eROCompact

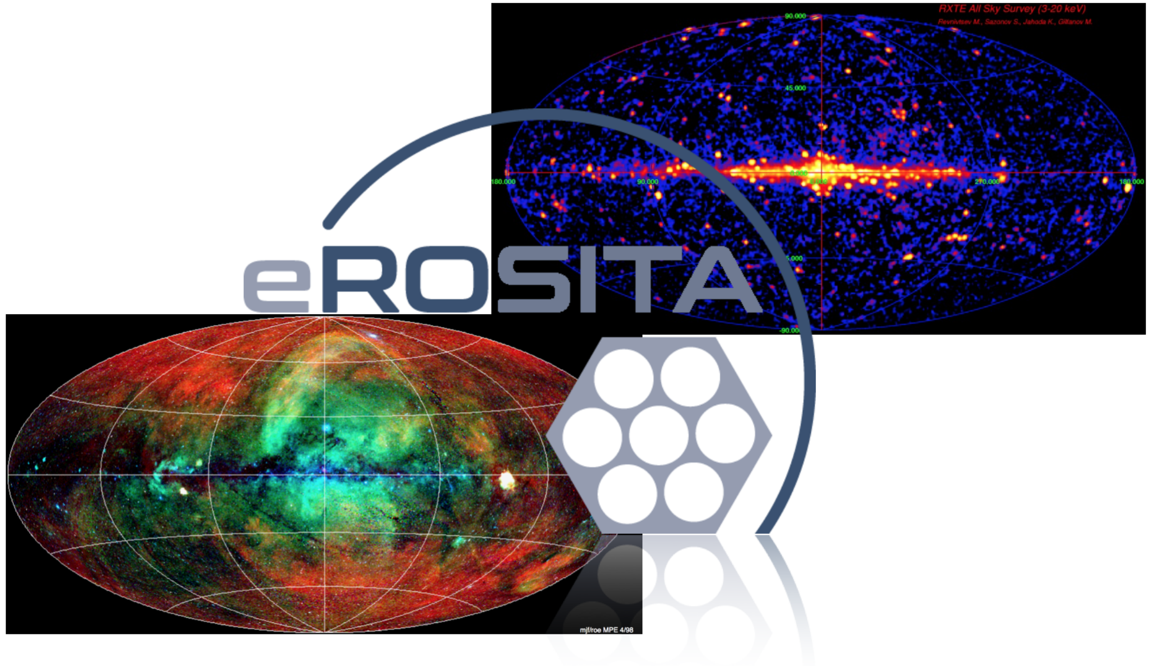
WG summary

MPE consortium meeting April 2018

A. Schwope

Updates

- Organizational:
  - eRO-STEP
  - TAIPAN
  - SDSS-5
  - IEC: Gloria Sala (eROSITA view of old novae)
- Scientific:
  - IP survey (H. Worpel)
  - Pulsars (V. Doroshenko)
  - HXMT (A. Santangelo)



The **eRO**SITA View of **St**ellar **E**nd**p**oints
eRO-STEP

Concept Paper for a Research Unit

DFG Reasarch Unit (Forschergruppe): ECAP – IAAT – UH – MPE – AIP

Speaker: Prof. Manami Sasaki

To be submitted in April 2018

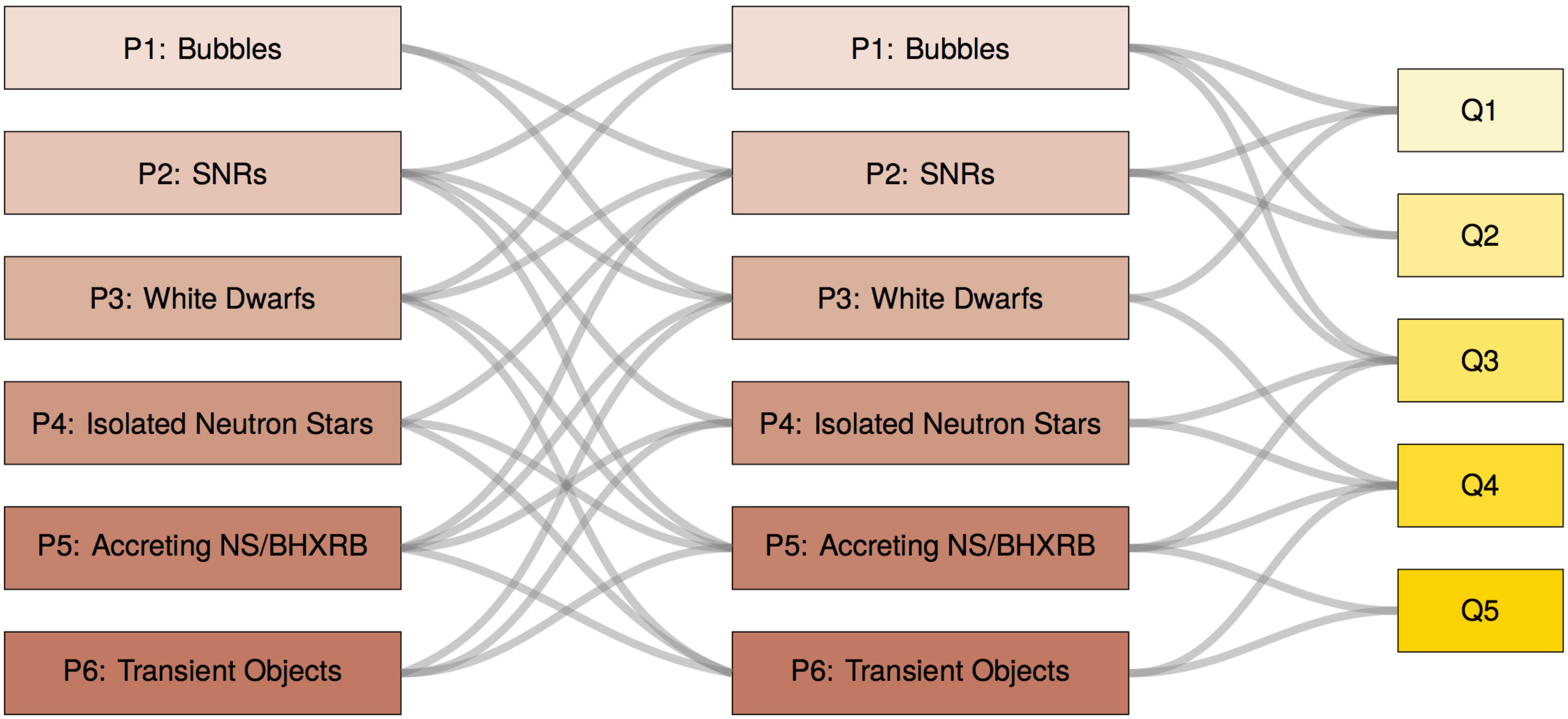
Overarching goals

- Study the population of compact objects in a galaxy, their formation, evolution, and fate
- Understand the nature of the Galactic diffuse X-ray emission, the physics of the hot interstellar medium, the contribution of unresolved sources, and ist relation to star formation history

Main questions

- Q1 What is th enature of the diffuse X-ray emission in our Galaxy?How much is the contribution of unresolved point sources vs. that of truly diffuse emission?
- Q2 What are the fraction, composition, and physical properties of the hot plasma in the interstellar medium? How do particles gain relativistic energies?
- Q3 What is the SN rate in our Galaxy? What is the population of the different SNR types? How is their evolution related to the interstellar environment?
- Q4 How do close compact objects and their binary systems evolve? How do the magnetic fields in compact objects form and decay? How do the spin and the accretion mechanism change?
- Q5 What is the number of stellar mass BHs in our galaxy? How do BHs accrete matter in binaries or in isolation?

Interconnectivity: P-P & P-Q



Distribution of FTEs

	FAU	UHH	IAAT	AIP	MPE	Total
P1	0.75	0.75			0.75	2.25
P2	0.75		0.75		0.75	2.25
P3			0.75	0.75		1.5
P4				0.75		0.75
P5	0.75		0.75			1.5
P6	1.0					1.0
Total	3.25	0.75	2.25	1.5	1.5	9.25

9.25 FTEs: 1 postdoc, 11 PhD students
Universities: 68%
Research Institutes: 32%

TAIPAN

- Galaxy survey of the Southern sky, UK Schmidt, ~150+ fibres, R~2000, 1$ per spectrum

TeRAS:

A Taipan-eROSITA AGN Ancillary Survey

A. Merloni, on behalf of the eROSITA_DE AGN and Compact Objects Working Groups

1. Executive Summary

We propose here TeRAS, an ancillary program for Taipan aimed at obtaining a complete spectroscopic identification of X-ray selected AGN and accreting compact objects with bright optical counterparts (i_{AB}<17) over the full Taipan footprints. We will use the newly processed ROSAT All-Sky Survey (2RXS; available now) and the first catalogs of the eROSITA All-Sky survey (available from March 2019 till March 2020) to select our targets. Our program

- ~10.000 sources fm 2RXS and XMMSL defined

What will SDSS V be?

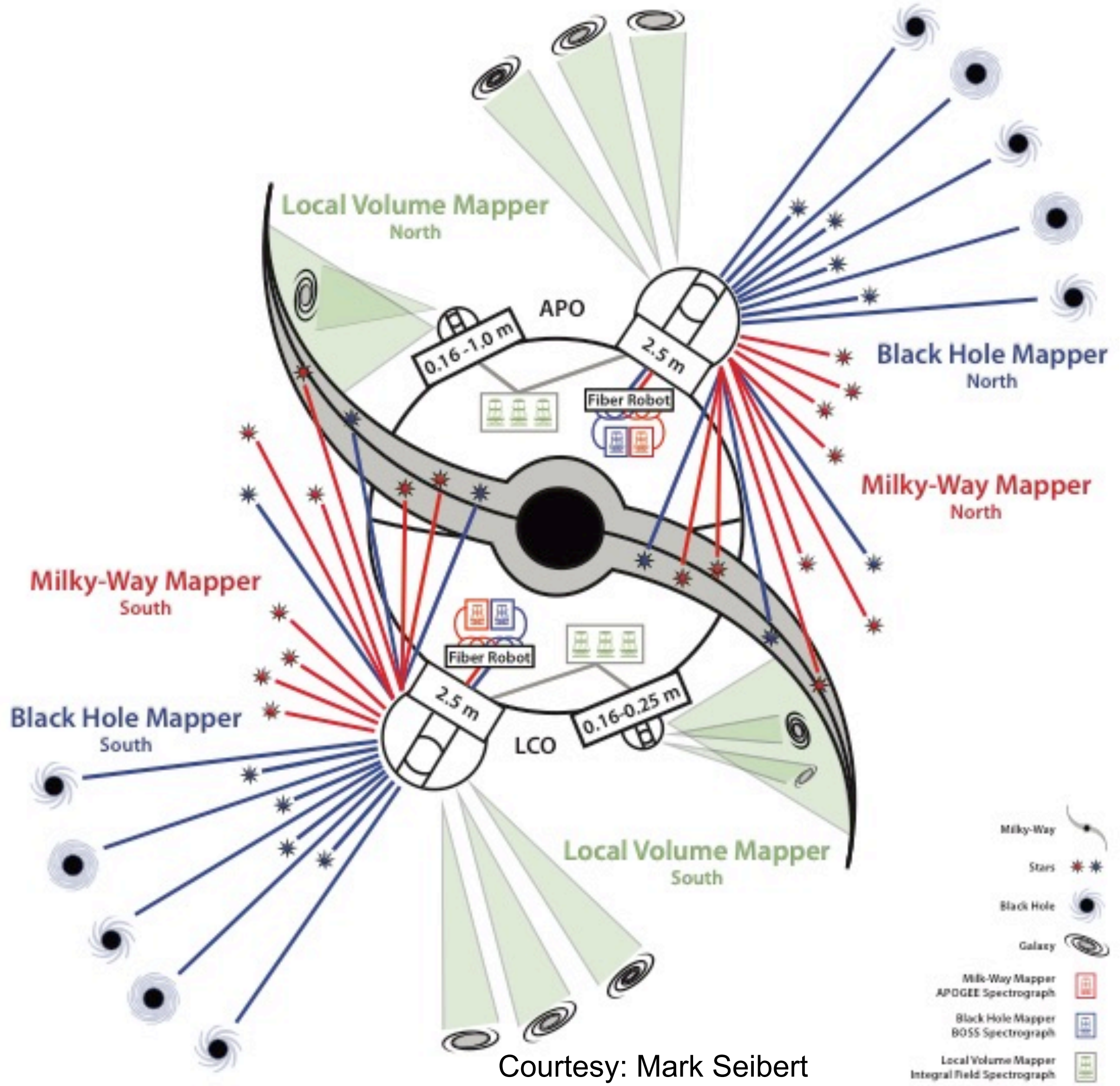
HWR Pasadena Jan 2018

- an observing facility:
  telescopes, hardware, software

- a science survey program:
  panoptic spectroscopy

- a consortium and collaboration

- in definition, implementation and fund-raising phase
  to start 2020 (…5 years



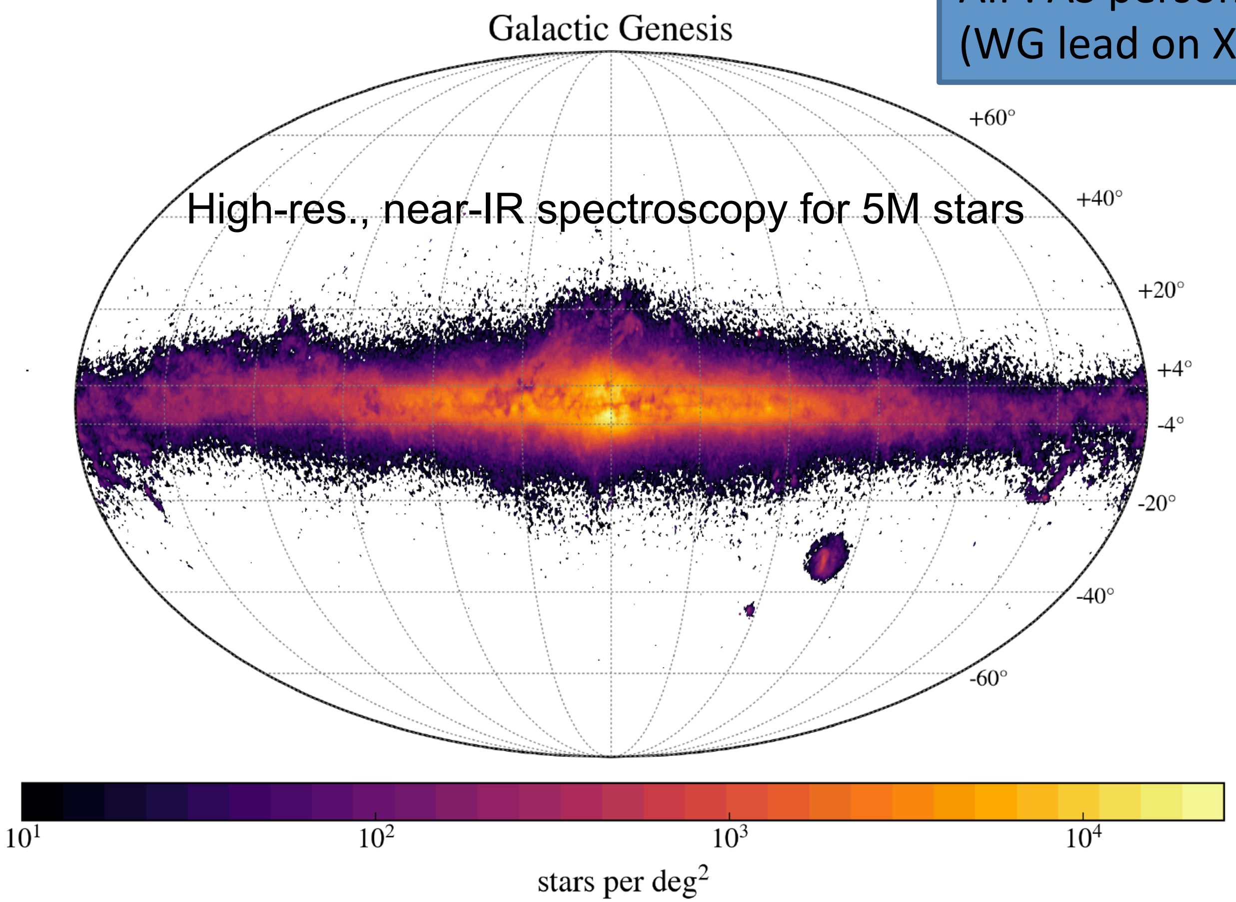
Courtesy: Mark Seibert

SDSS V Milky Way Mapper

Targeting:

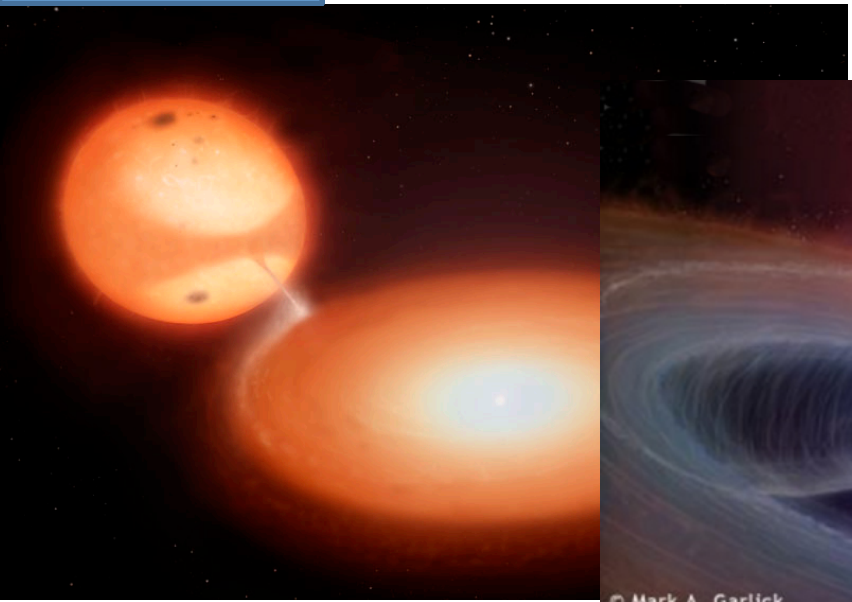
- **all** stars in the MW with H<11, G-H>3.5
  - >10.000 stars on the ``far” side of the Galaxy
- “all” massive or young stars H<11
- 1-20 epochs

MPE: full institutional subscription
AM: survey scientist for BHM
AIP: AS personal slot foreseen
(WG lead on XRB/Compact Bin)

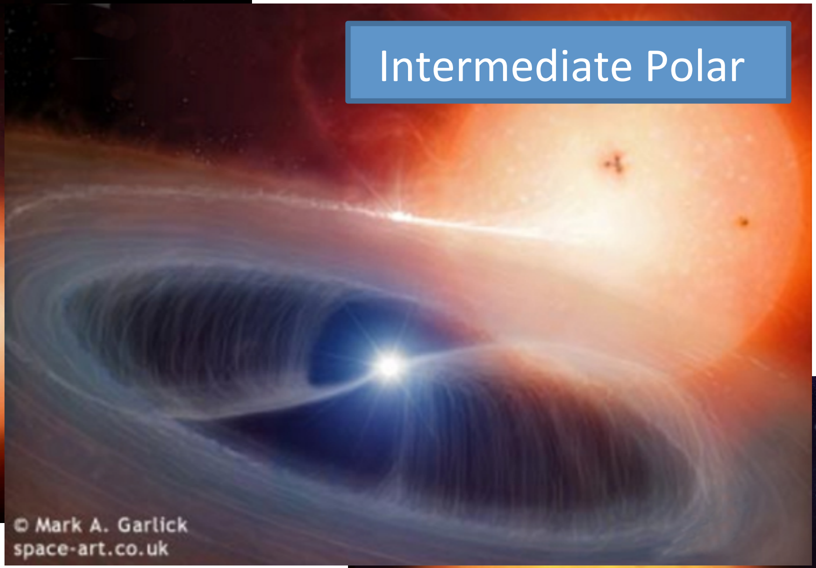


Three flavours of CVs

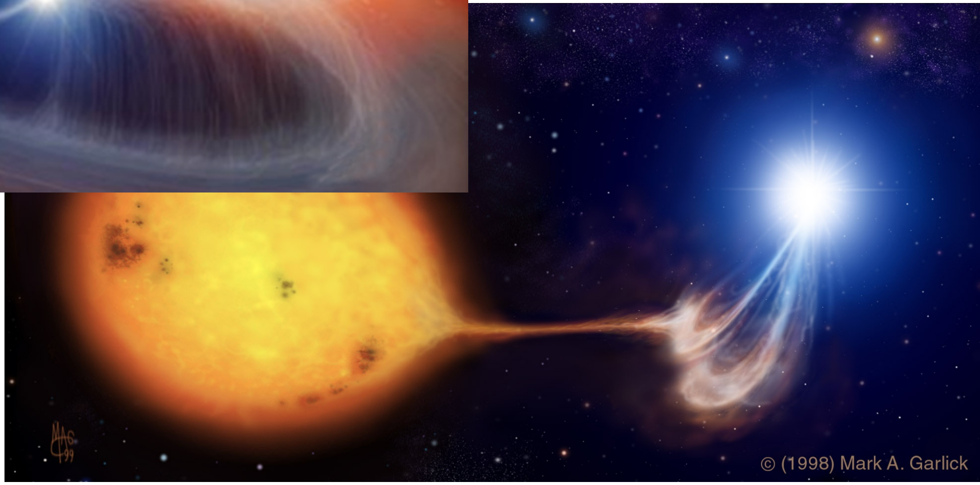
nova-like
dwarf nova



Intermediate Polar



Polar



$\mu \leq 10^{33}\ Gcm^3$

$R_* \approx R_M << a$

$\mu \leq 10^{34}\ Gcm^3$

$R_* << R_M < a$

$\mu \geq 10^{34}\ Gcm^3$

$R_* << R_M \approx a$

Optical counterparts

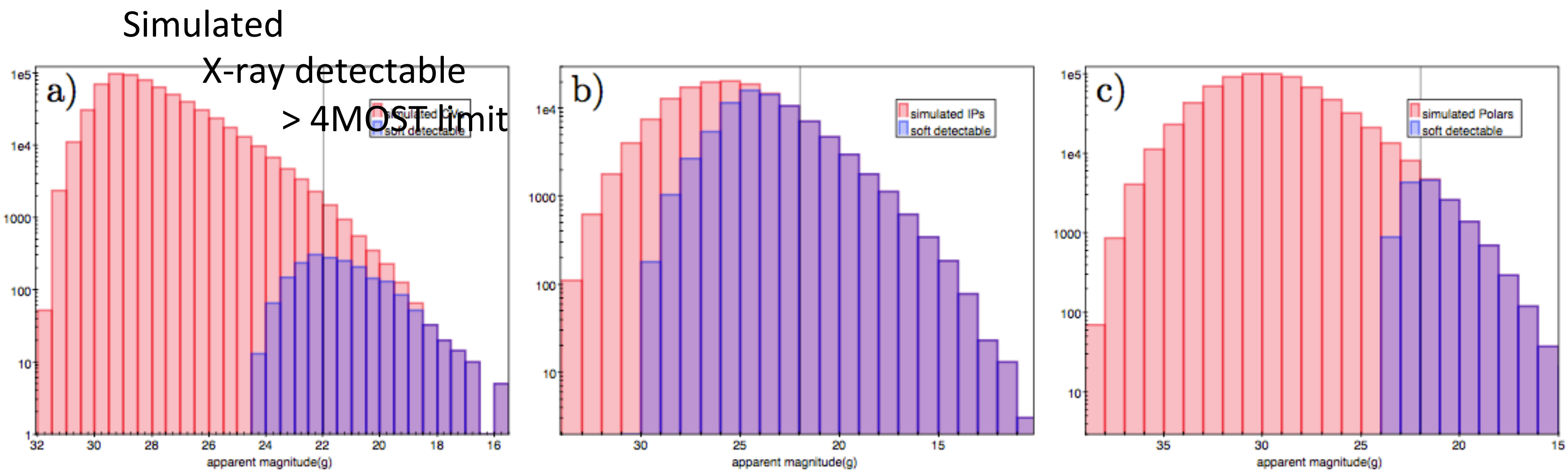
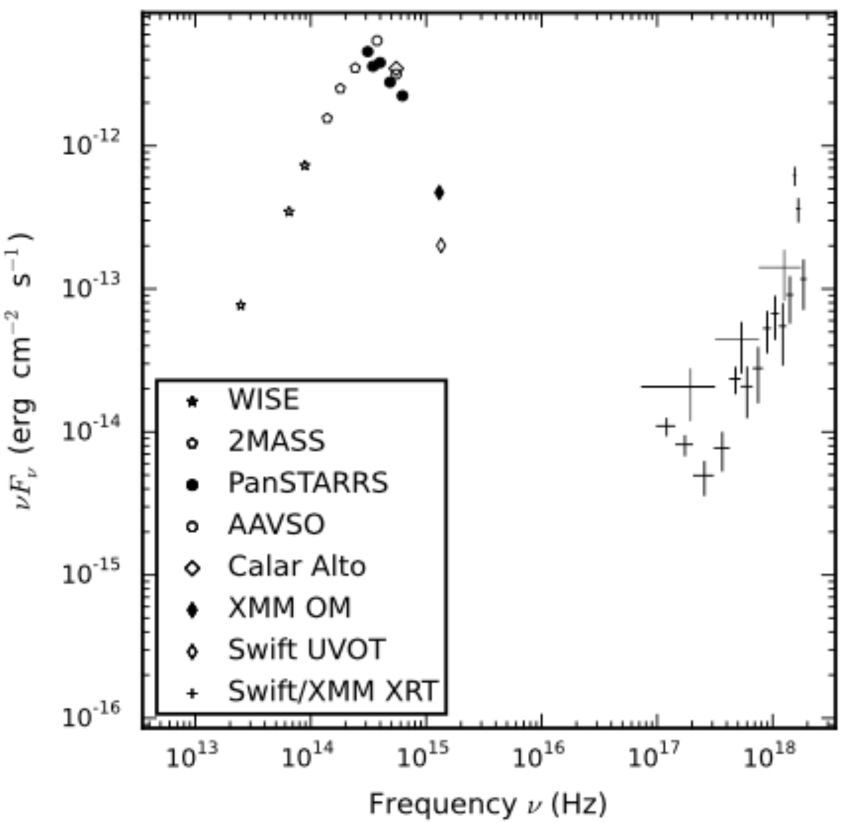
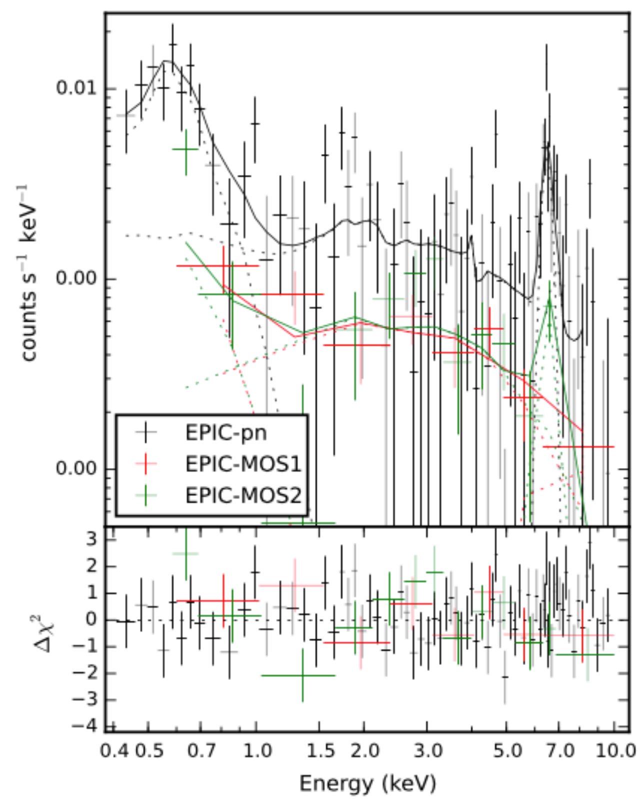


Figure 5: Optical magnitudes of simulated and observable a) CVs b) IPs and c) Polars.

Type	Modelled	Soft detectable	Mag g < 22	g < 21
Non-mag CV	653.000	2.000	1.200	700
IP	147.000	80.500	19.000	11.900
Polar	735.000	15.000	9.800	5.200

Search for low-lum Intermediate Polars with XMM-Newton (H. Worpel)



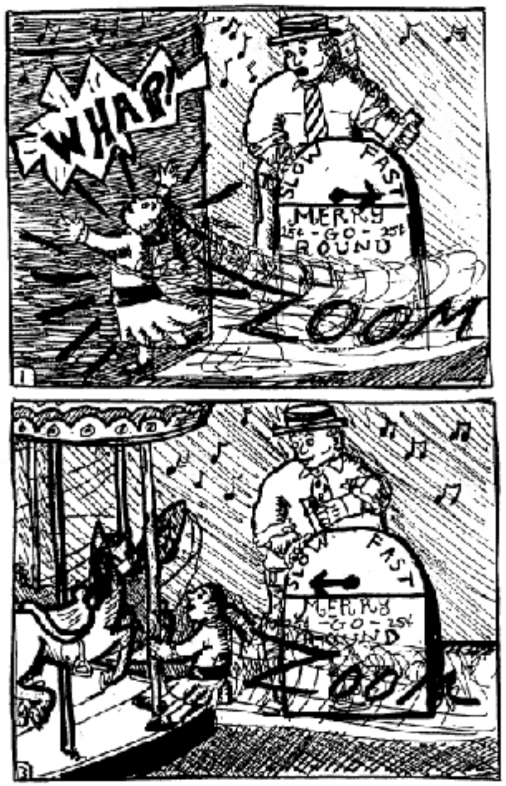


Gaia DR2: d = 3.5 kpc

All of his program objects (10 so far) above eRASS:8 limit

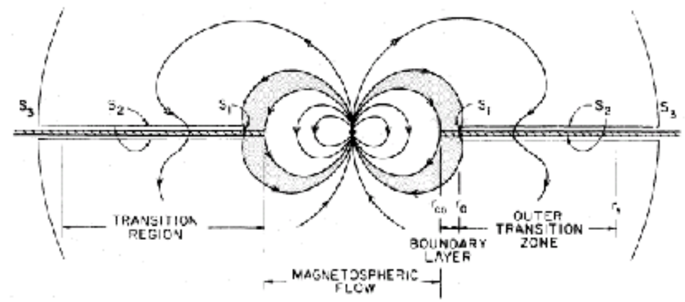
VD: eRASS and low-rate accretion in pulsars

Propeller effect



Patterson, 1994

Illarionov & Sunyaev, 1975



$$r_{\rm co} = \left(\frac{GM}{\Omega^2}\right)^{1/3} \qquad r_{\rm A} = \left(\frac{\mu^4}{2GM\dot{M}^2}\right)^{1/7}$$

$R_m < R_c$ - accretion is possible

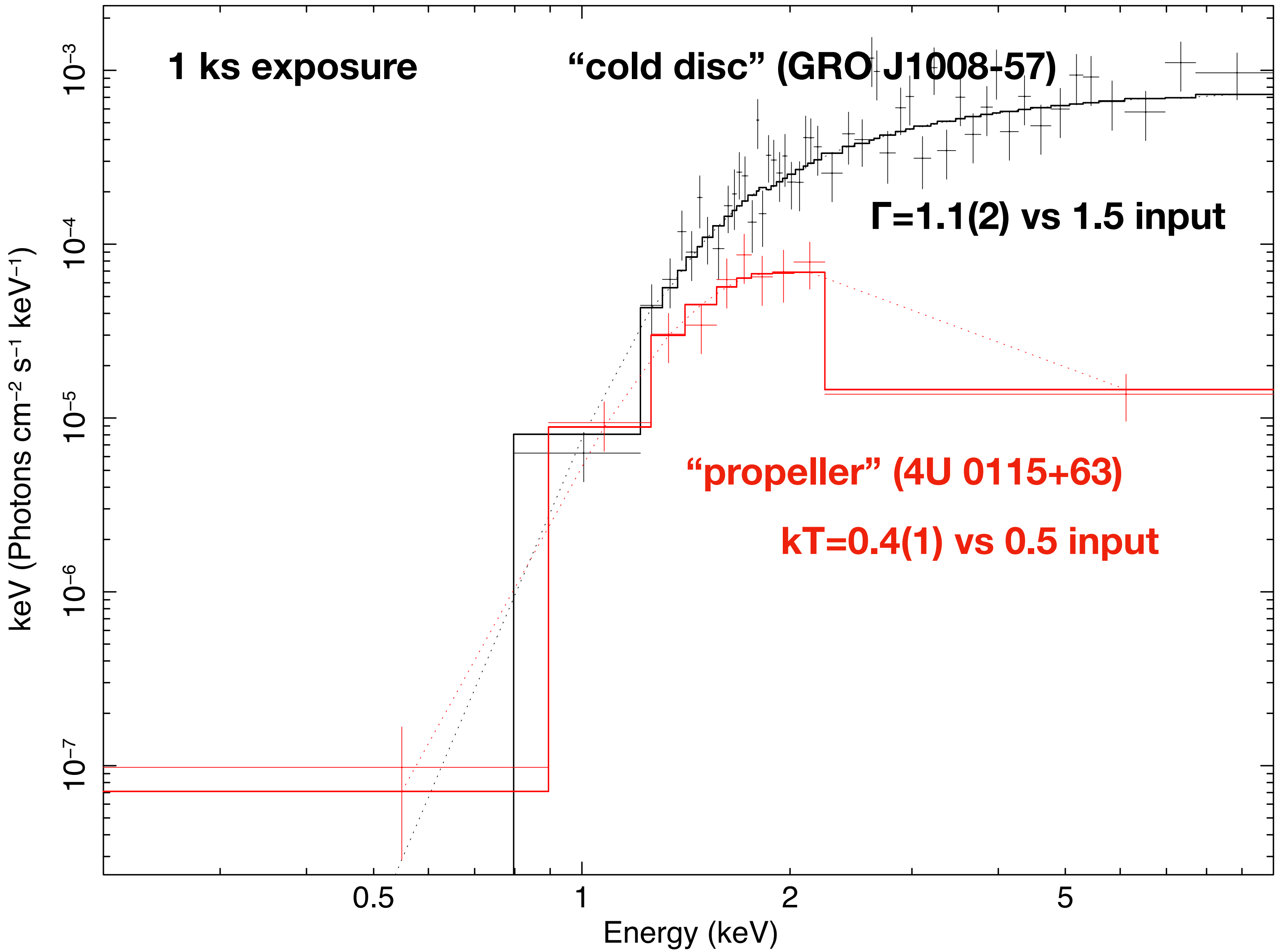
$R_m > R_c$ - accretion is prohibited due to centrifugal barrier

$$r_{\rm m} = \xi r_{\rm A}$$

Alfven radius: magnetic pressure equals to the ram pressure of gas in spherical free-fall from infinity

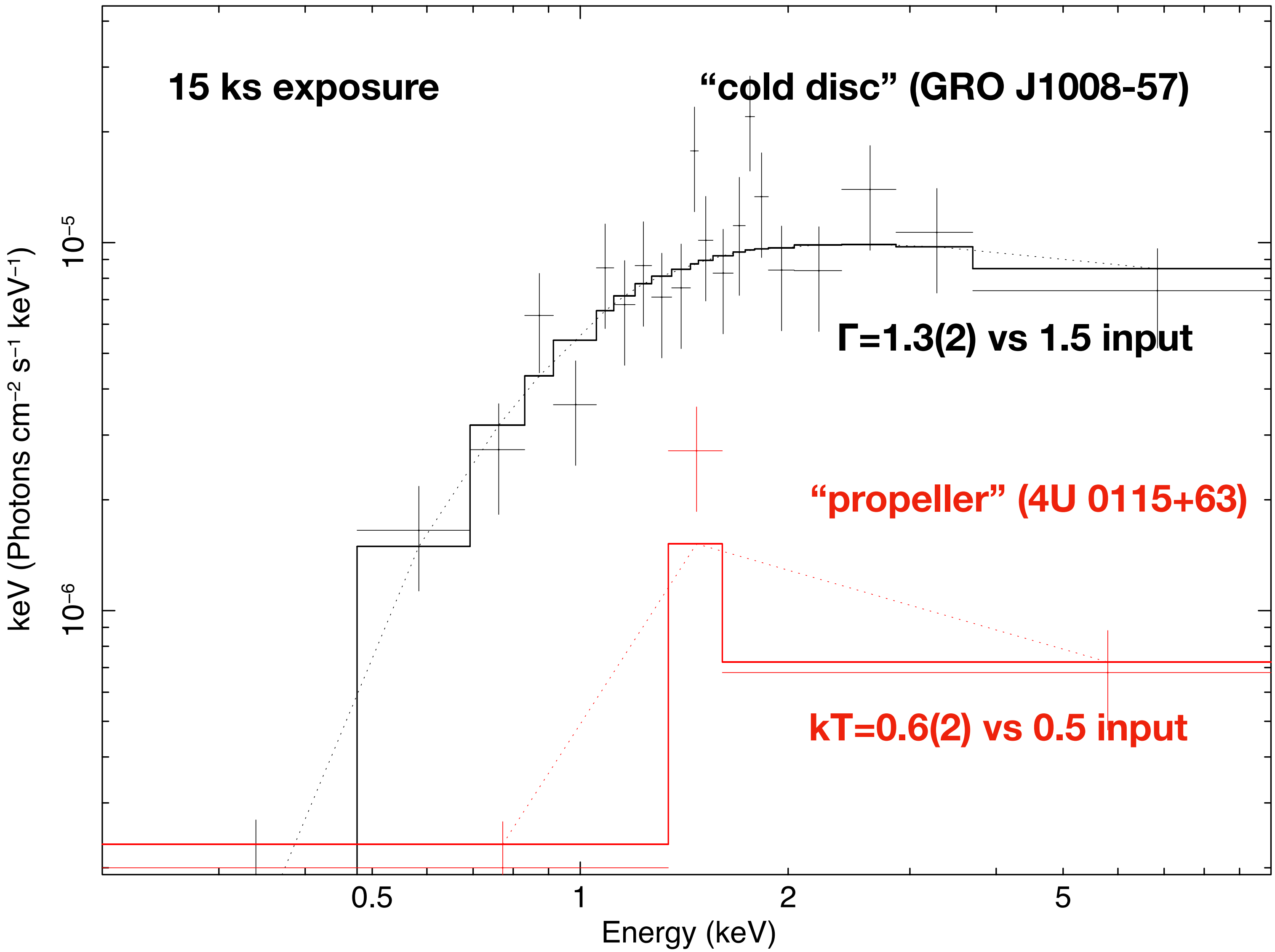
$$L_{\rm lim}(R) \simeq \frac{GM\dot{M}_{\rm lim}}{R} \simeq 4\times10^{37}\xi^{7/2}B_{12}^2P^{-7/3}M_{1.4}^{-2/3}R_6^5 \,{\rm erg\ s^{-1}}$$

Predictions for eRASS (Galactic plane)



Daily exposure of ~250 s is sufficient to constrain the flux assuming fixed spectrum -> lightcurves

Predictions for eRASS (Magellanic clouds)



detect most (all) transient X-ray pulsars also in propeller state, distinguish between propeller/accretion by colours

Samples known, only X-rays needed → early science

What comes out of eRASS

- For the Galactic pulsars:
  - systematically investigate behaviour in quiescence (lightcurves)
  - detect most systems which continue to accrete (unless N_H>>10^{22})
  - detect large fraction of systems switching to propeller regime (again, unless N_H>>10^{22})
  - distinguish between the quiescent states based on spectra/colours
- For MC pulsars (large sample!):
  - Detect all systems which accrete in quiescence
  - Detect large fraction of "propeller" systems (depending on distance/local absorption/actual survey exposure/background)
  - distinguish between the two based on X-ray colours
- For both:
  - verify predictions of the "cold disc" hypothesis
  - constrain typical quiescent luminosities
  - refine conditions for switching to the propeller state, and estimate B for pulsars in question
  - Main caveat is that eventually (years after an outburst) propeller will set in in all sources if the disc is not replenished
  - identify peculiar sources for follow-up

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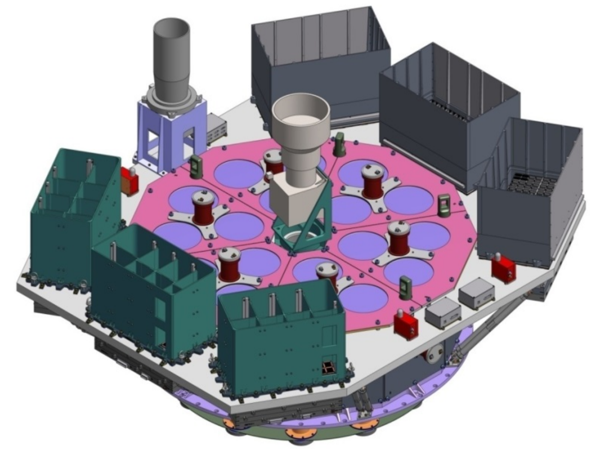
慧眼 – HXMT



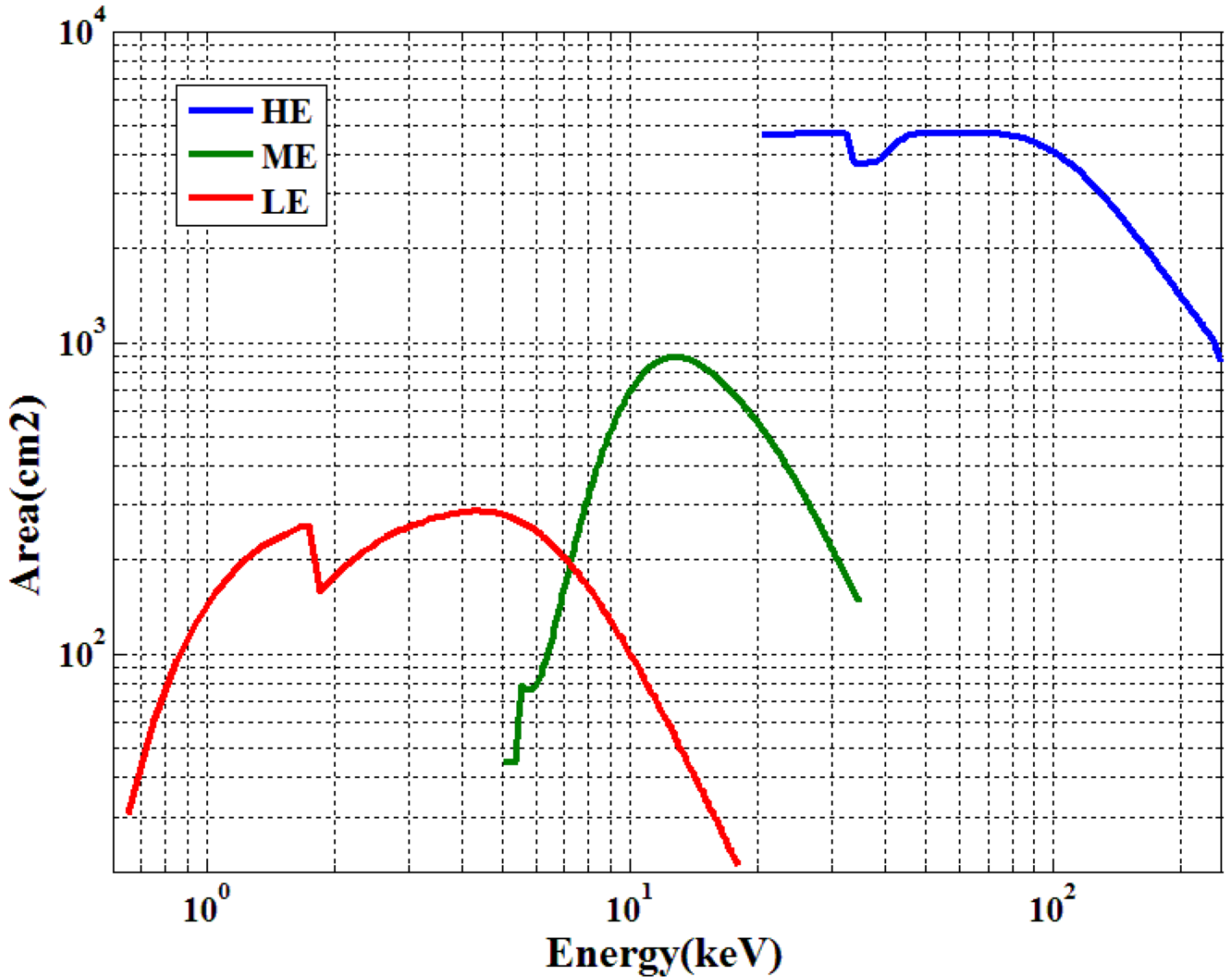
A brief introduction to Insight-HXMT

Andrea Santangelo* 安圣杰

*Visiting Full Professor at IHEP-CAS

eRosita Consortium meeting Munich April 23-25.2018

Effective area



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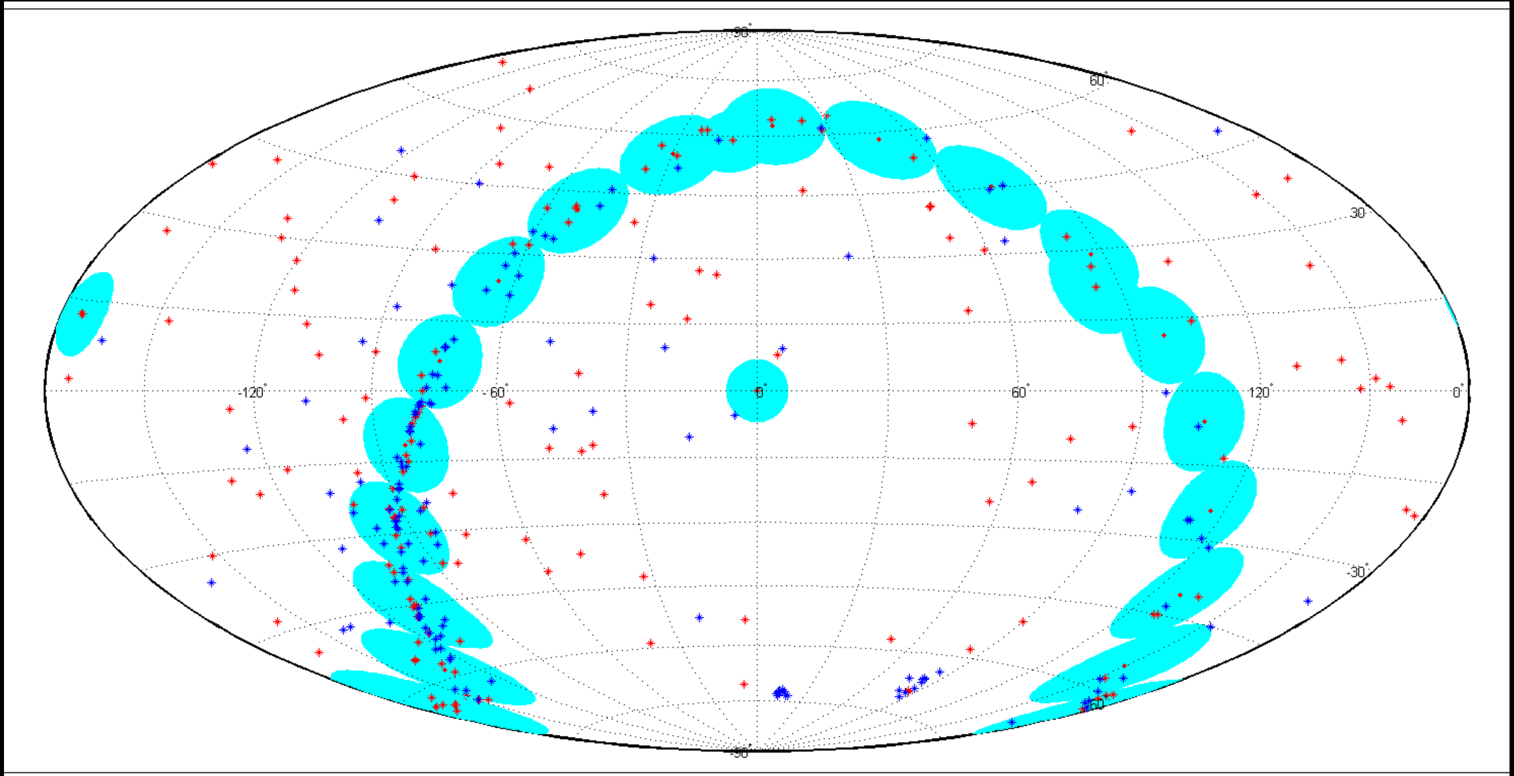
1st year observation program



From *Insight*-HXMT AO-1 : Regular; ToO; scanning

Since July 2017