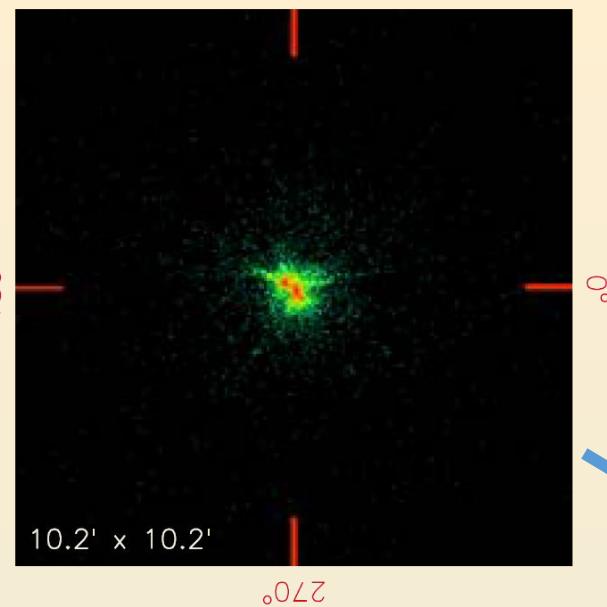
Approx. Number of X-ray sources detected per year

eROSITA surveys in context



At the end of its first year of operations, eROSITA will have detected as many new sources as have been catalogued in 50 years of X-ray astronomy

X-ray Mirrors



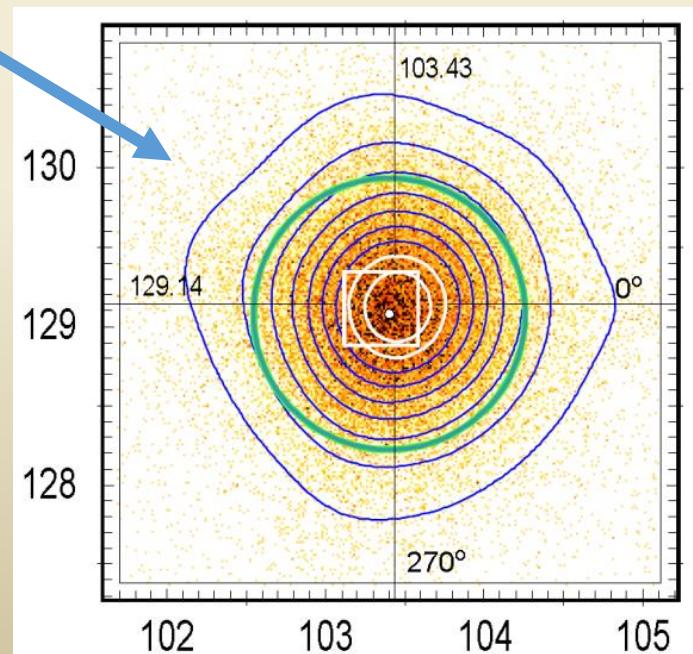
Engineering Model, 2009
42 arcsec



We know all bumps and road holes
between Monza and Garching



Flight Model, 2013
16 arcsec



Via Mala

Packing in clean container



Transport from MUC to SVO



Transport from SVO to NPOL



Transport from SVO to NPOL



Navigator finished TV Test



eROSITA FAQs

What is the launch date?

March 29 – April 12, 2019

How are data shared btw Ru/D?

50:50 in galactic coordinates

Science (D)

12 Working Groups
>135 Scientists
+ External Collaborators

When gets data public?

D: Survey after 2 years
D: Pointed after 1 year, as usual

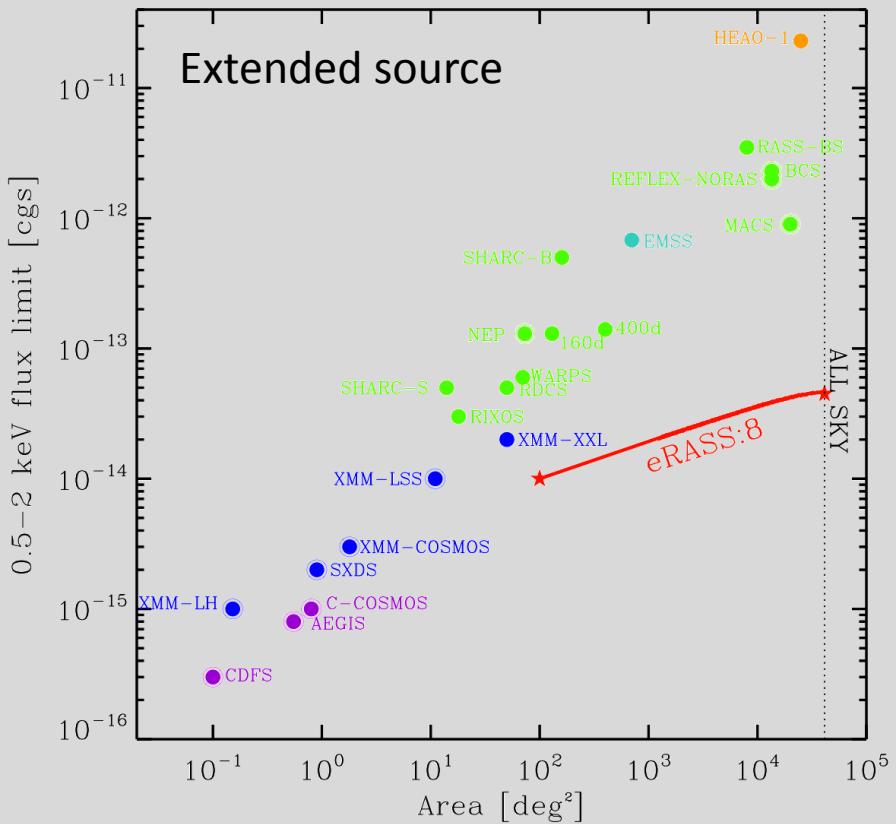
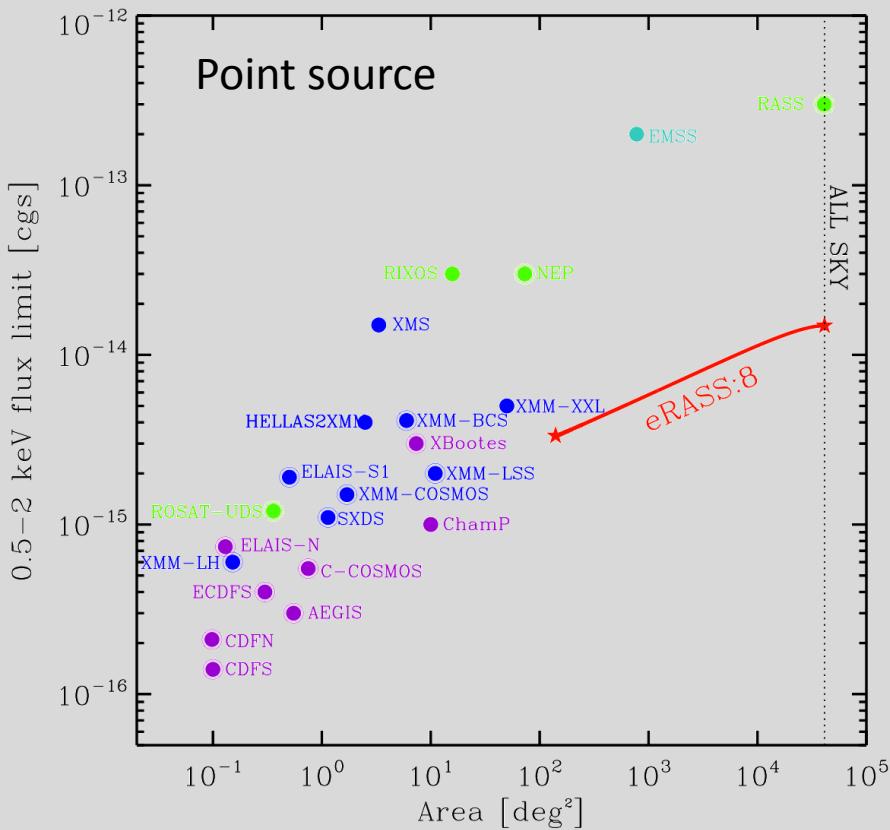
Alerting transient detections?

Yes, of course. But...

What is the sensitivity?

Point sources: $3 - 12 \times 10^{-15}$ erg/s/cm²
Ext. sources: $1 - 4 \times 10^{-14}$ erg/s/cm²

eROSITA Performance



Point source sensitivity:

~25 times better than ROSAT (soft band 0.5–2 keV)

~100 times better than HEAO/RXTE (hard band 2–10 keV)