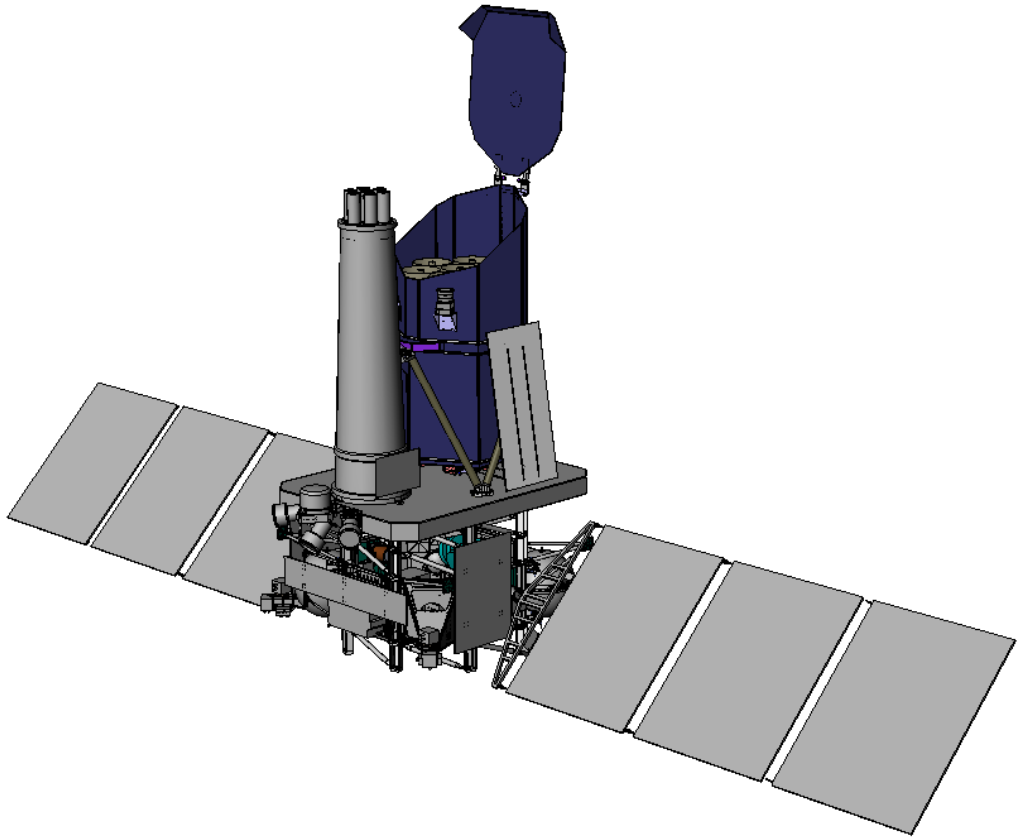
Spectrum-Roentgen-Gamma status and scientific prospects

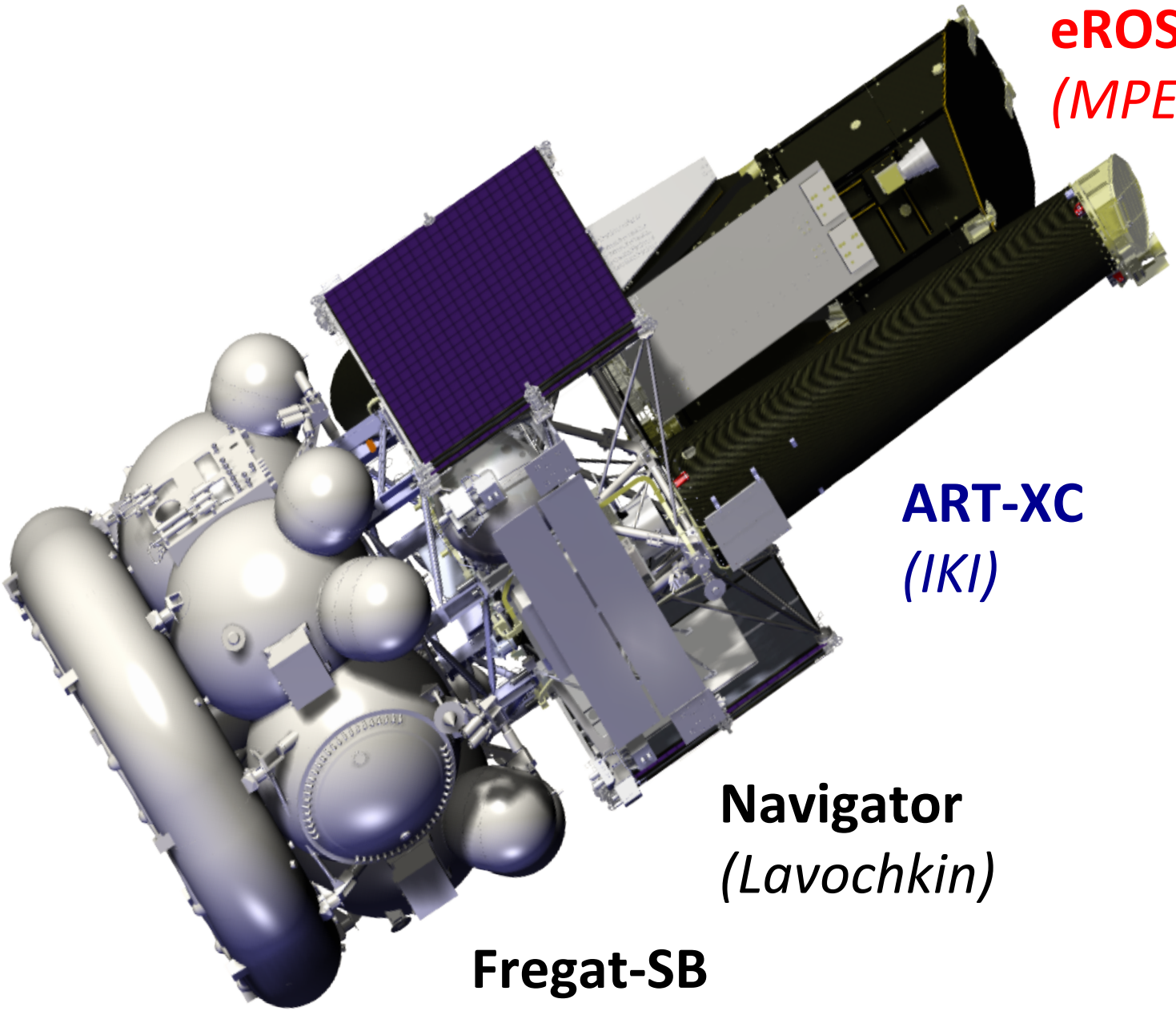


Sergey Sazonov

Space Research Institute (IKI), Moscow

Collaboration

- Roscosmos
- Space Research Institute (IKI), Moscow
- Lavochkin Association, Khimki
- VNIIEF, Sarov
- MSFC/NASA
- DLR
- Max Planck Institute for Extraterrestrial Physics (MPE), Garching
- Institute for Astronomy und Astrophysics, University Tubingen
- Leibniz Institute for Astrophysics, Potsdam
- University Erlangen-Nuernberg
- Hamburg University

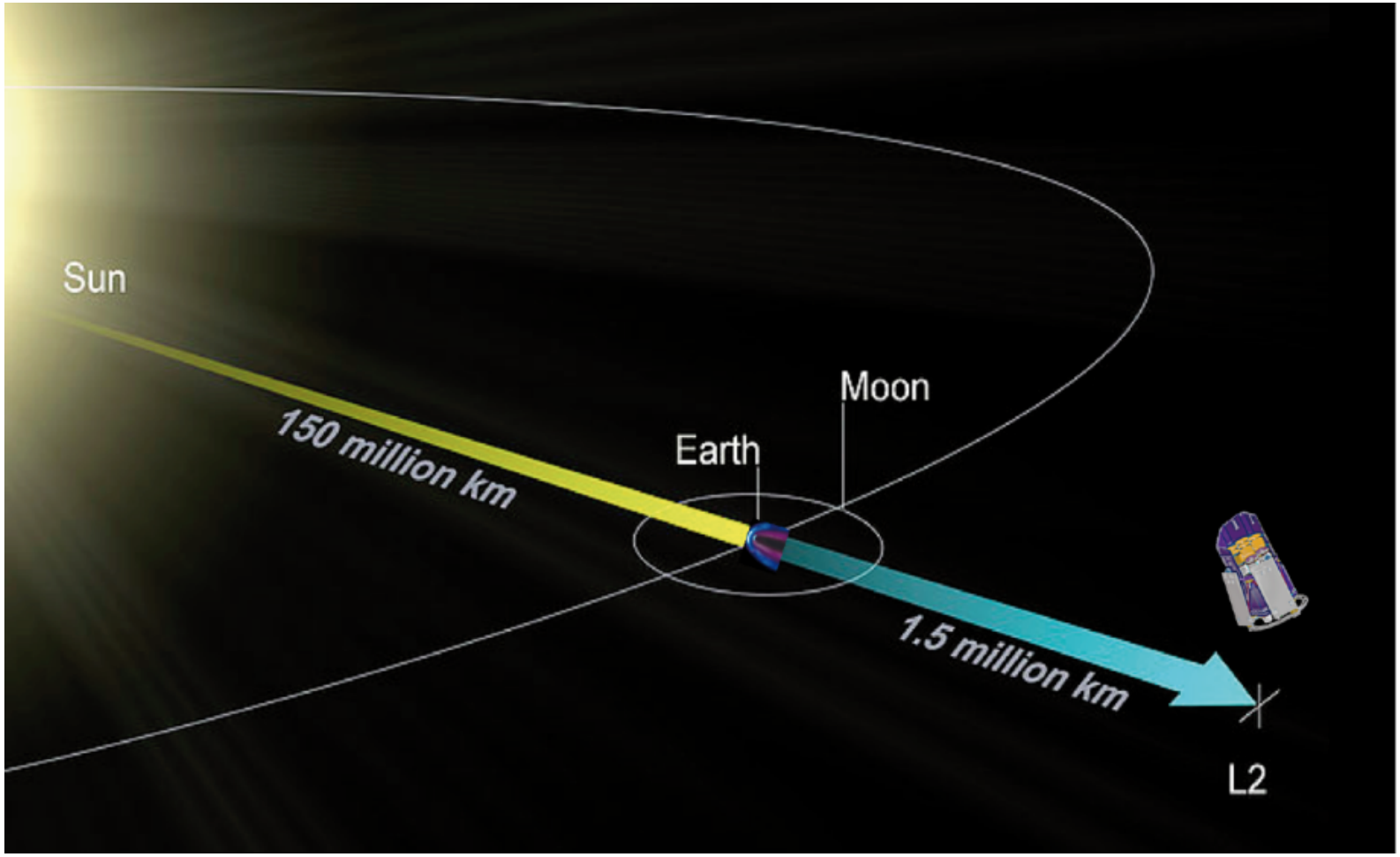


eROSITA
(MPE)

ART-XC
(IKI)

Navigator
(Lavochkin)

Fregat-SB
(Lavochkin)

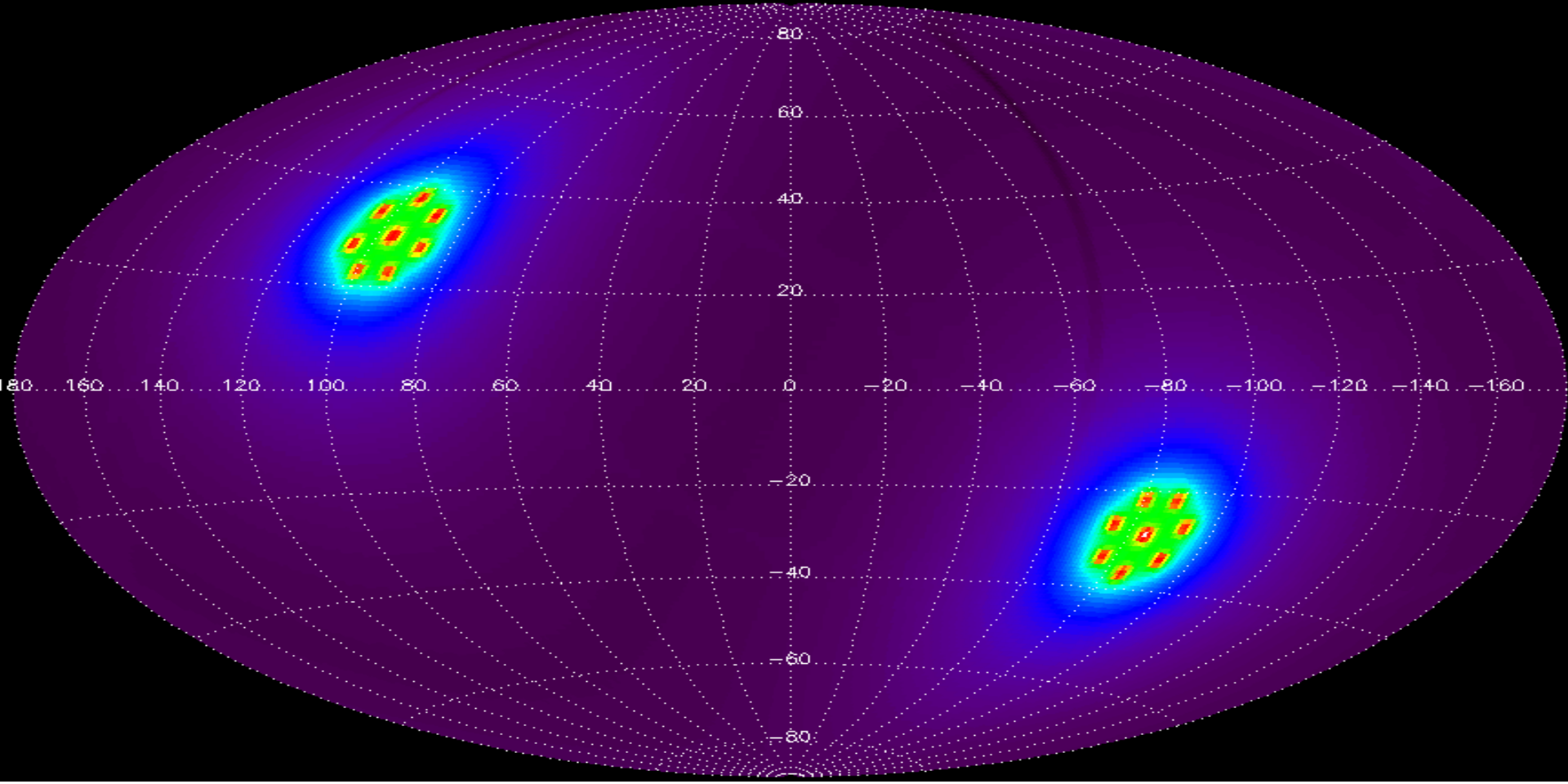


Launch from Baikonur with Zenit-Fregat, 2016

- 3 months: flight to L2, verification and calibration phase

- 4 years: 8 all-sky surveys (scanning mode: 6 rotations/day, 1 deg advance/day)

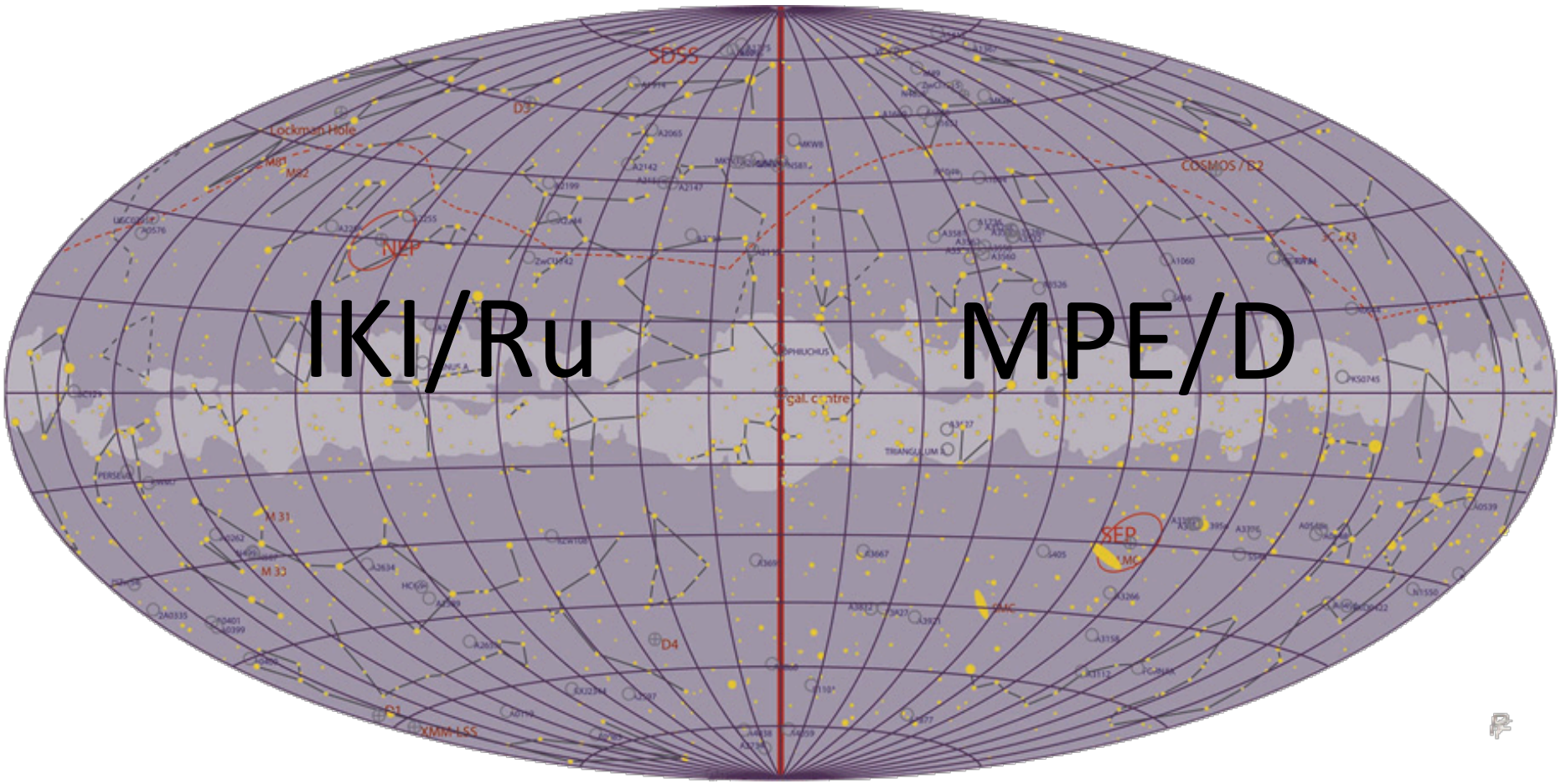
- 3 years: pointed observation phase (1 AO per year)



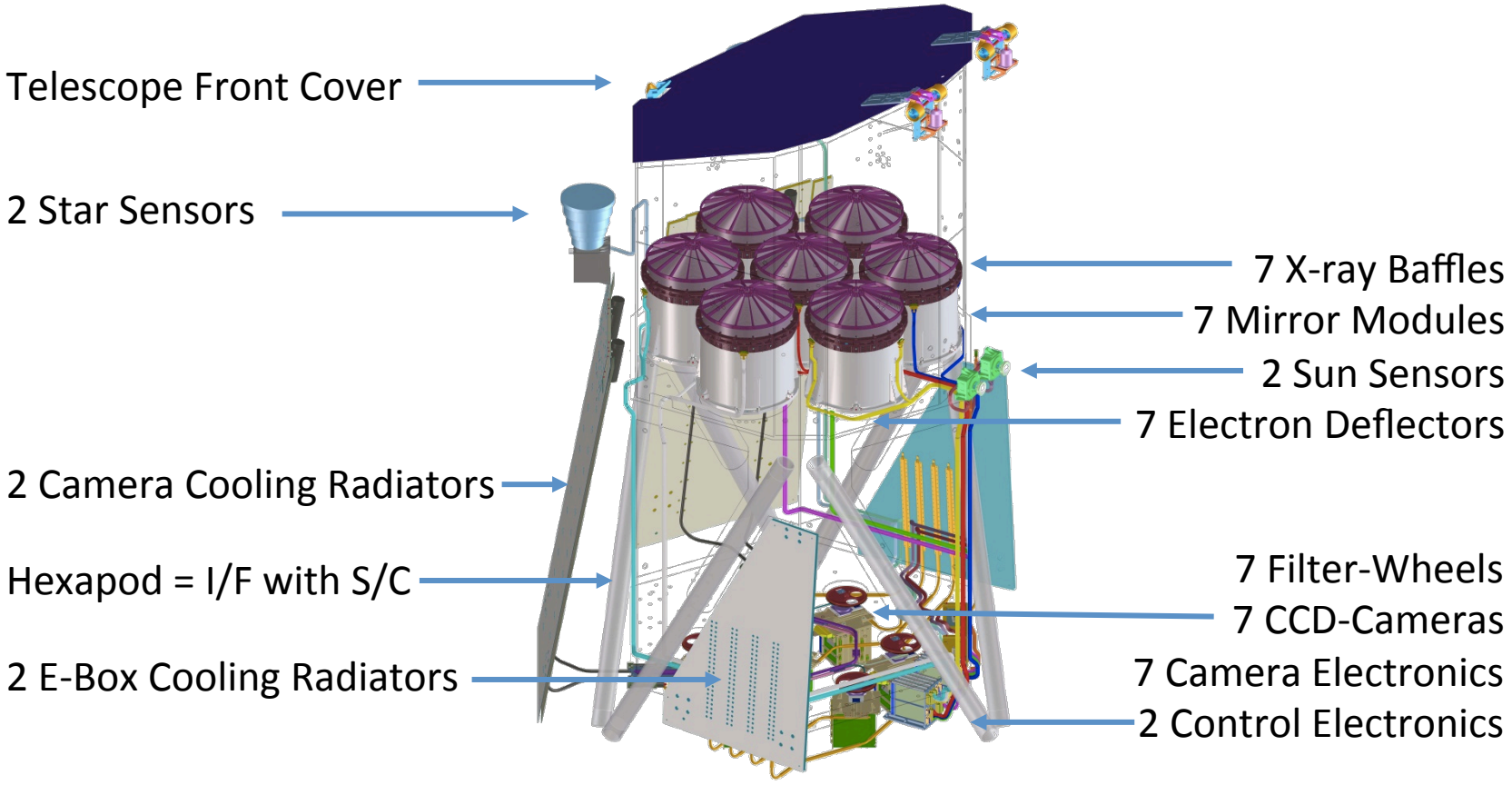
Exposure map (Galactic coordinates)

- **Average exposure (4 years) ~2 ks**
- **Exposure near Ecliptic poles ~30 ks**

Sky division

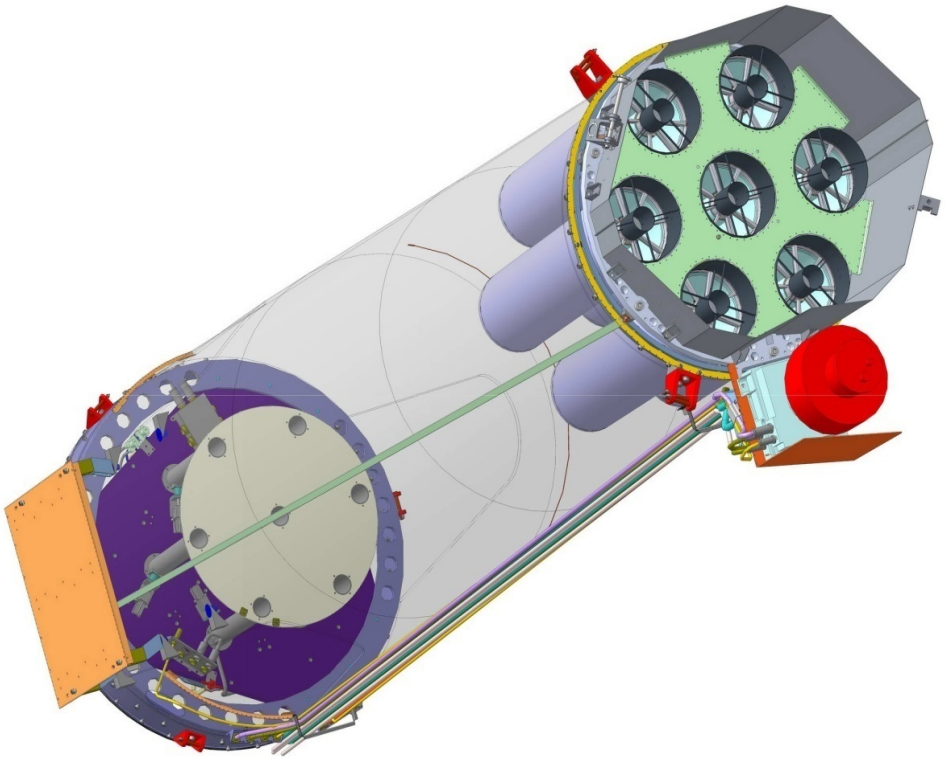


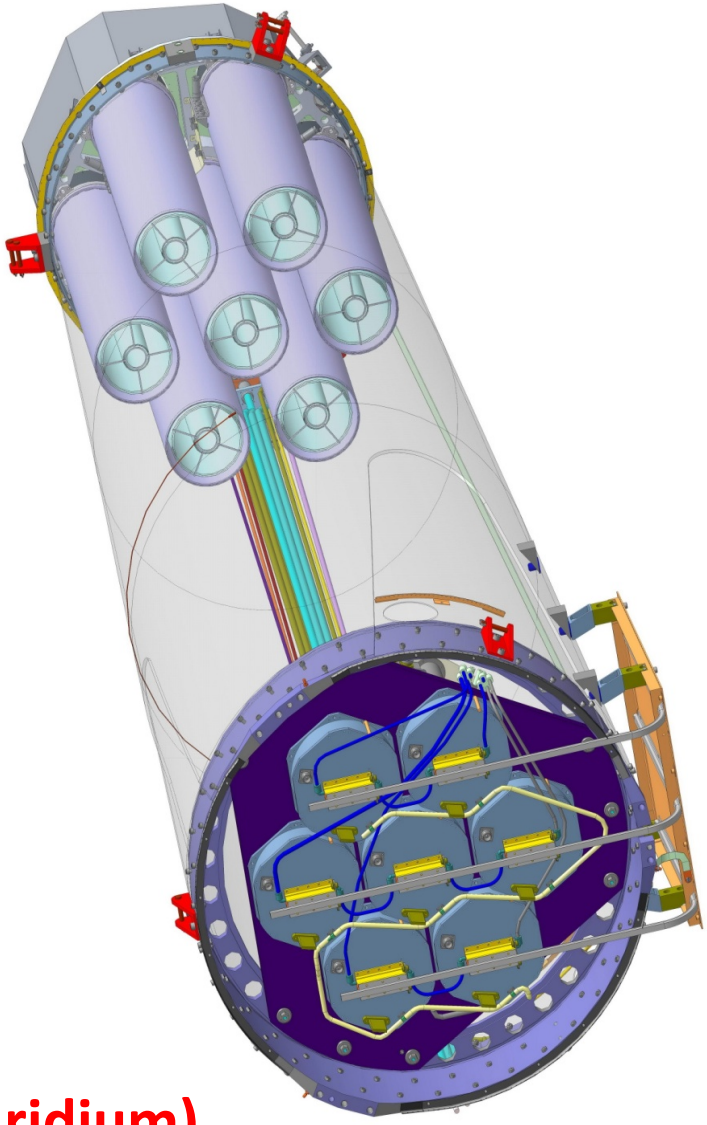
eROSITA



Wolter-1 optics
Focal length 1.6 m
7 mirror modules of 54 shells (coated by gold)

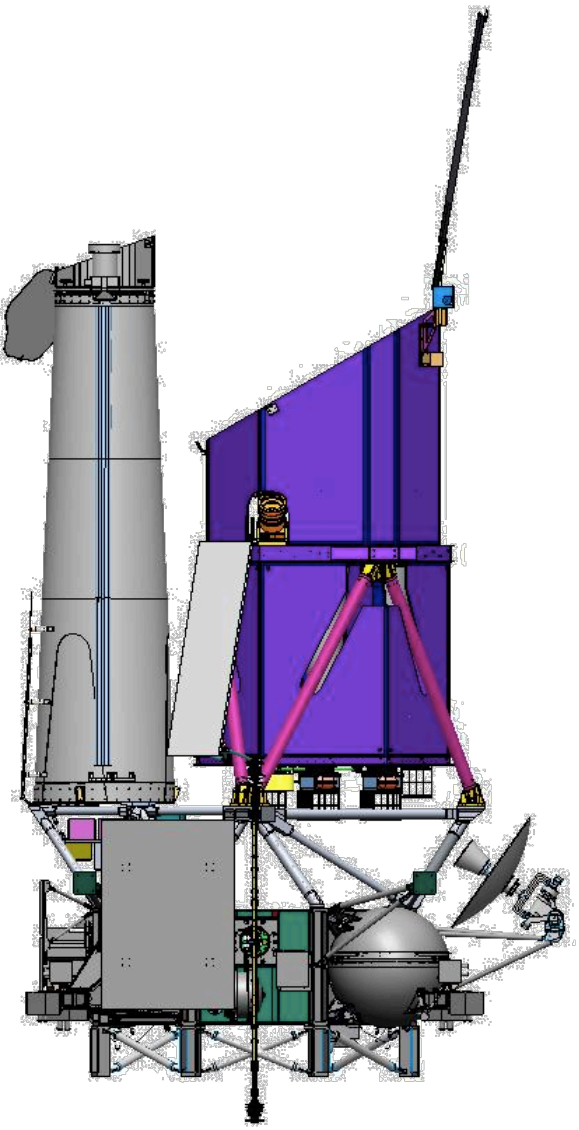
ART-XC





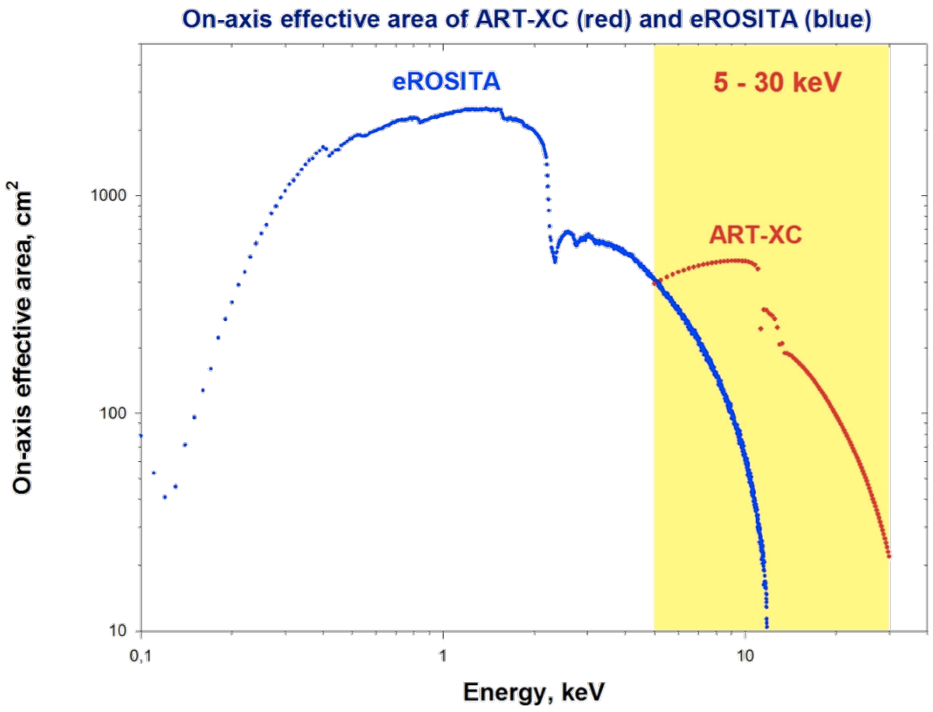
Wolter-1 optics
Focal length 2.7 m
7 mirror modules of 28 shells (coated by Iridium)

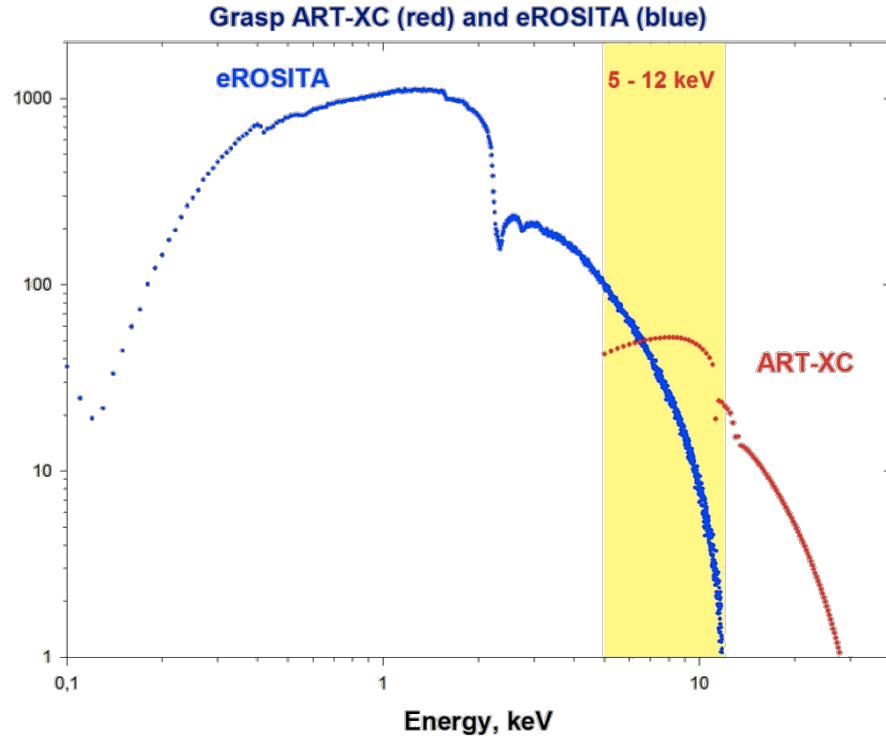
Scientific payload



	eROSITA	ART-XC
Energy band	0.2-10 keV	5-30 keV
Field of view	1 deg	30’
Angular resolution (HEW on-axis)	15”	45”
Area	2400 cm^2 @ 1 keV	450 cm^2 @ 8 keV

Effective area and grasp



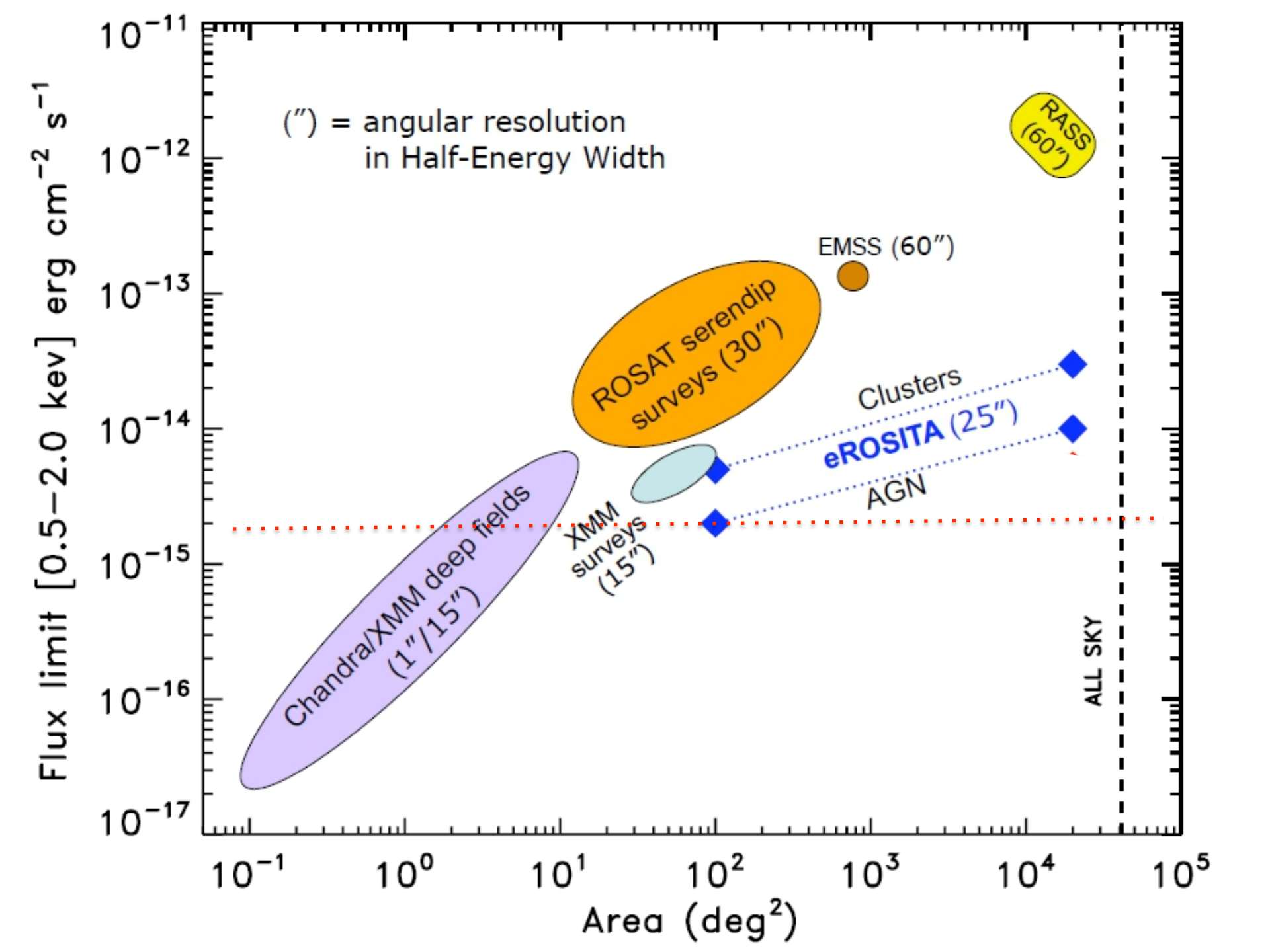


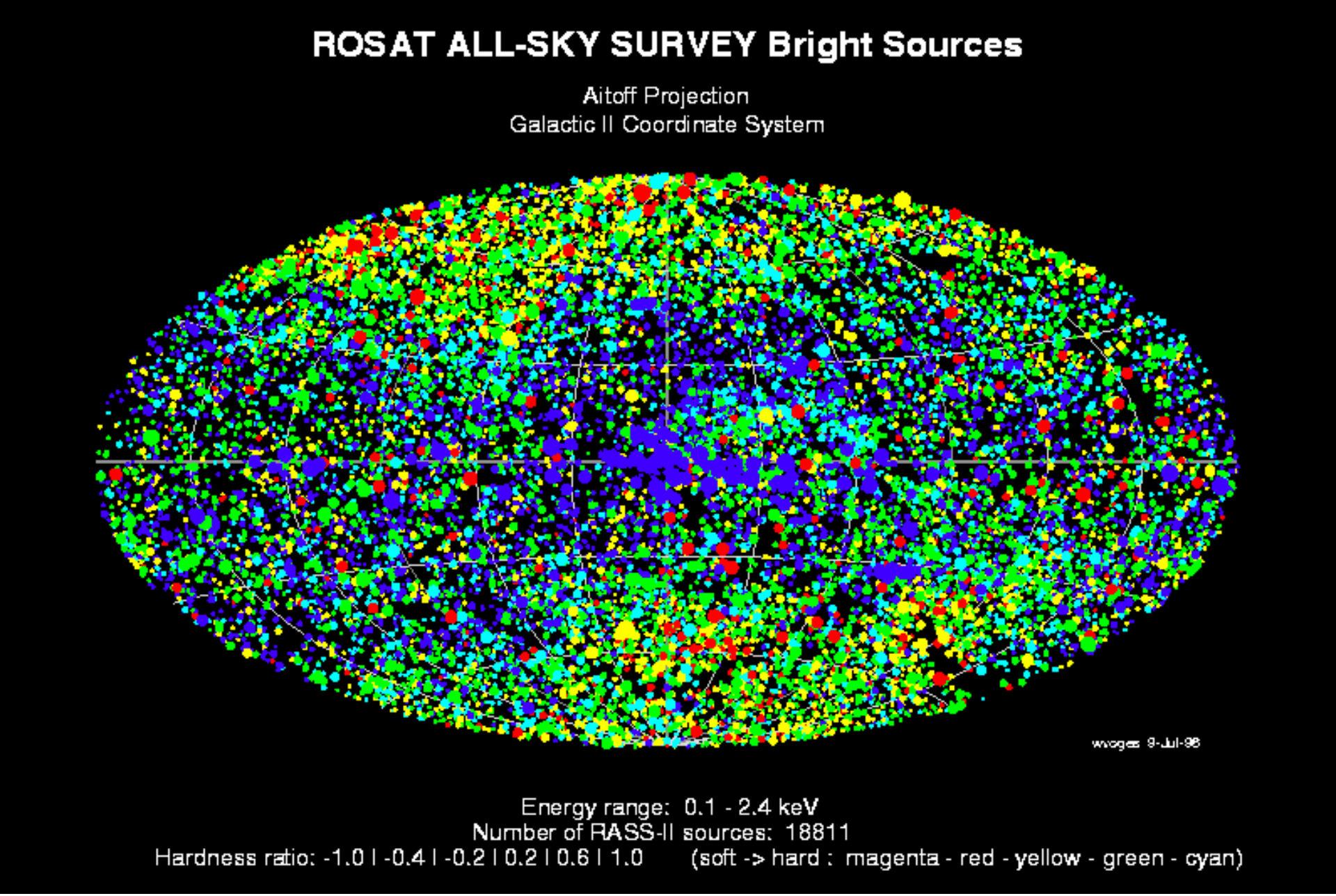
2500 см^2 @ 1.4 keV

450 см^2 @ 8 keV

1100 см^2 deg^2 @ 1.4 keV

45 см^2 deg^2 @ 8 keV


(″) = angular resolution
in Half-Energy Width
RASS (60″)
EMSS (60″)
ROSAT serendip surveys (30″)
Clusters
eROSITA (25″)
AGN
XMM surveys (15″)
Chandra/XMM deep fields (1″/15″)
ALL SKY
Flux limit [0.5−2.0 kev] erg cm^{-2} s^{-1}
Area (deg^2)
10^{-11}
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}



Bright Source Catalog: 18811 sources

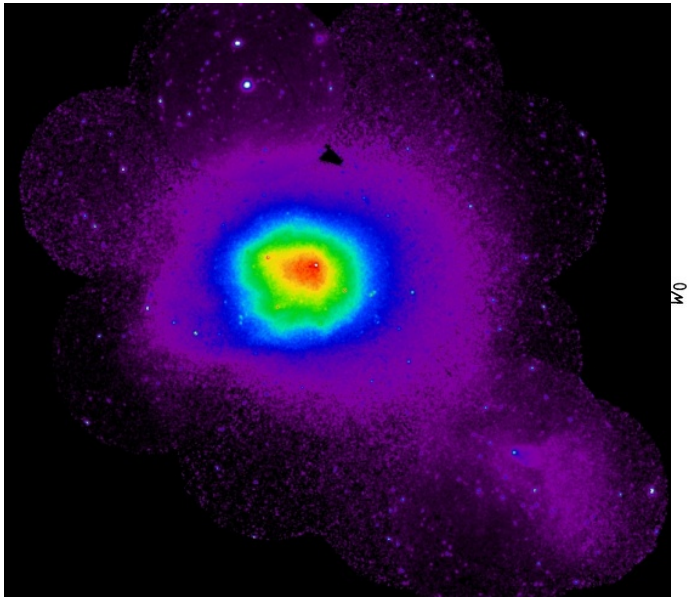
Faint Source Catalog: 105924 sources

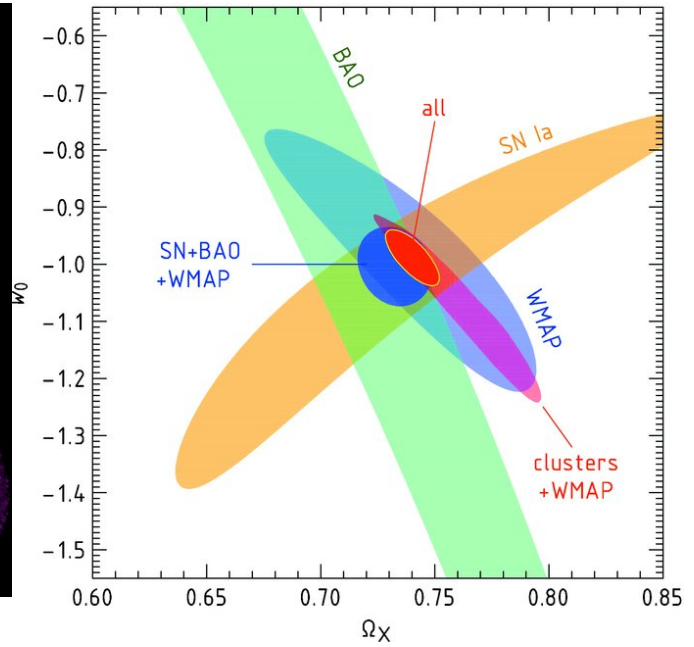
SRG All-Sky Survey

- ~100,000 Galaxy clusters
- ~3,000,000 Active Galactic Nuclei
- ~1,000,000 Stars
- ~100,000 Cataclysmic variables
- Isolated neutron stars, X-ray binaries …
- Diffuse X-ray emission (SNRs, local bubble …)
- Planets, comets …
- ???

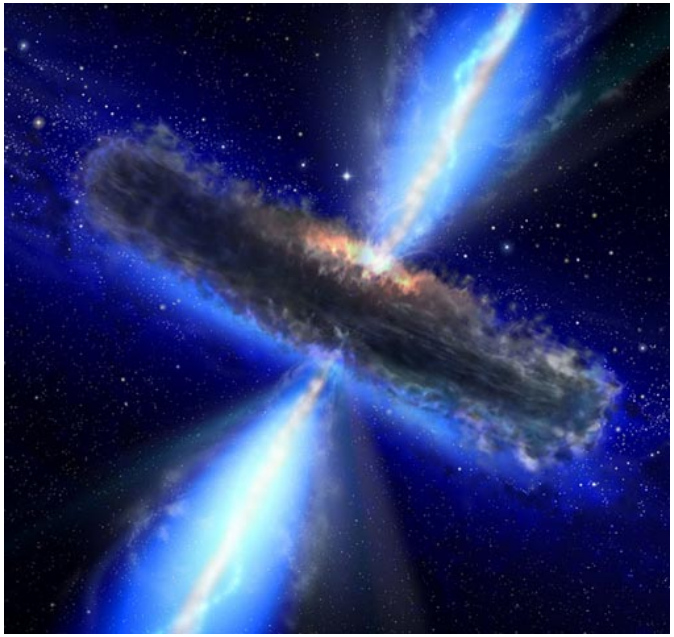
Including rare/exotic objects!

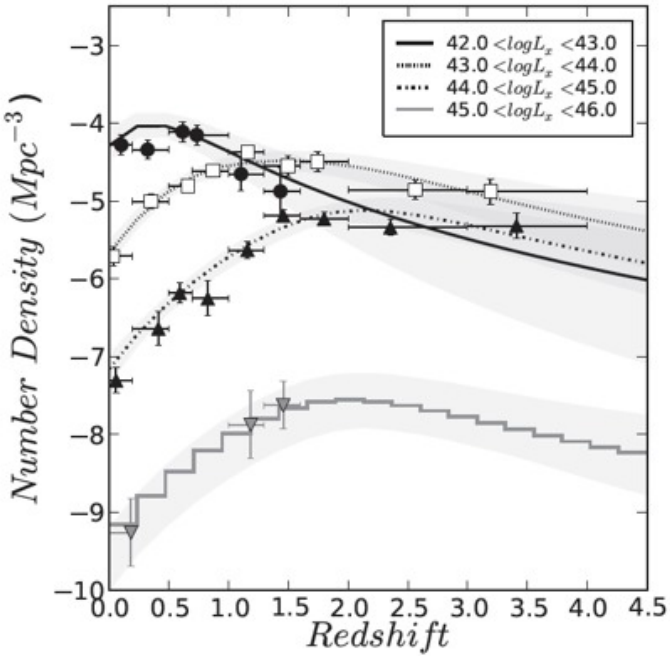
Dark energy equation of state



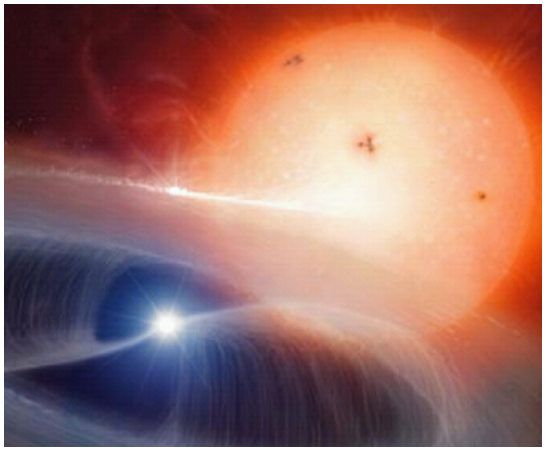


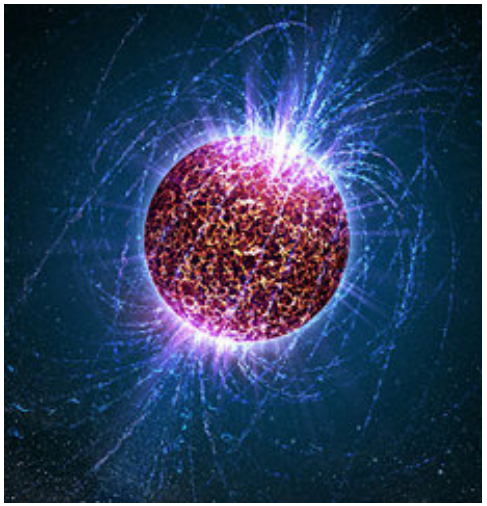
Growth of SMBHs

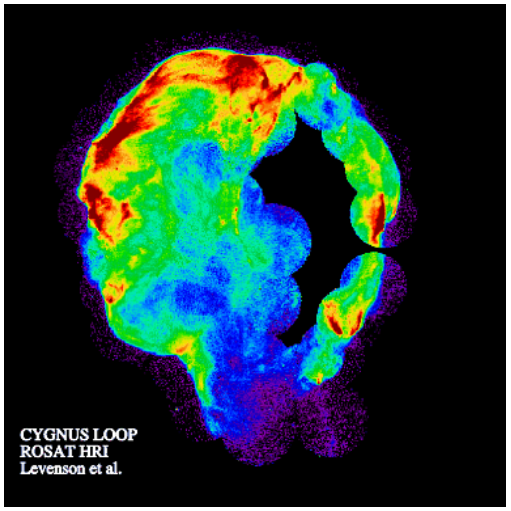


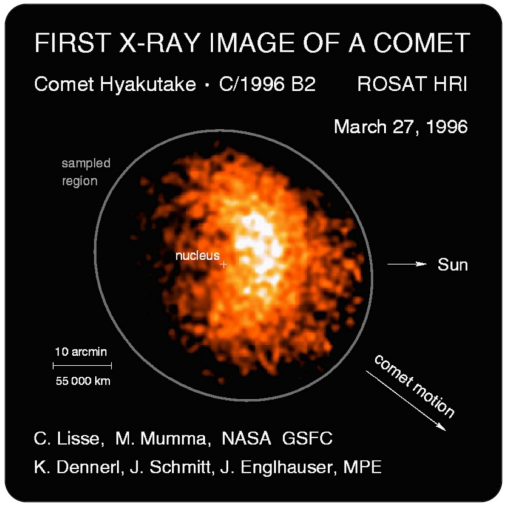


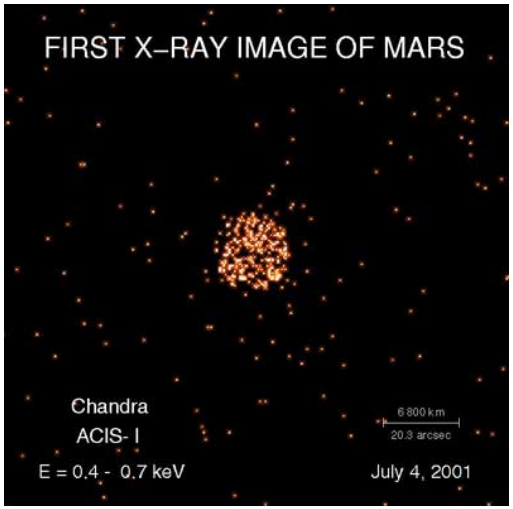
Galactic objects









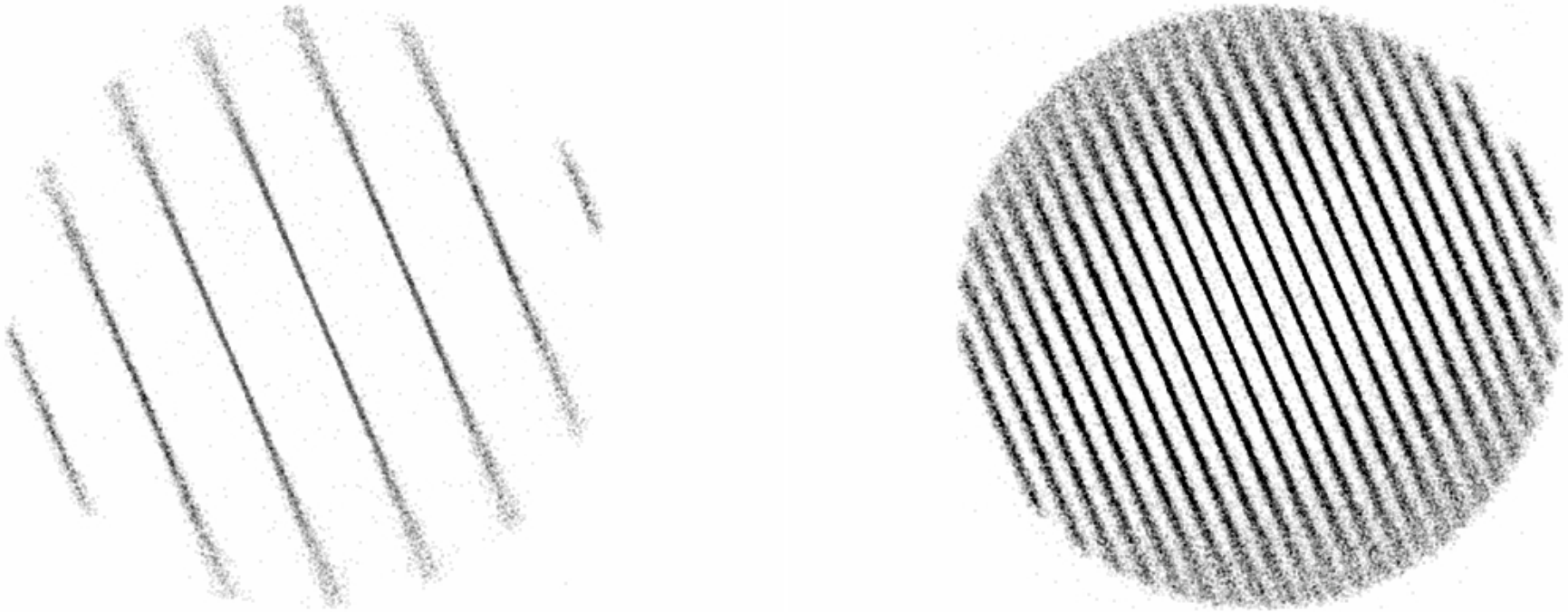


Isolated neutron stars

eROSITA (+ART-XC) can discover:

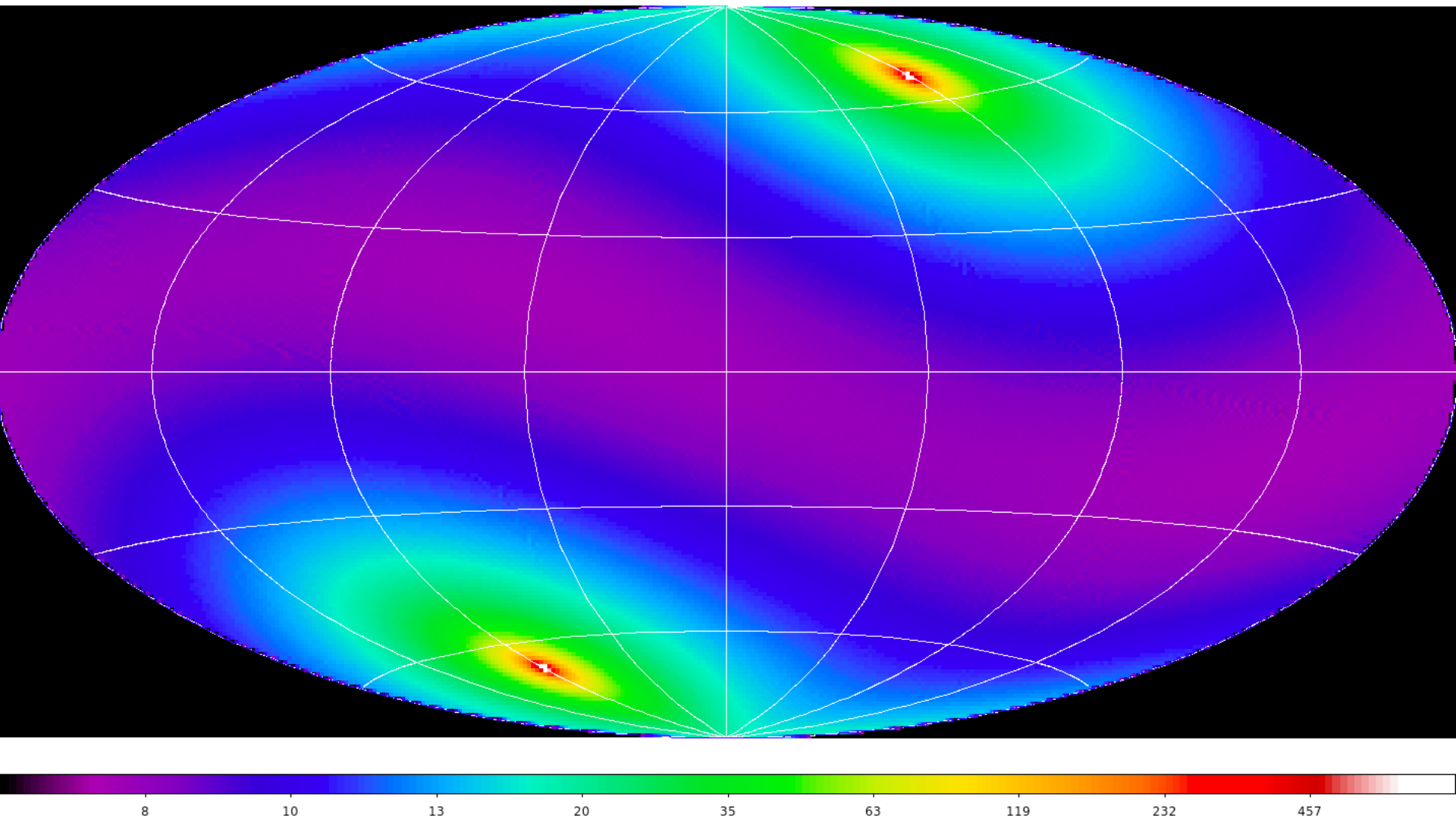
- ❑ **XDINSs (M7) beyond the Gould Belt (~100 or more)**
- ❑ **Faint magnetars, compact central objects**
- ❑ **Accreting ISNs**

Variability studies



Simulated images of a series of eROSITA scans over a bright (~100 mCrab) point-like source at low ecliptic latitude

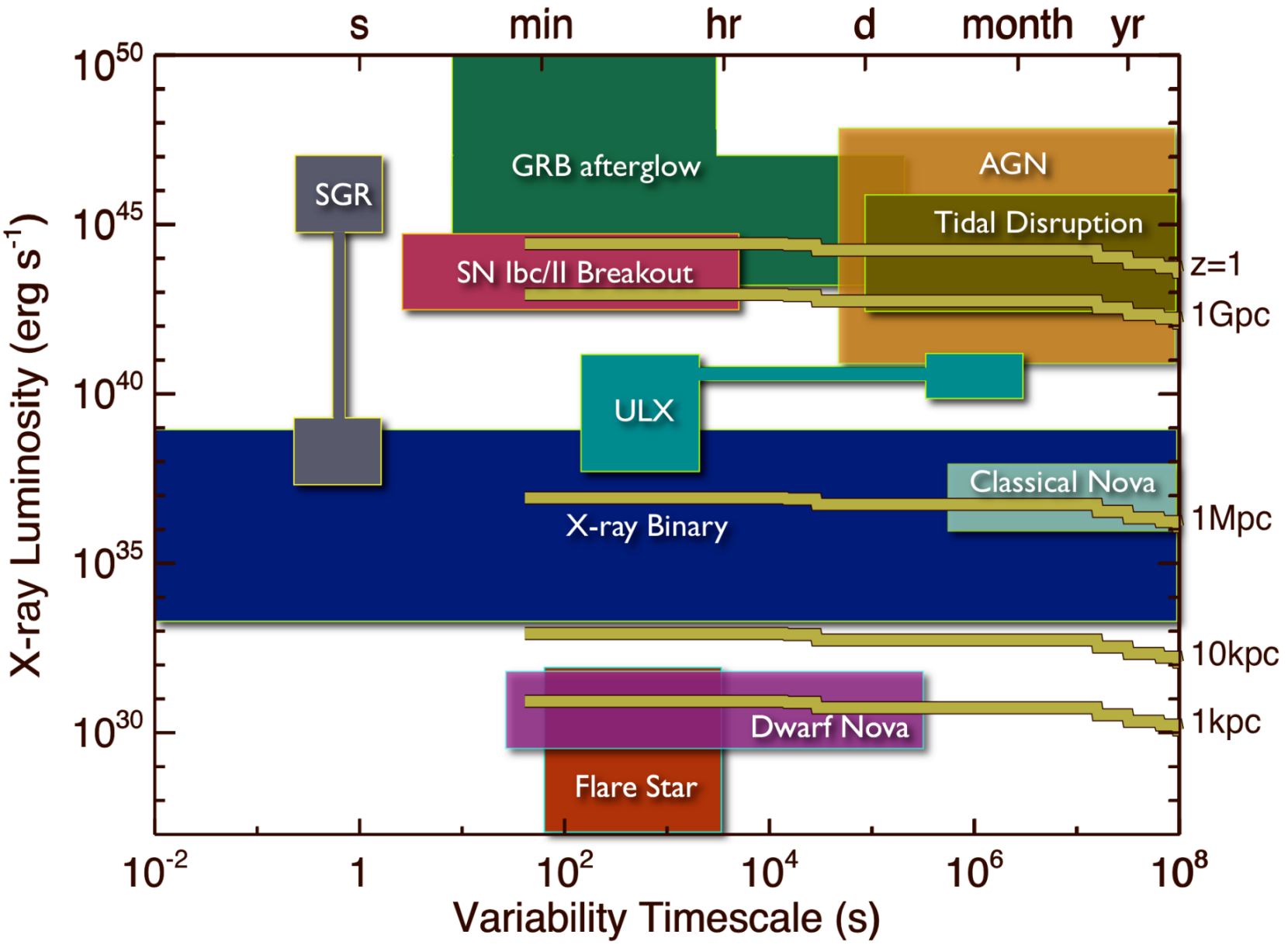
Merloni et al. 2012



eROSITA all-sky survey “cadence” map (equatorial coordinates)

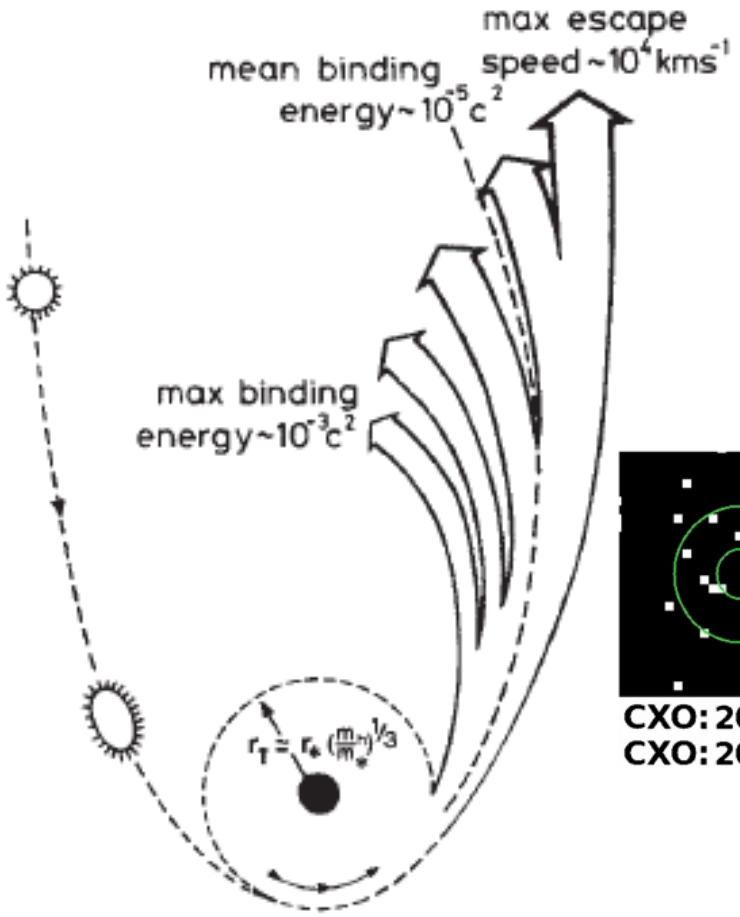
Number of daily visits of eROSITA during the 4-year survey. Each daily visit, with a total exposure of ~250 s consists of ~6 scans of ~30 sec each. About 1,000 deg^2 around the poles will be visited more than 30 times.

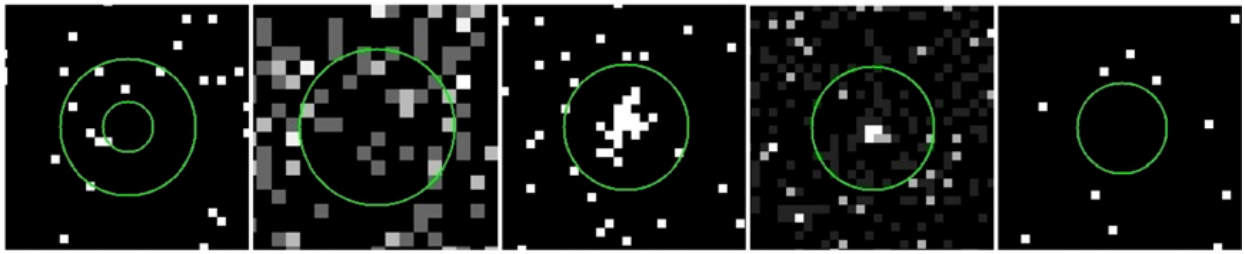
Merloni et al. 2012



Merloni et al. 2012

Tidal disruption events

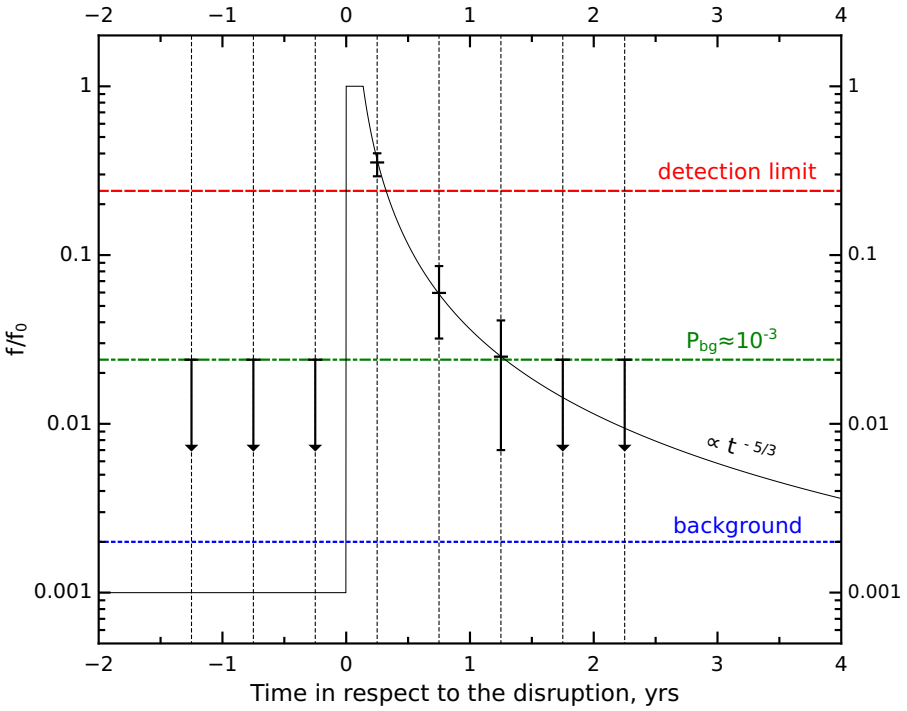


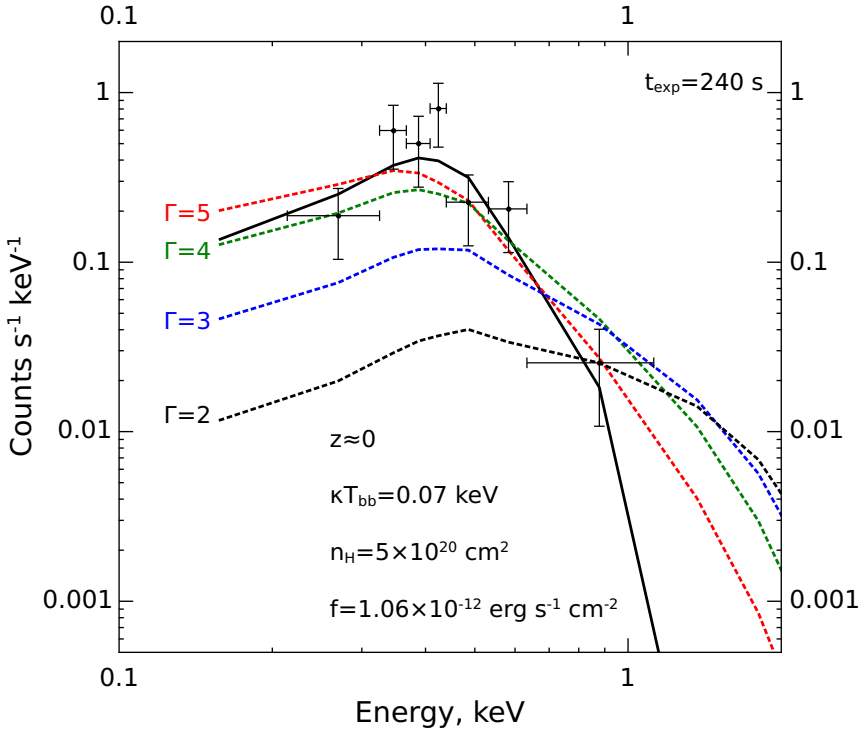


Maksym et al. 2010

Rees,1988

Tidal disruption events



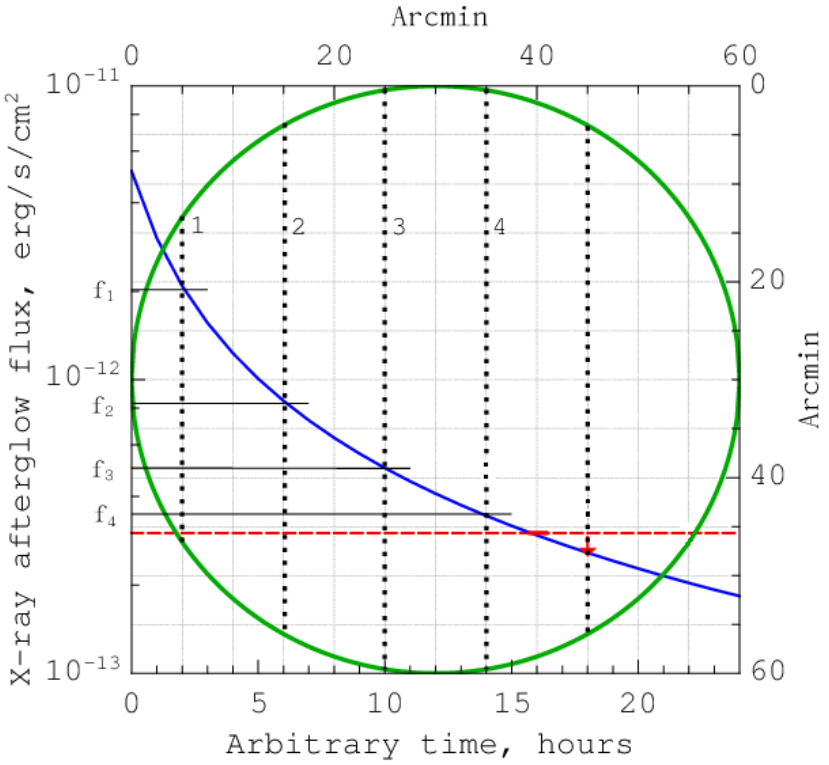


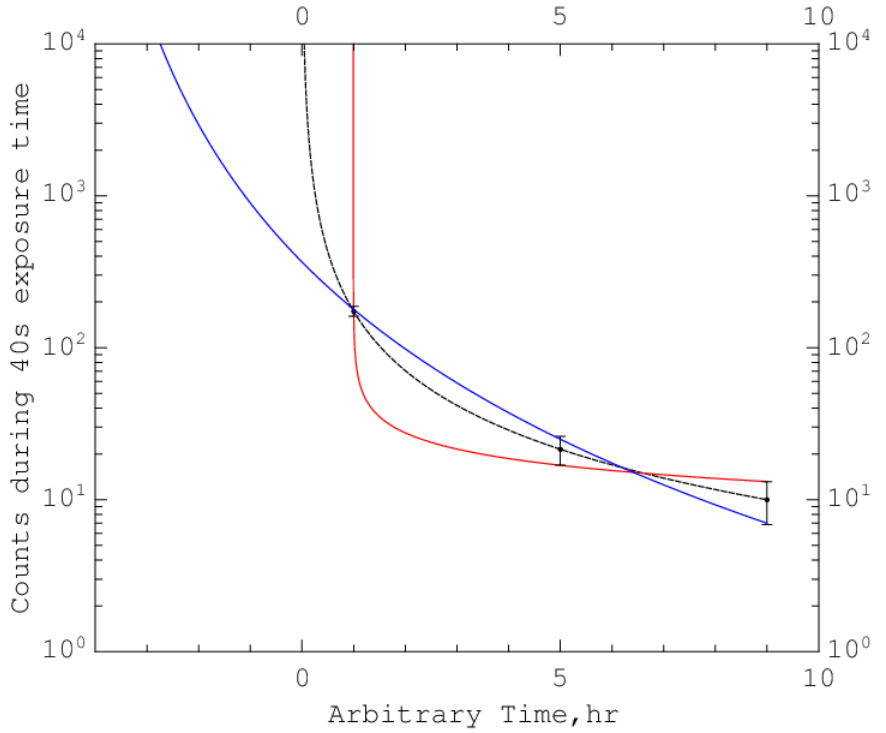
eROSITA can detect ~1,000 such X-ray flares per year

=> Wealth of information about SMBHs and nuclear stellar clusters

Khabibullin et al. 2014

GRB afterglows



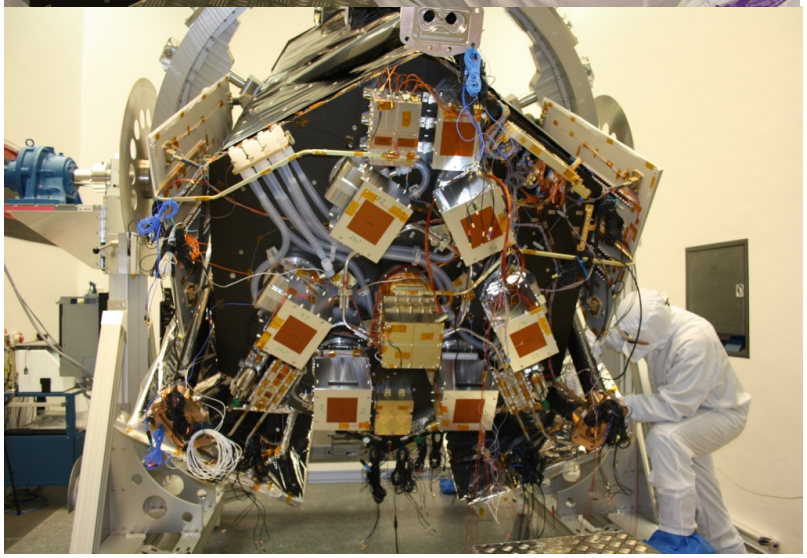


eROSITA can detect ~10 GRB afterglows/year + unknown number of orphan afterglows and failed GRBs

⇒ Unbiased statistics of GRB afterglows and related phenomena

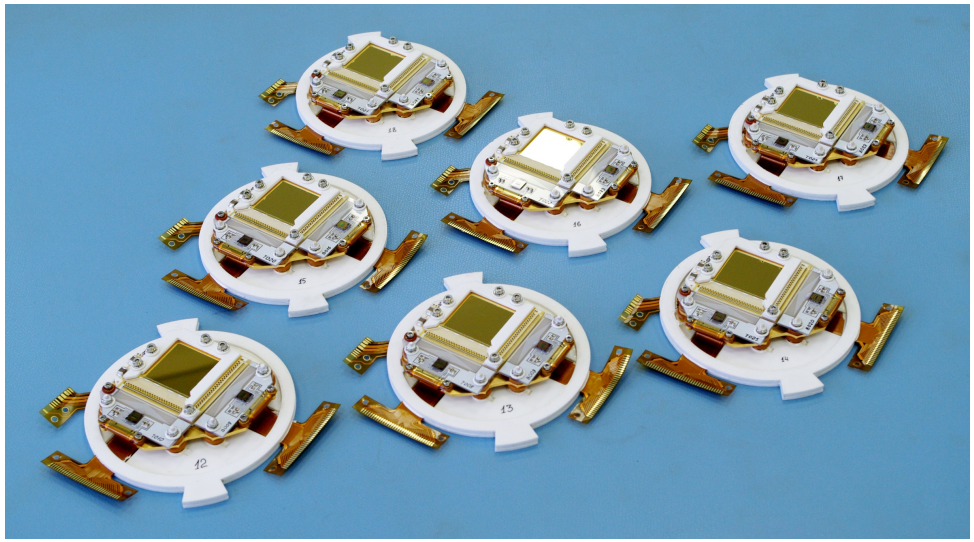
Khabibullin et al. 2012

eROSITA

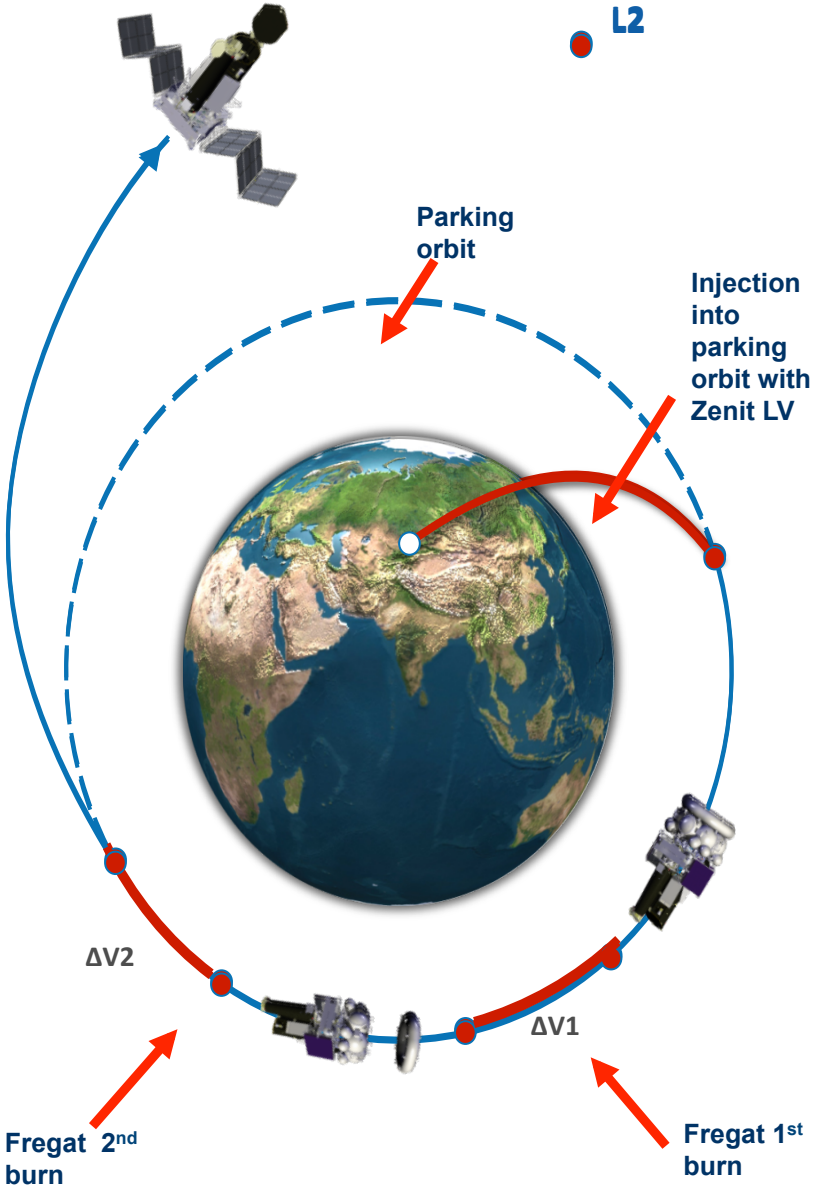


Predehl et al. 2014

ART-XC



2016


L2
Parking orbit
Injection into parking orbit with Zenit LV
ΔV2
ΔV1
Fregat 2nd burn
Fregat 1st burn