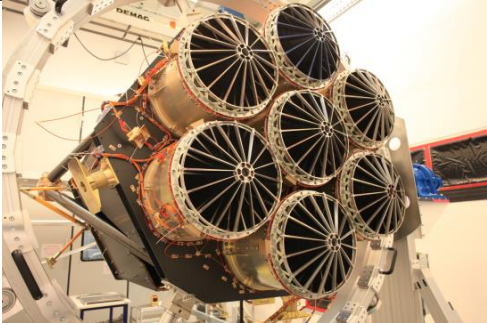
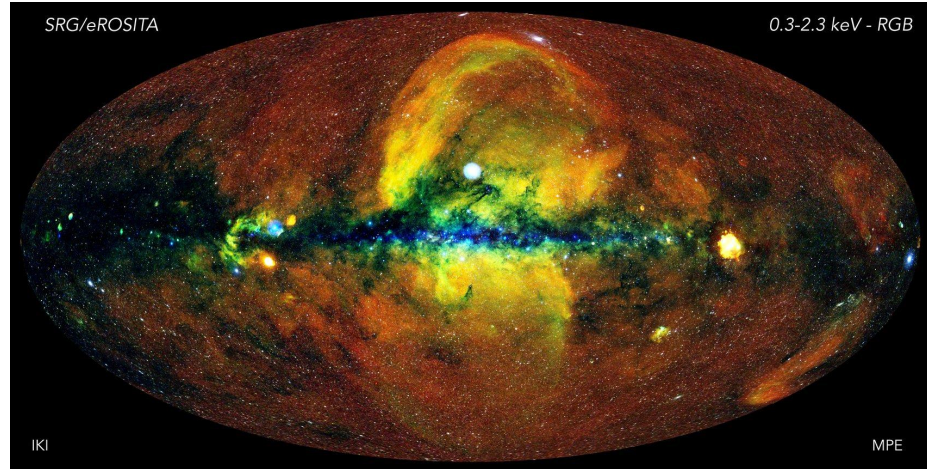




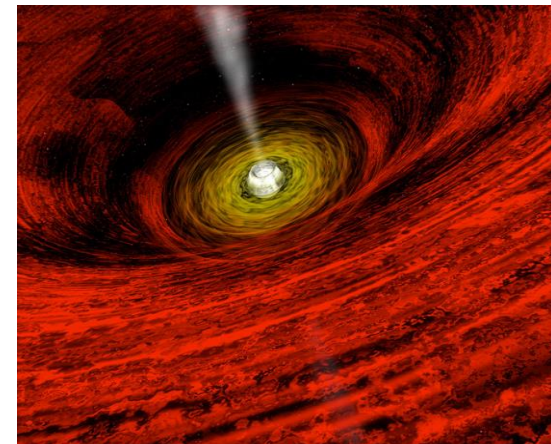
UN Committee  
Vienna

April 27<sup>th</sup>, 2021



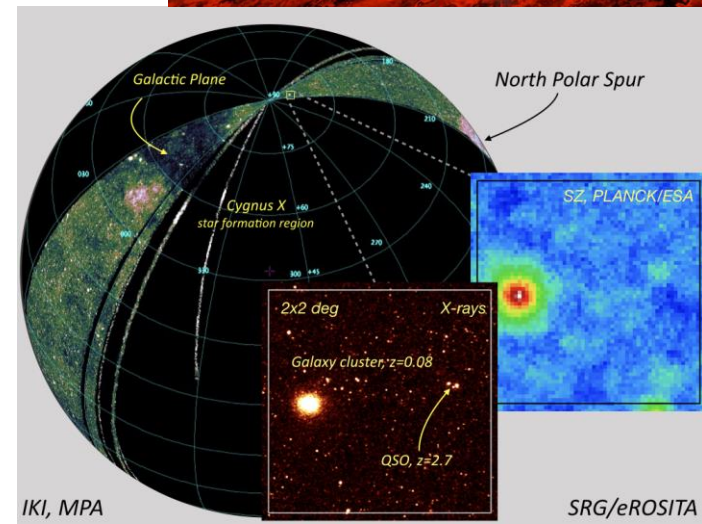
**SRG Orbital Observatory**  
*with Russian ART-XC and  
German eRosita X-Ray Telescopes  
aboard*

*A million of accreting supermassive  
Black Holes  
on the X-Ray Map of the whole Sky*



Rashid Sunyaev

**Space Research Institute (IKI),  
Russian Academy of Sciences  
Moscow**





Lavochkin industry  
mass 2700 kg

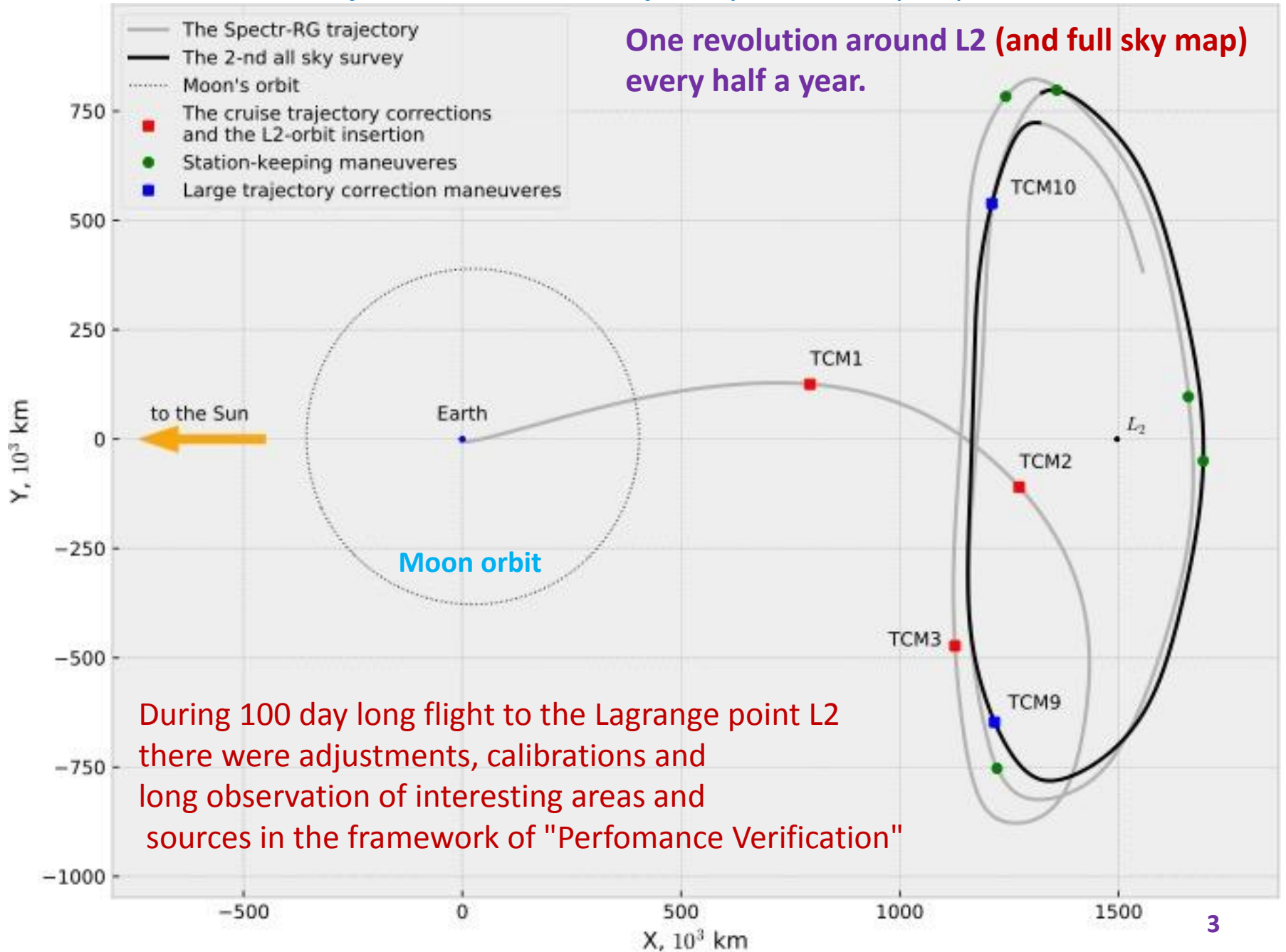
ART-XC (350 kg)  
Russia

Navigator  
Platform

eRosita (808 kg)  
3.5m \* 1.9m  
Germany



# Projection of the SRG trajectory on the ecliptic plane

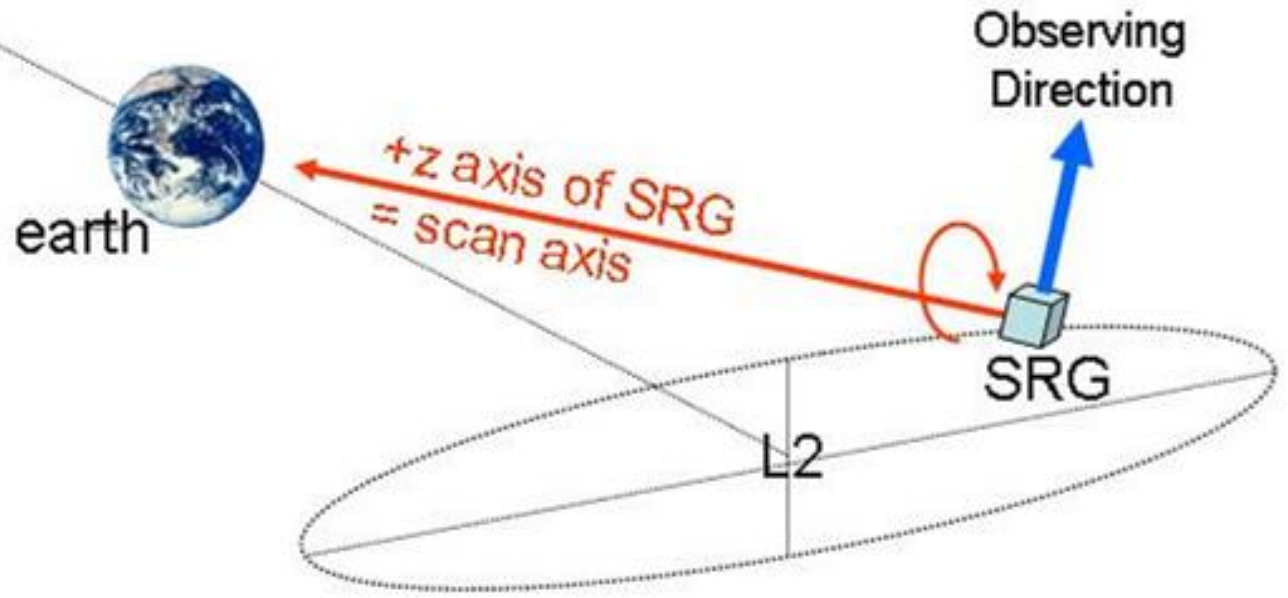
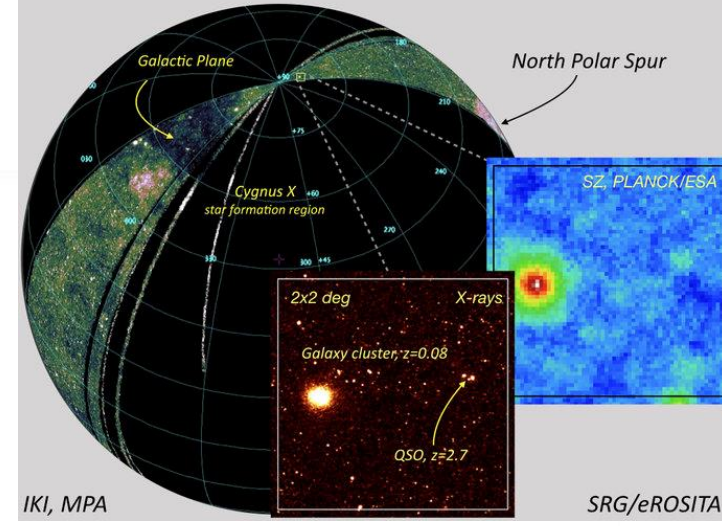




Every day the plane of the scan shifts slowly to one degree, following the Sun and leaving one degree wide strip on the sky map



One revolution around direction toward Sun every 4 hours.



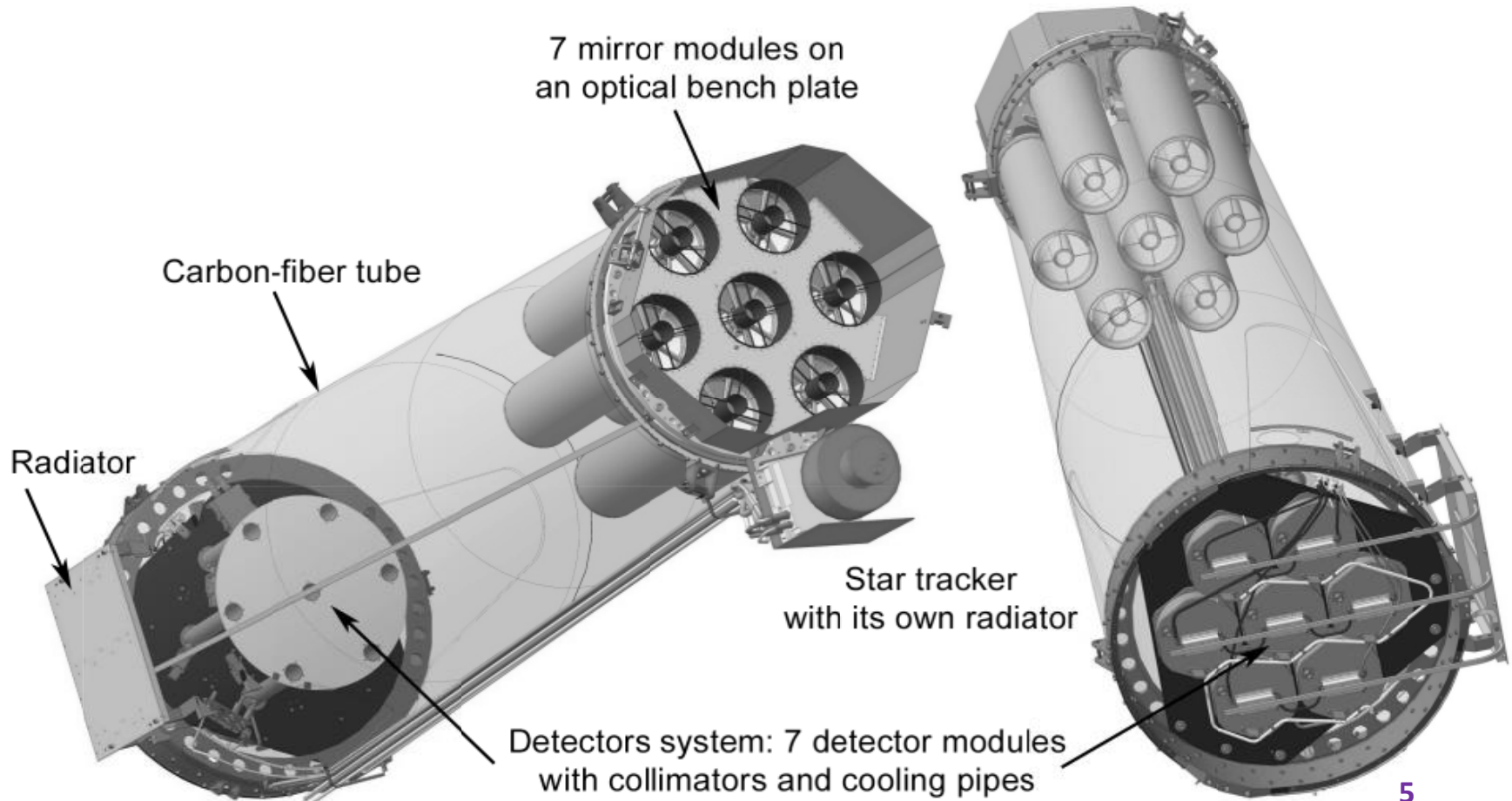
Every source on the sky is observed 6 times per day once in a half year (This permits to look for the short time variability)

**ART-XC named after  
Mikhail Pavlinsky**

- Energy range: 5-30 keV
- FOV: 34°
- On-axis resolution 1'
- Energy resol. 12% at 14keV
- Time res. 27 microsec

**IKI, Russian Federal Nuclear Center VNIIEF**

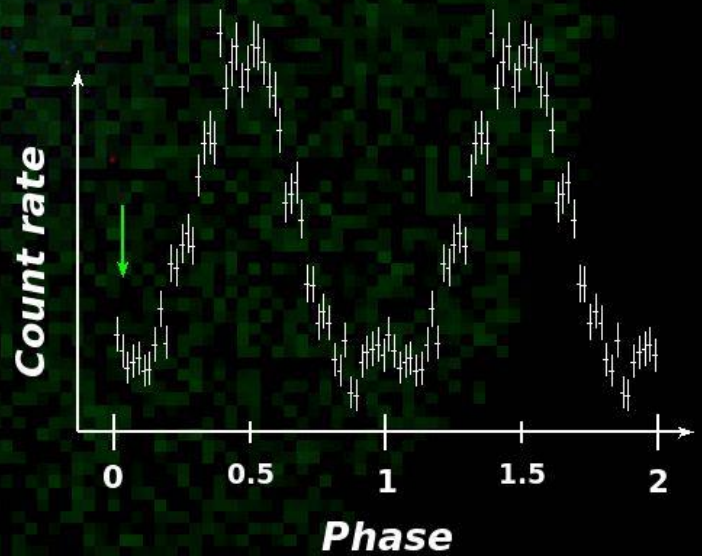
**X-Ray grazing incidence mirrors: Marshall Space Flight Center, NASA**



1 arcmin



CHANDRA: 0.5 - 1.7 keV  
1.7 - 3.0 keV  
ART-XC: 4.0 - 12.0 keV



SRG/ART-XC: IKI RAS  
CHANDRA : NASA/CXC/SAO

pulsar *PSR B1509-58* in X-rays

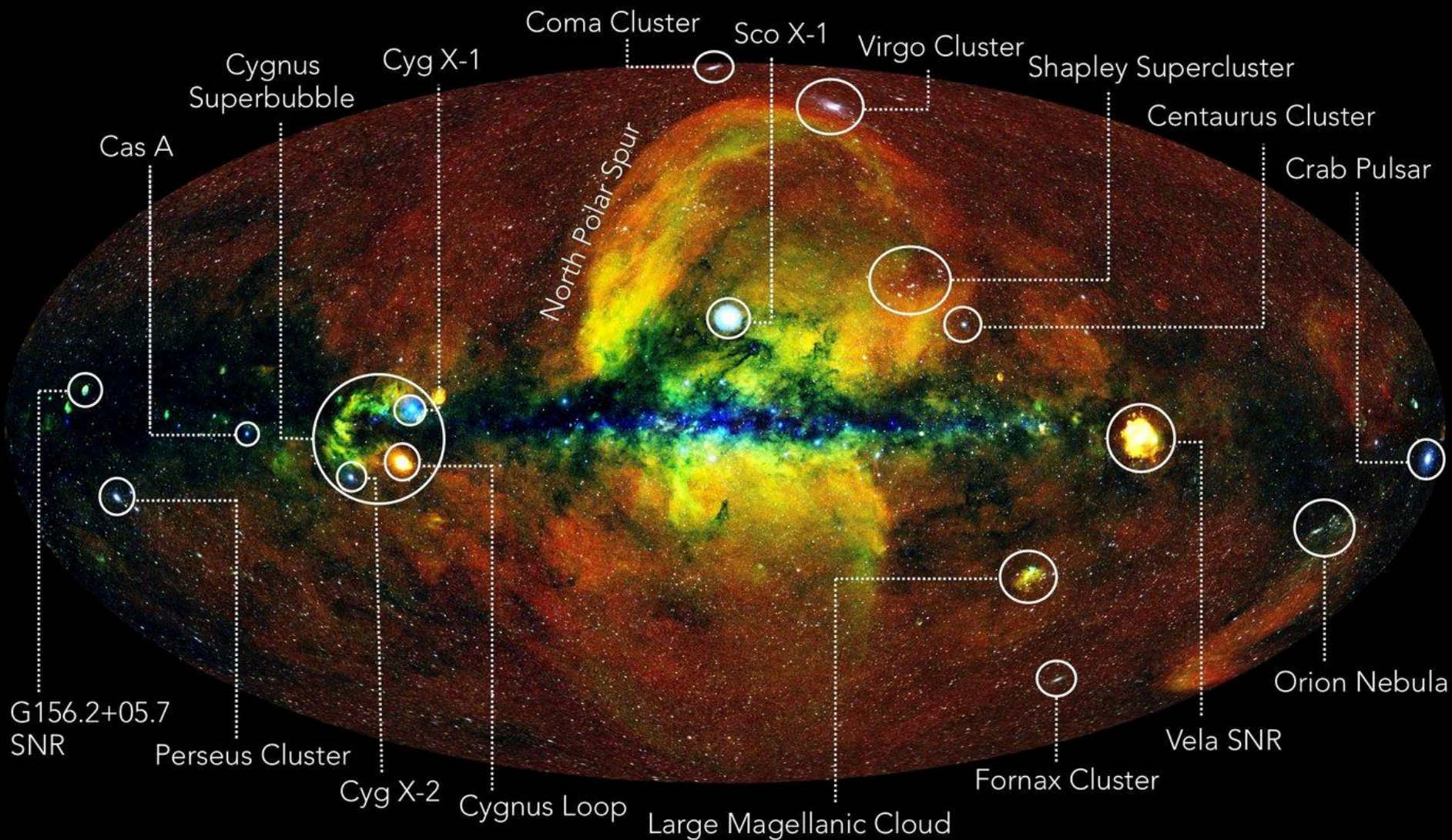
The integration time of the eROSITA CCDs is 50 ms.

ART-XC has excellent time resolution of 23  $\mu$ s.

ART-XC team



# Navigating the eROSITA X-ray sky

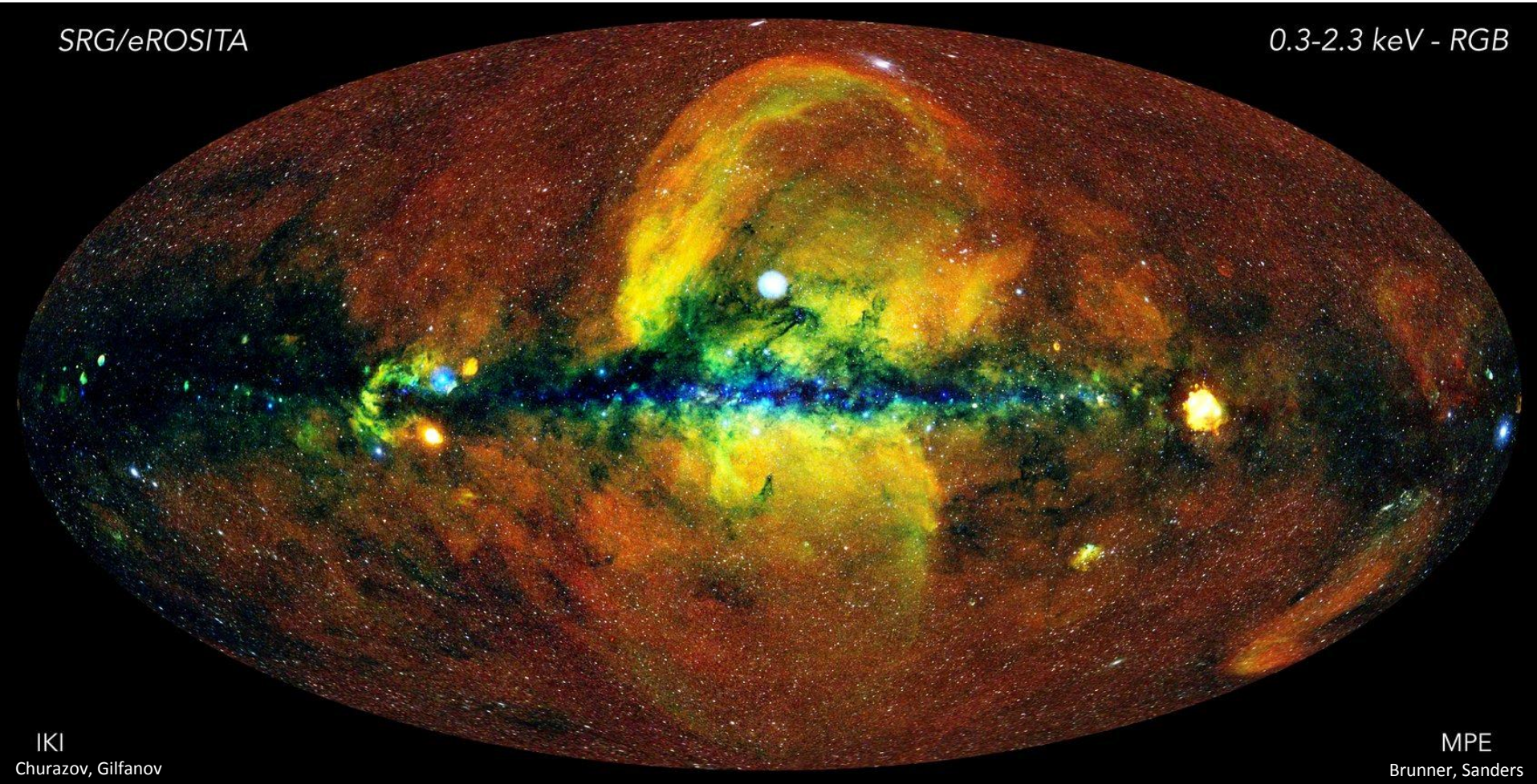




The first SRG all-sky survey allowed to construct a map containing almost 8 times more X-Ray sources than the former world-best map of the ROSAT satellite, obtained in 1990.

SRG/eROSITA

0.3-2.3 keV - RGB

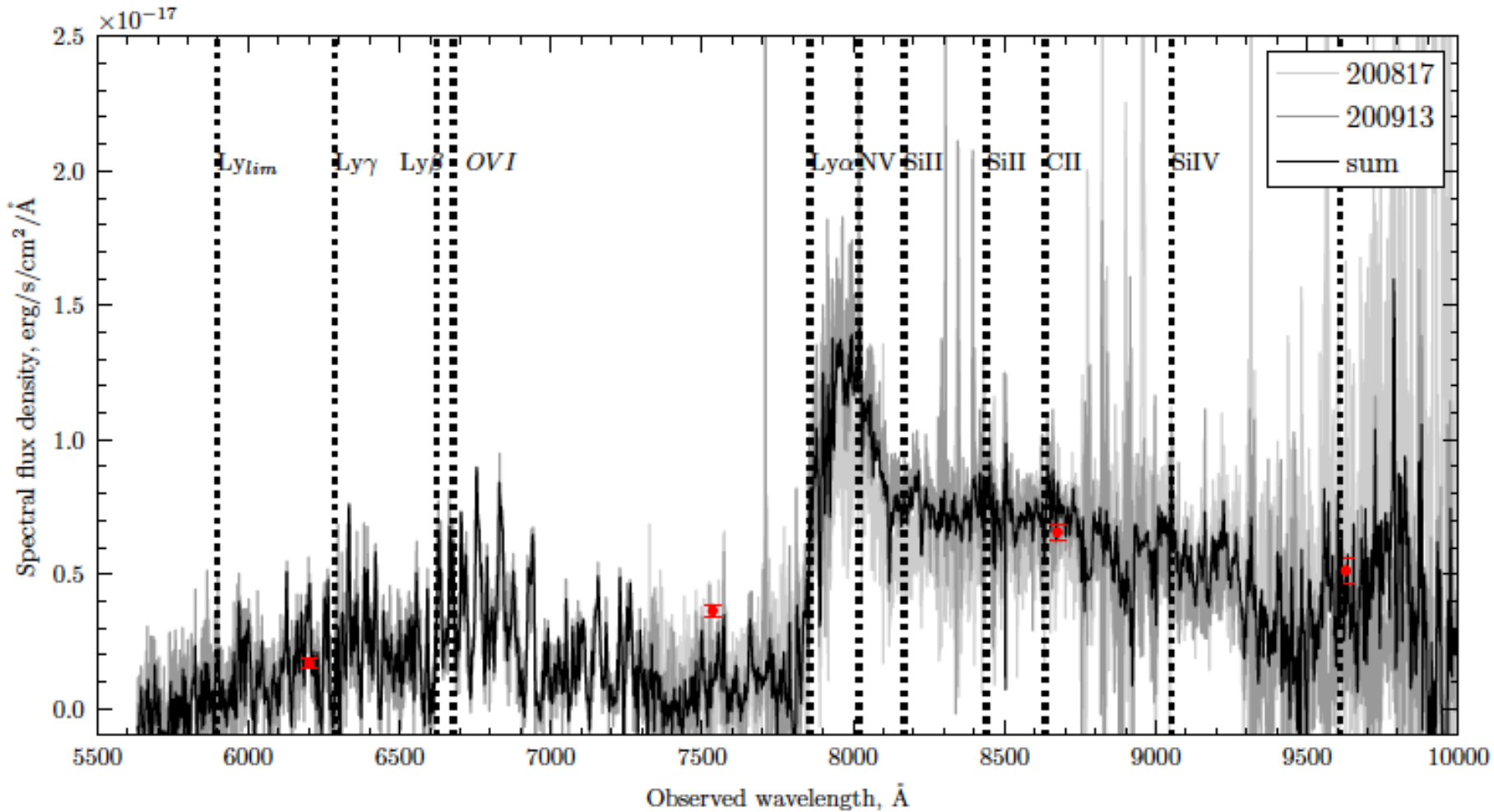


IKI  
Churazov, Gilfanov

MPE  
Brunner, Sanders

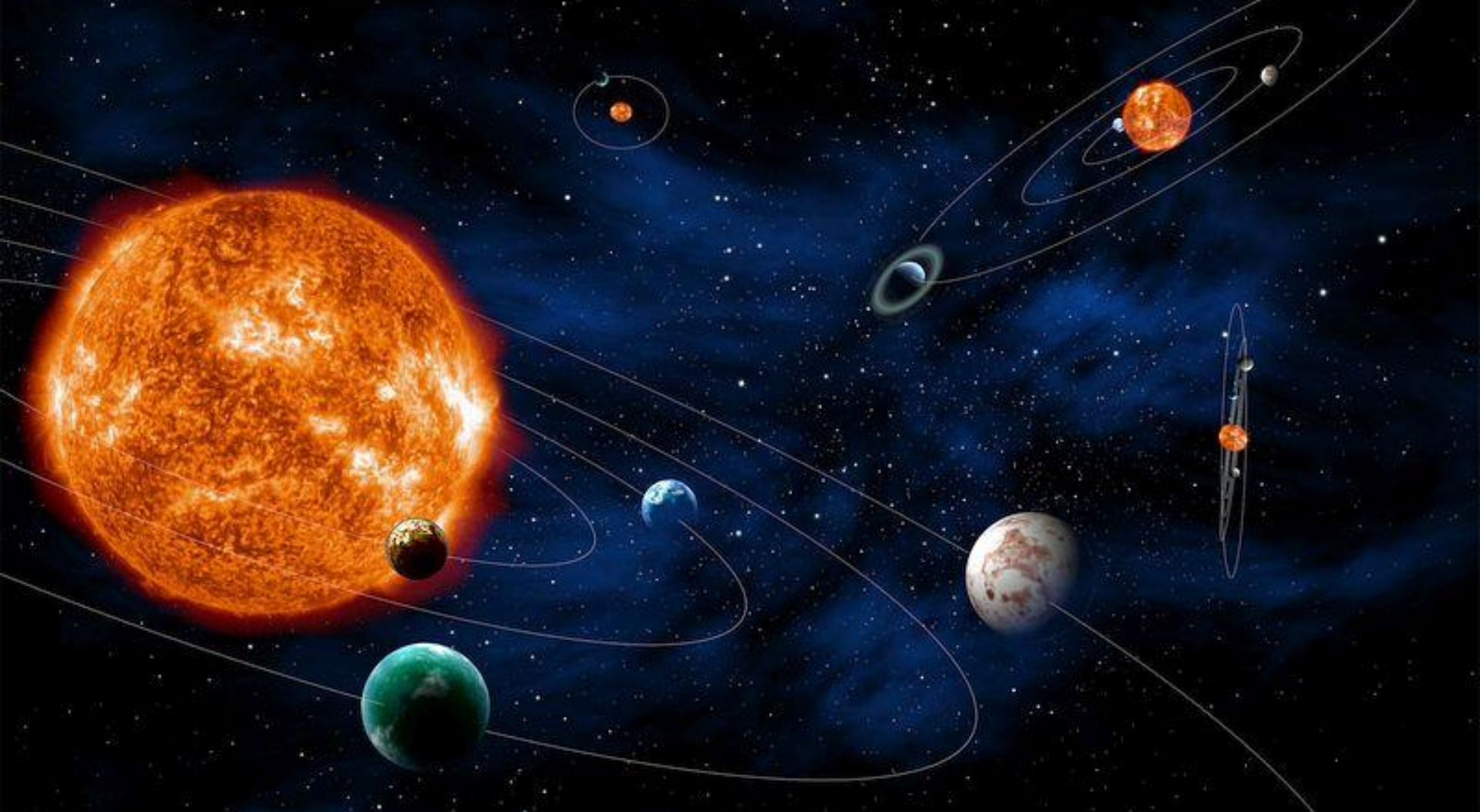
Three quarters of a Million objects on this map are distant quasars and active galactic nuclei powered by accretion of matter onto supermassive black holes residing in their centers. They are far beyond the Milky Way at distances of hundreds of millions and billions of light years from us. We see also 20 000 extended objects (mainly clusters of galaxies) and more than 200 000 galactic stars with active coronae.





Optical spectrum of quasar SRGEJ170245.2+130107 (discovered by SRG/eROSITA) obtained with the BTA 6m telescope. The vertical dashed lines show the expected positions of the peaks of the emission lines of the quasar at  $z = 5.466$ . Adopted from (Khorunzhev et al. 2021)

**All lines are redshifted 6.466 times !**



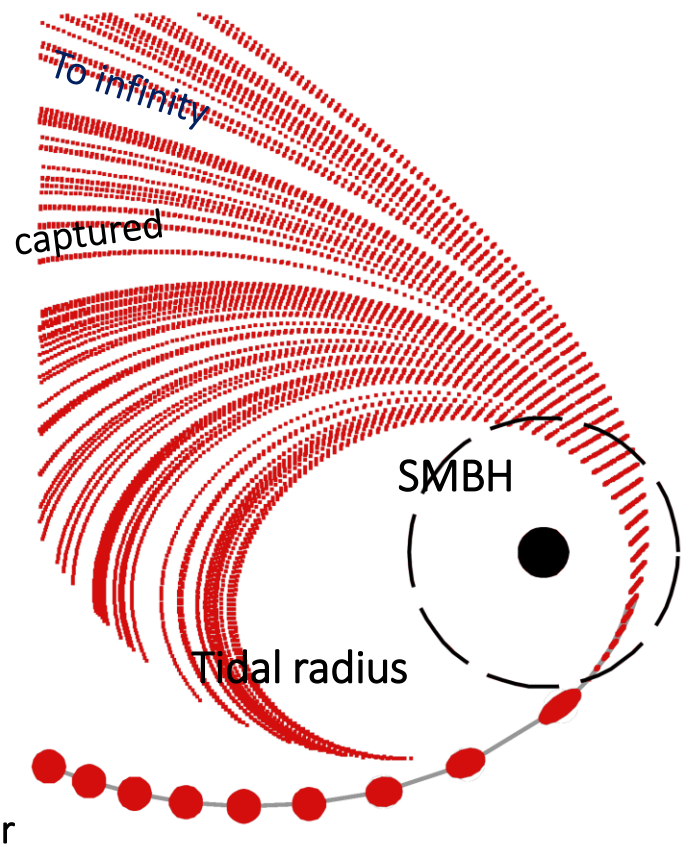
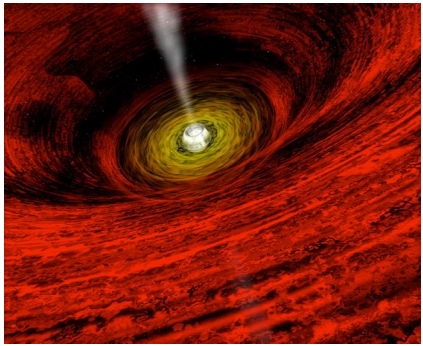
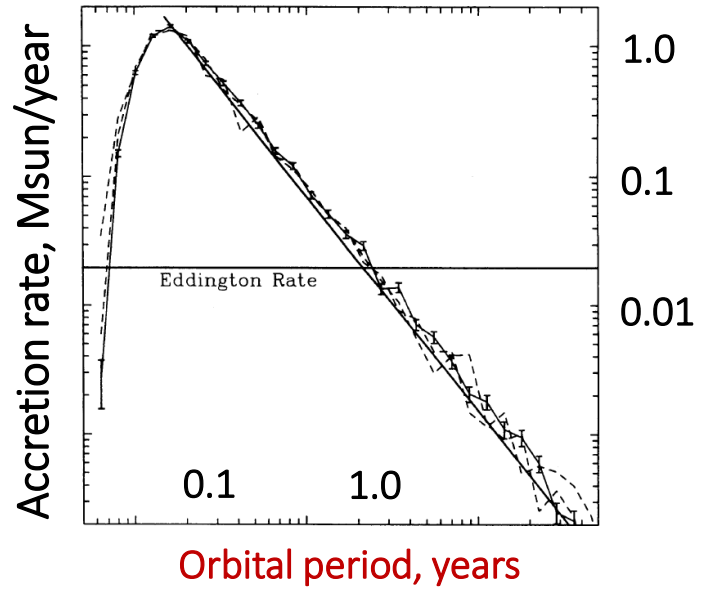
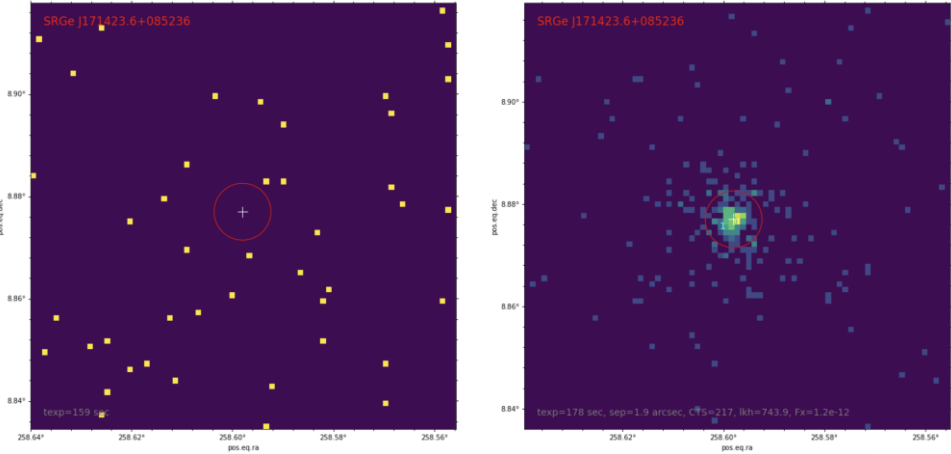
*SRG/eRosita during first sky survey detected X-Rays from 90 stars with known exoplanets. This is close to 10% of all nearby stars with known exoplanets on the RU side of sky (except Kepler spacecraft field).*

*We do not yet see in X-rays a single star with exoplanets in habitable zone.*



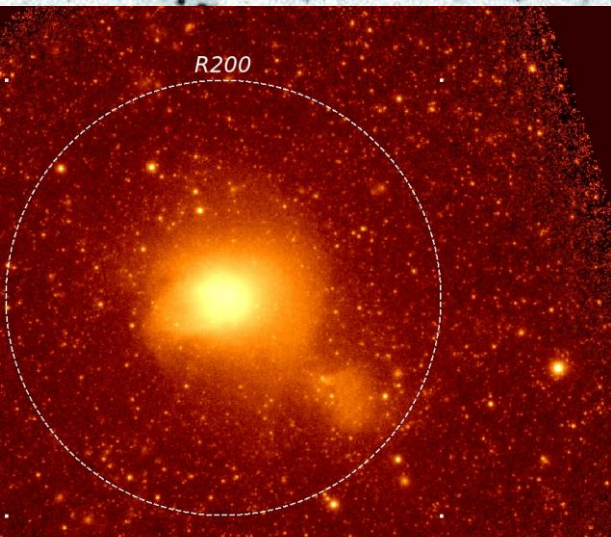
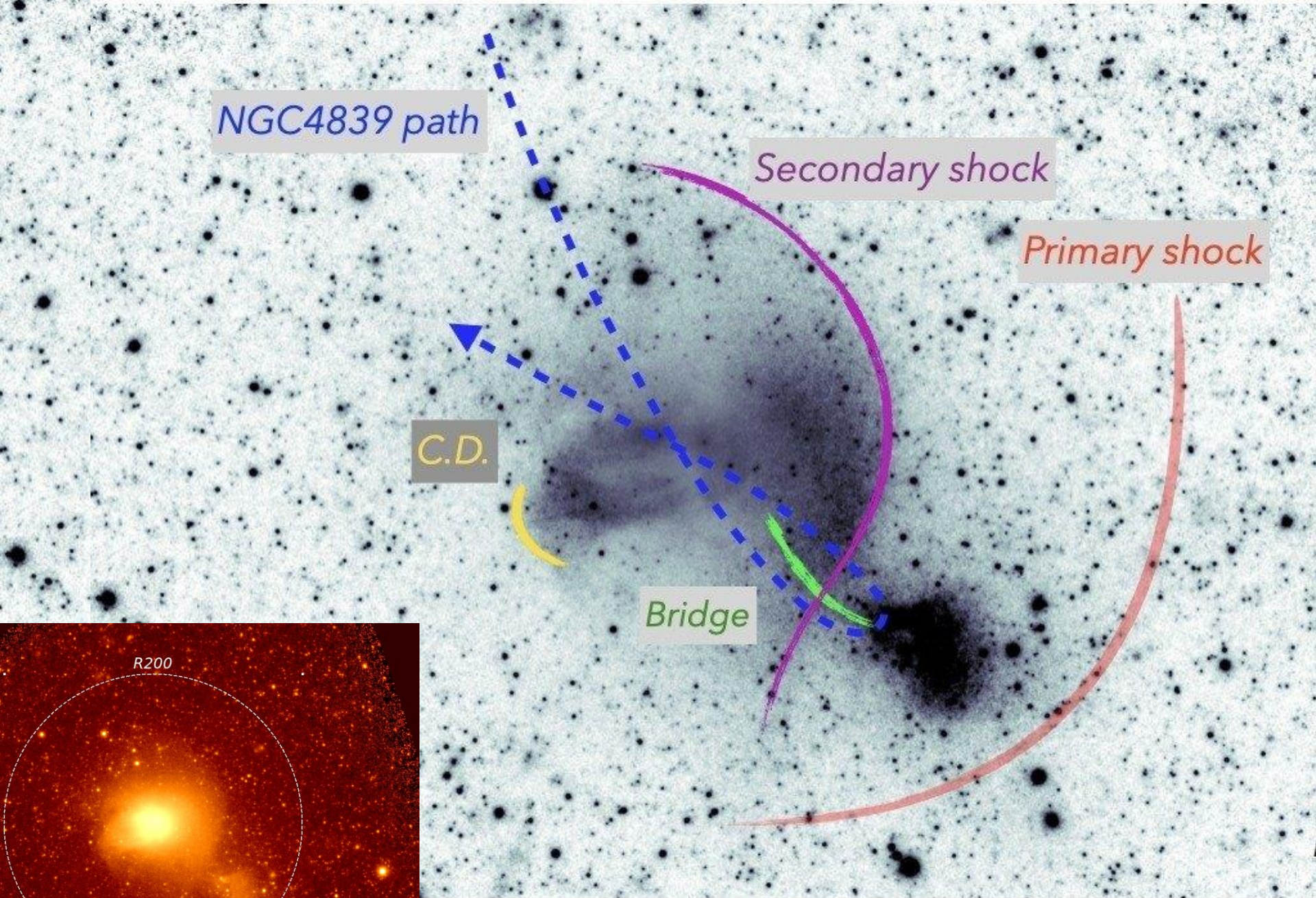
# Extragalactic transients

# Tidal star disruption by a supermassive black hole (TDE)



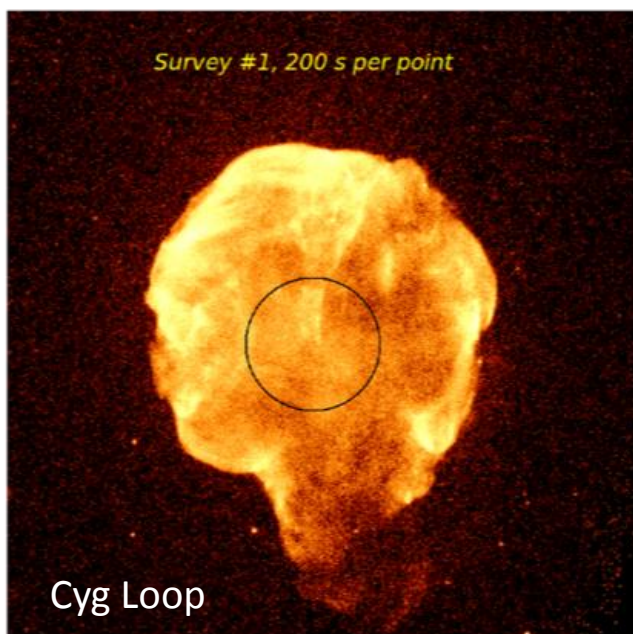
Typically we **detect ~3-5 objects per day** **changing their flux by >10 times** (stars, AGN, X-ray binaries in the Milky Way).  
 On average, we detect **one good TDE candidate per ~10 days**. They are being followed up by telescopes in Russia, Hawaii, Turkey



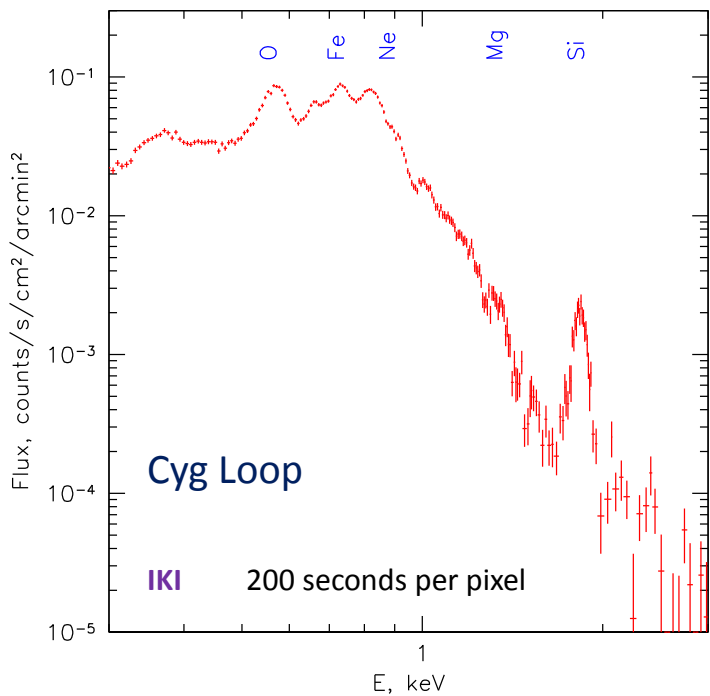


massive cluster of galaxies Coma in our vicinity

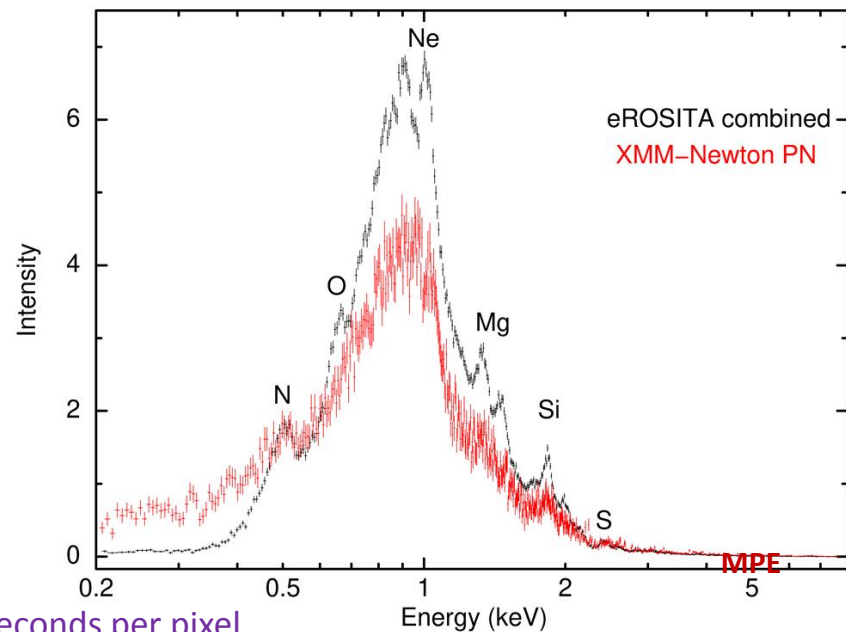




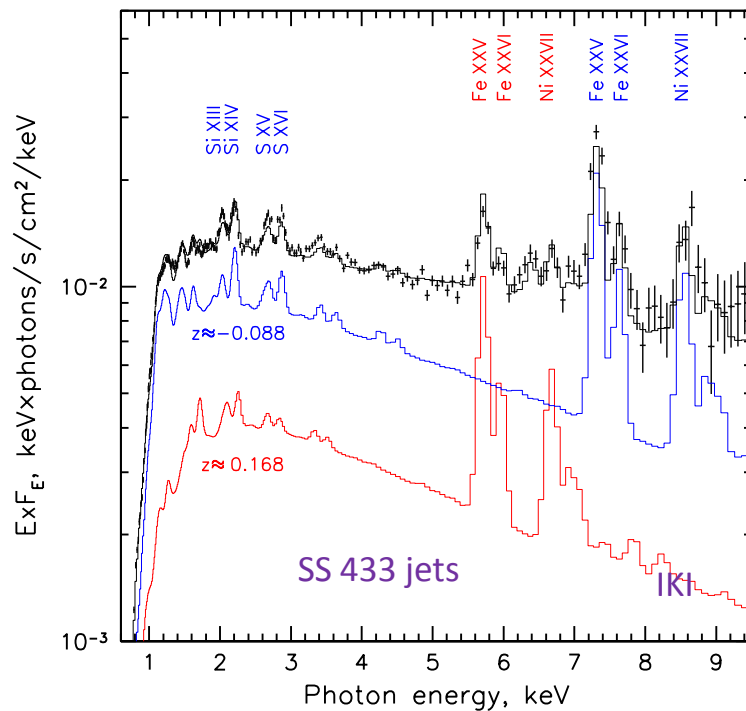
Spectroscopy capabilities of SRG/eRosita



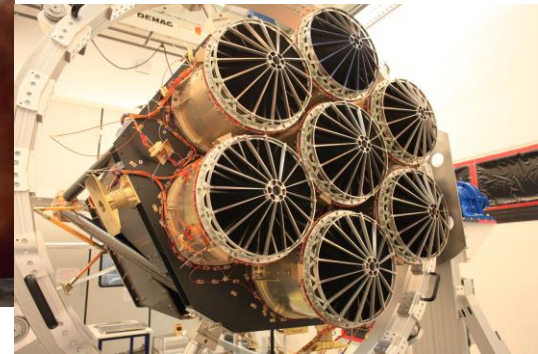
SN 1987A in the LMC



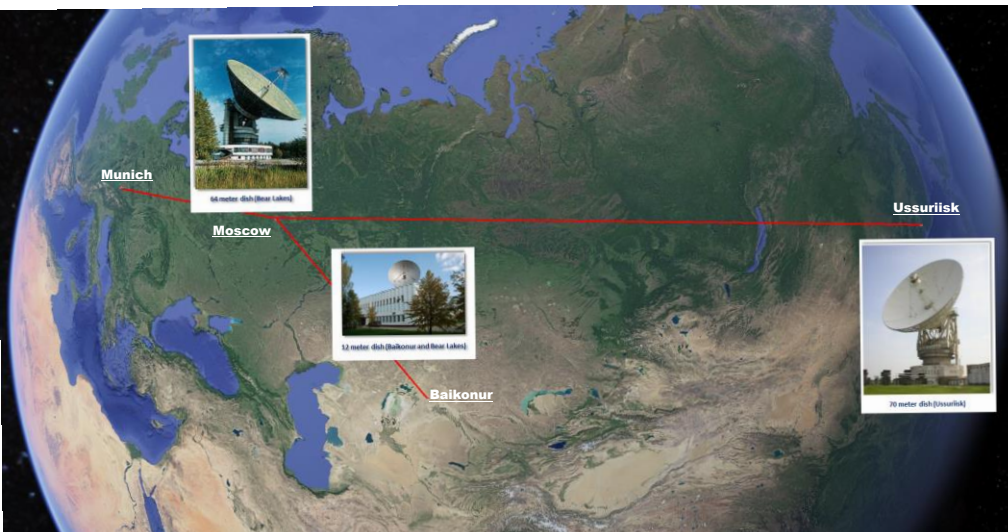
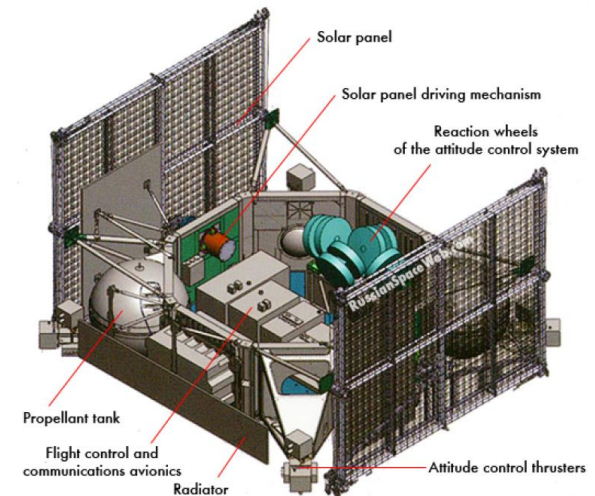
several Kseconds per pixel



**Future plans** – additional 2.5 years of scans. Then – 2 years in pointing mode and scans of selected deep fields.



*We are grateful to many people in the Lavochkin industry, two giant antennae in Bear Lakes (64 m) and Ussiriysk (70 m), MPE and IKI, who are every day sending commands to the spacecraft and telescopes, receiving scientific data and sending them to scientists.*



**And many thanks to scientists and engineers who created excellent grazing incidence telescopes and Navigator platform, Proton launcher and its DM-03 upper stage, to people in Baikonur launch site for a beautiful and successful launch**





