Frascati workshop, 11 June 2019

Colibrì

Taking the pulse of neutron stars and black holes

Colibrì Collaboration

Ilaria Caiazzo

University of British Columbia

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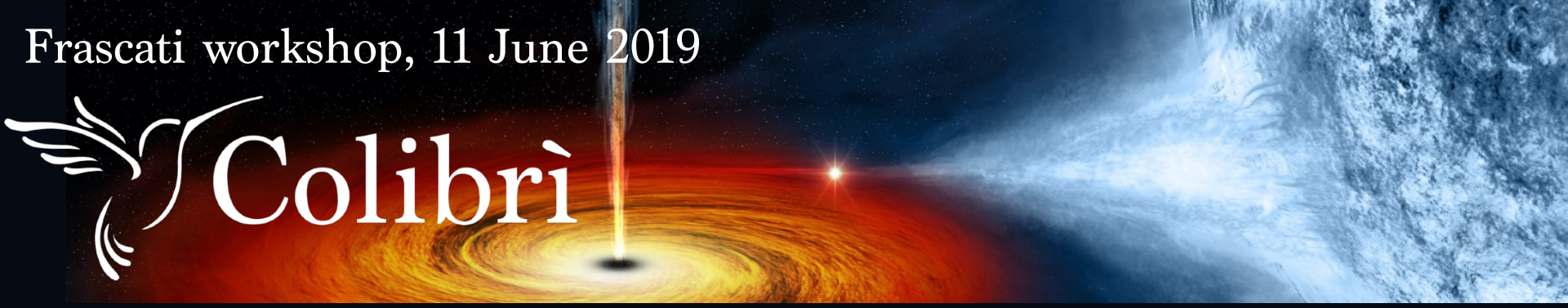

Very high spectral and timing resolution and high count rate X-ray telescope

http://www.colibri-telescope.ca/
CSA Space Astronomy 18-month Concept Study. Started 4 September 2018

Universities: UBC, McGill, St. Mary's, Western, Queen's, TRIUMF, Bishop's, Alberta, Manitoba, SBQMI

Industry partners include Honeywell and MDA

Science team leaders

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Project Manager

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Mission Planning Lead

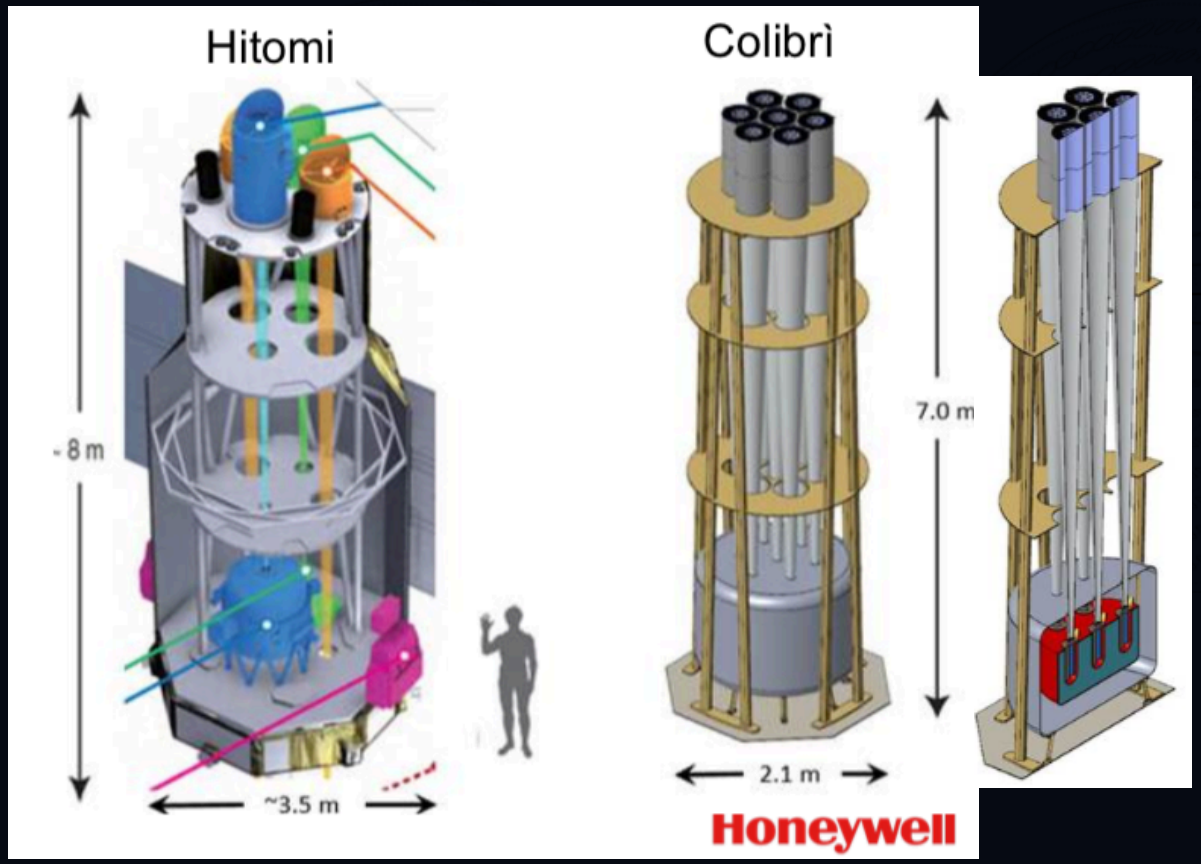
Sarah Gallagher, Western

Black holes WG Lead

Samar Safi-Harb, Manitoba

Neutron stars WG Lead

Colibrì



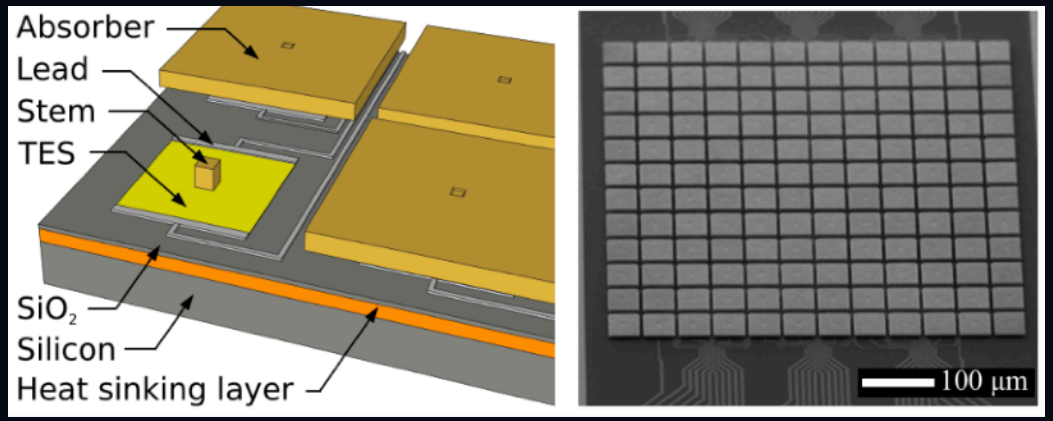
7 concentrators

Transition-edge sensors

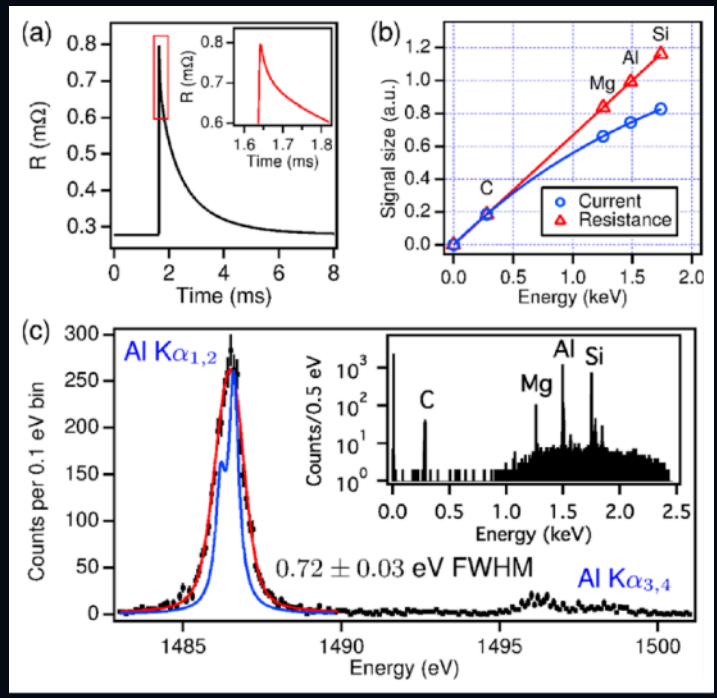
Ilaria Caiazzo

TES Detectors

A superconductive transition-edge sensor (TES) consists of a superconducting film operated in the narrow temperature region between the normal and superconducting state, where the electrical resistance varies between zero and its normal value.



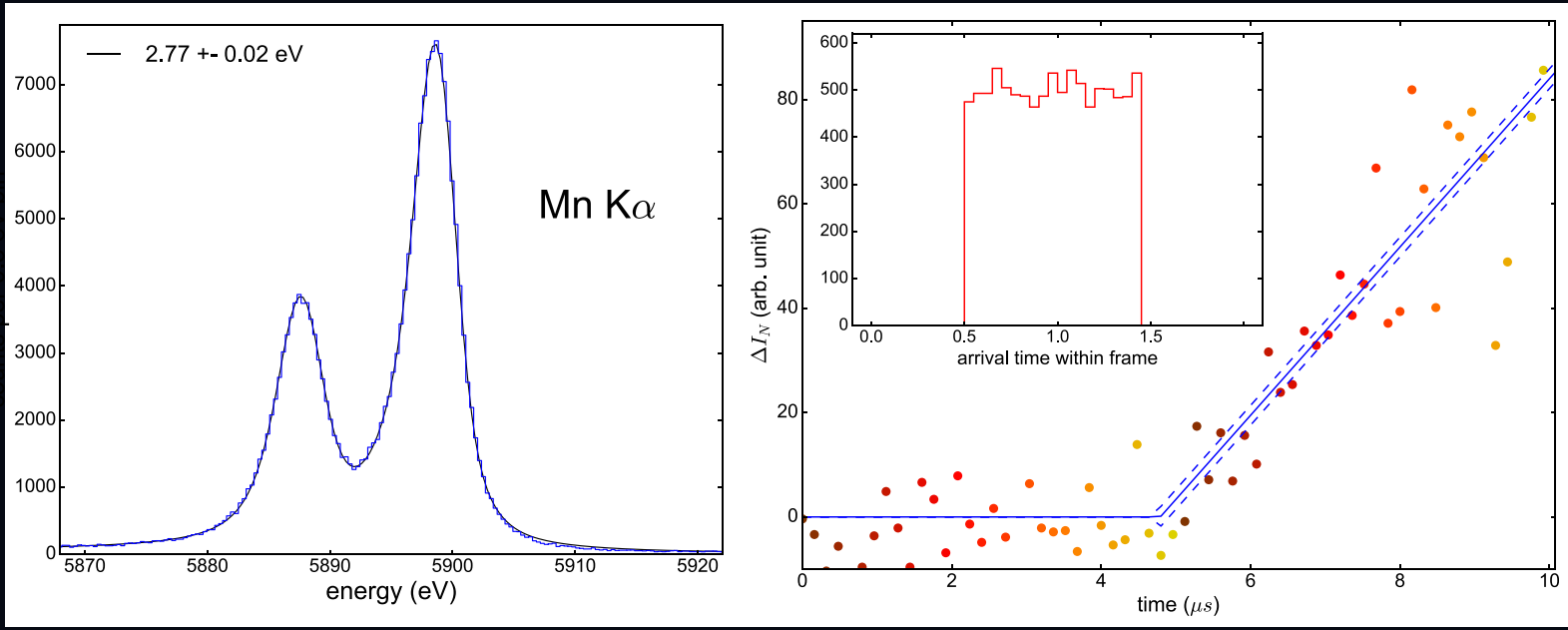
- X-ray stopped in the absorber
- temperature goes up (TES strongly coupled to the absorber)
- temperature change leads to a resistance change (and the inductively coupled SQUID measures the corresponding current change in the TES)
- Temperature returns to the quiescent temperature with a decay time constant determined by the thermal conductance between the TES and the heat bath

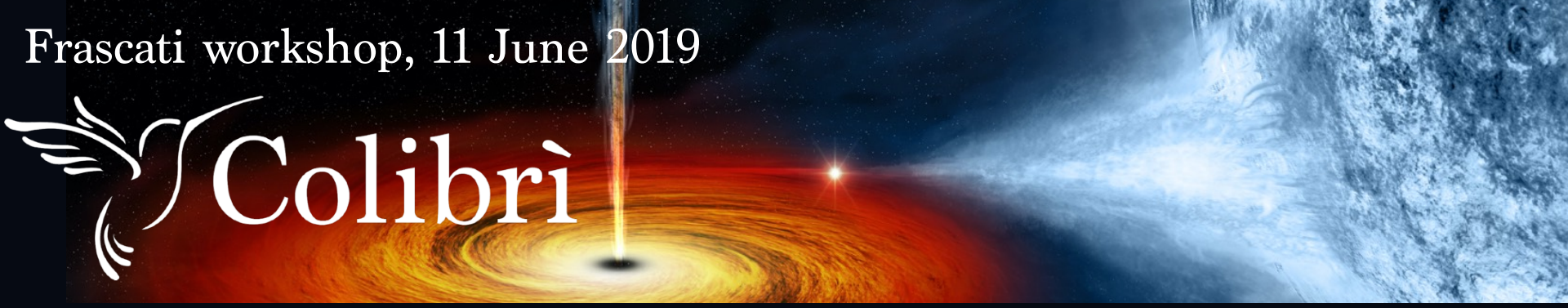


Lee et al. 2015, at Goddard

Resolution

Morgan et al. (2016) at NIST: Code-division-multiplexing readout
t = 5.12 μs, Δt = 275 ns; FWHM of 2.8 eV (2.5 times better than Hitomi SXS)

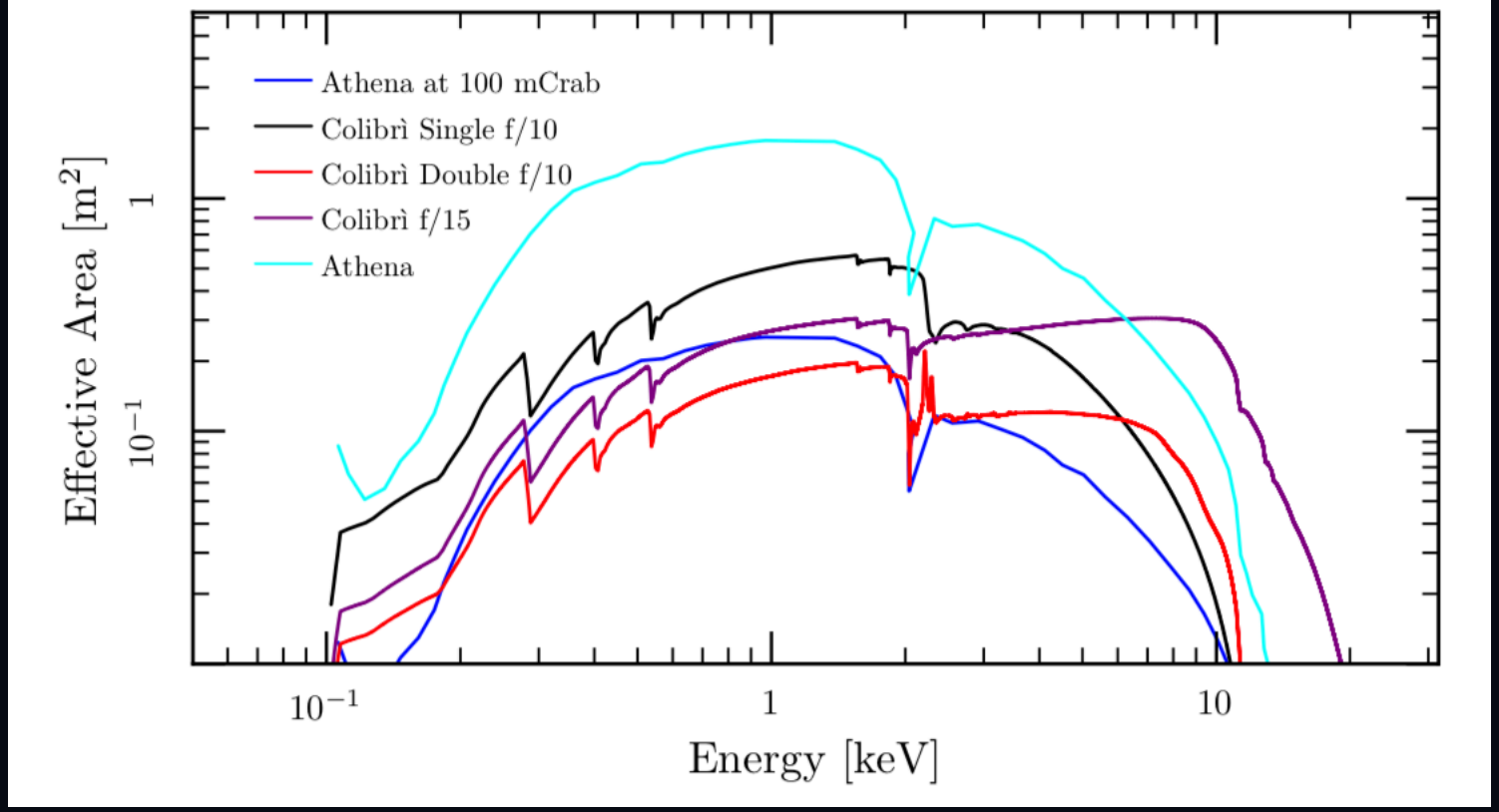




Mission concept initial baseline mission parameters:

- Energy range: 0.5-15 keV
- Energy resolution: finer than 1eV at 2keV (3eV at 6keV)
- count rates up to 100 kHz
- Timing capabilities: better than 1 μs
- Type of optics: collector optics
- effective area of at least 2000 cm2 at 6.4 keV
- Orbit of satellite: Investigate Sun Synchronous, Low-Earth Orbit

Colibrì



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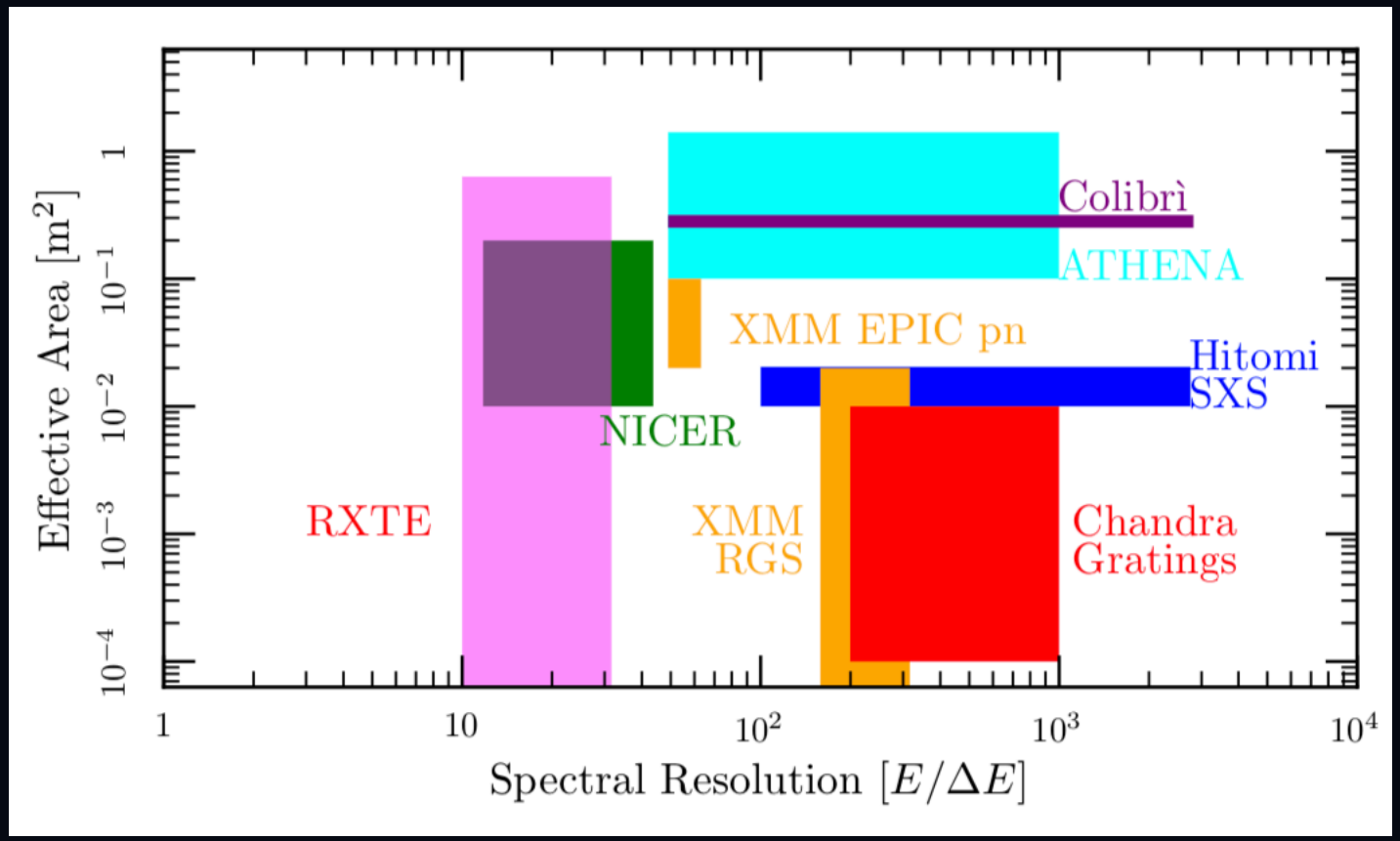

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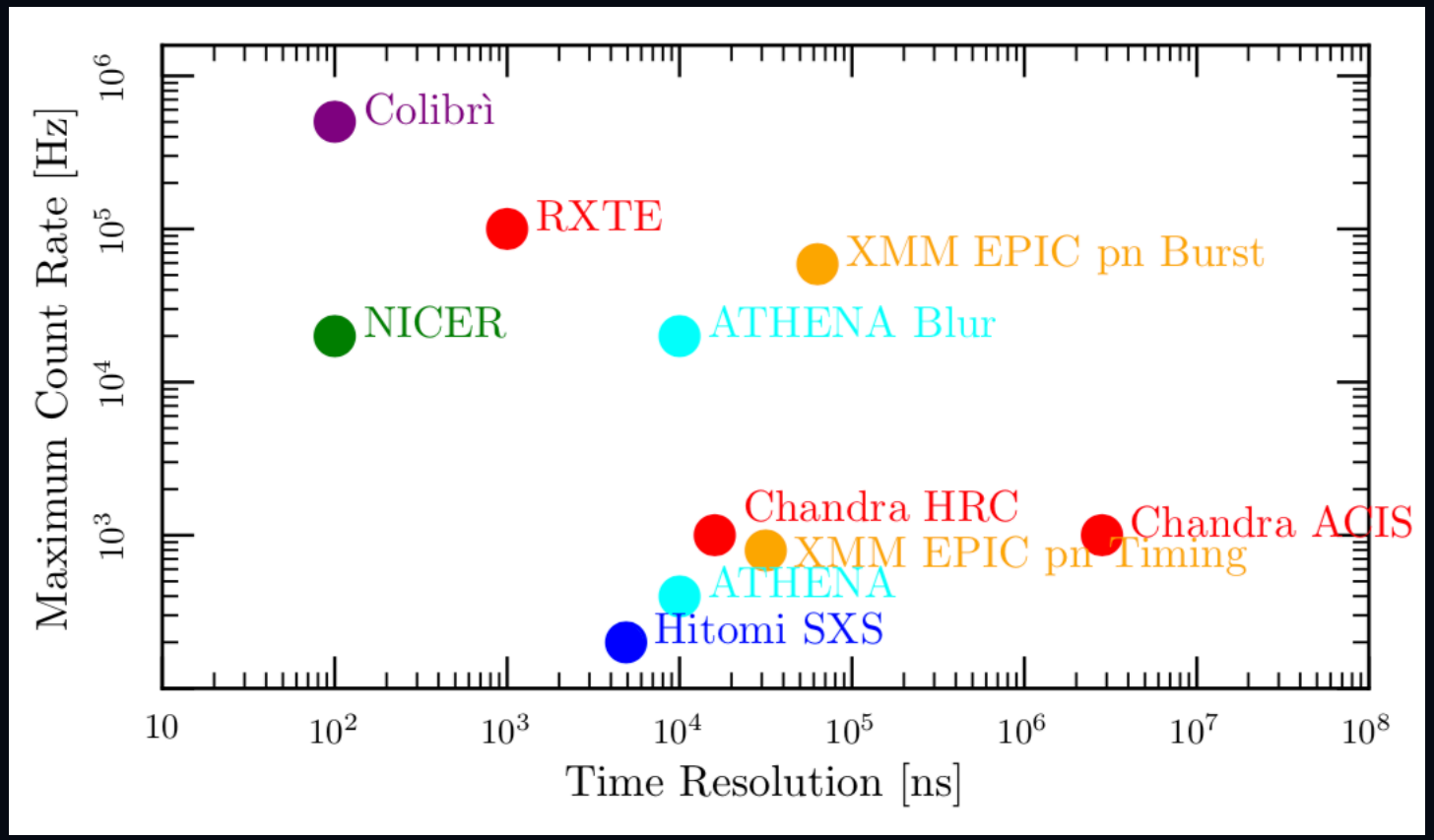

Specs

	Energy Range	Energy resolution	Timing resolution	Effective area
Colibrì	0.2 - 12 keV	3 eV @ 6.4 keV	<1 μs	> 2000 cm^2 @ 6.4 keV
NICER	0.2 - 12 keV	137 eV @ 6 keV	<0.3 μs	~ 600 cm^2 @ 6 keV
XMM-Newton	0.1 - 15 keV	130 eV @ 6.5 keV	300 μs	~ 700 cm^2 @ 6.4 keV
NuSTAR	3 - 79 keV	400 eV @ 6 keV	100 μs	~ 800 cm^2 @ 6.4 keV
Hitomi SXS	0.3 - 12 keV	7 eV @ 6 keV	5 μs	~ 210 cm^2 @ 6 keV
RXTE PCA	2 - 250 keV	1100 eV @ 6 keV	1 μs	~ 6000 cm^2 @ 6 keV
ATHENA X-IFU	0.2 - 12 keV	2.5 eV @ 6 keV	10 μs	~ 3000 cm^2 @ 6 keV

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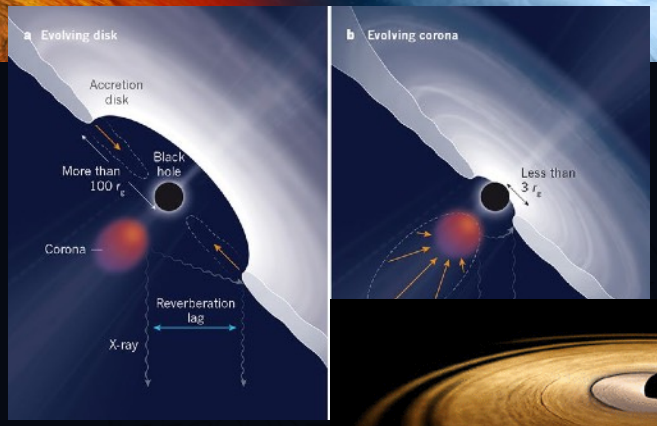
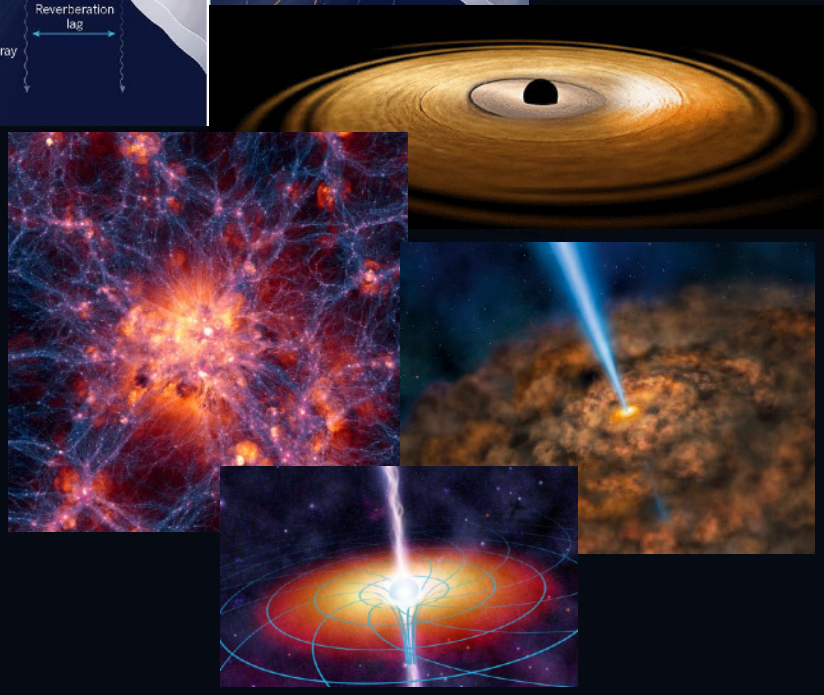


Science - Black Holes

- Black Hole Reverberation Mapping
- Quasi periodic oscillations
- Black Hole Spectrscopy and winds
- Warm Intergalatic Medium
- Super Massive Black Hole Spin
- Time variability of bright sources
- Testing General Relativity with Black Holes



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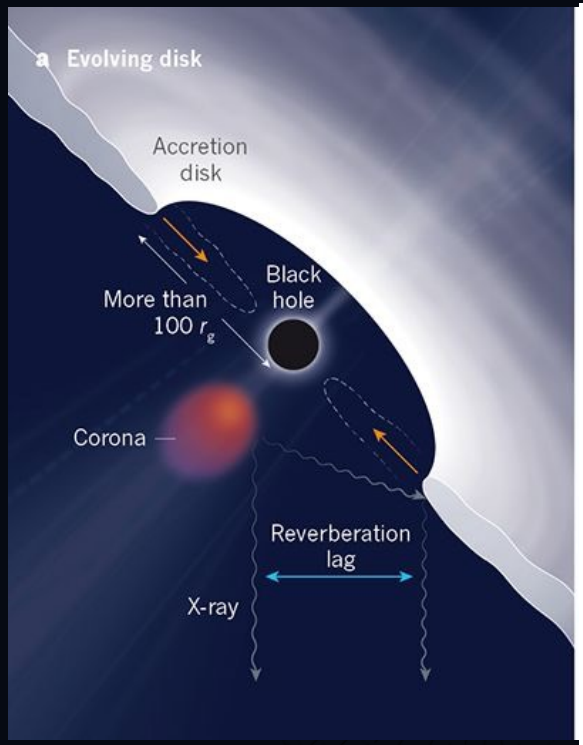
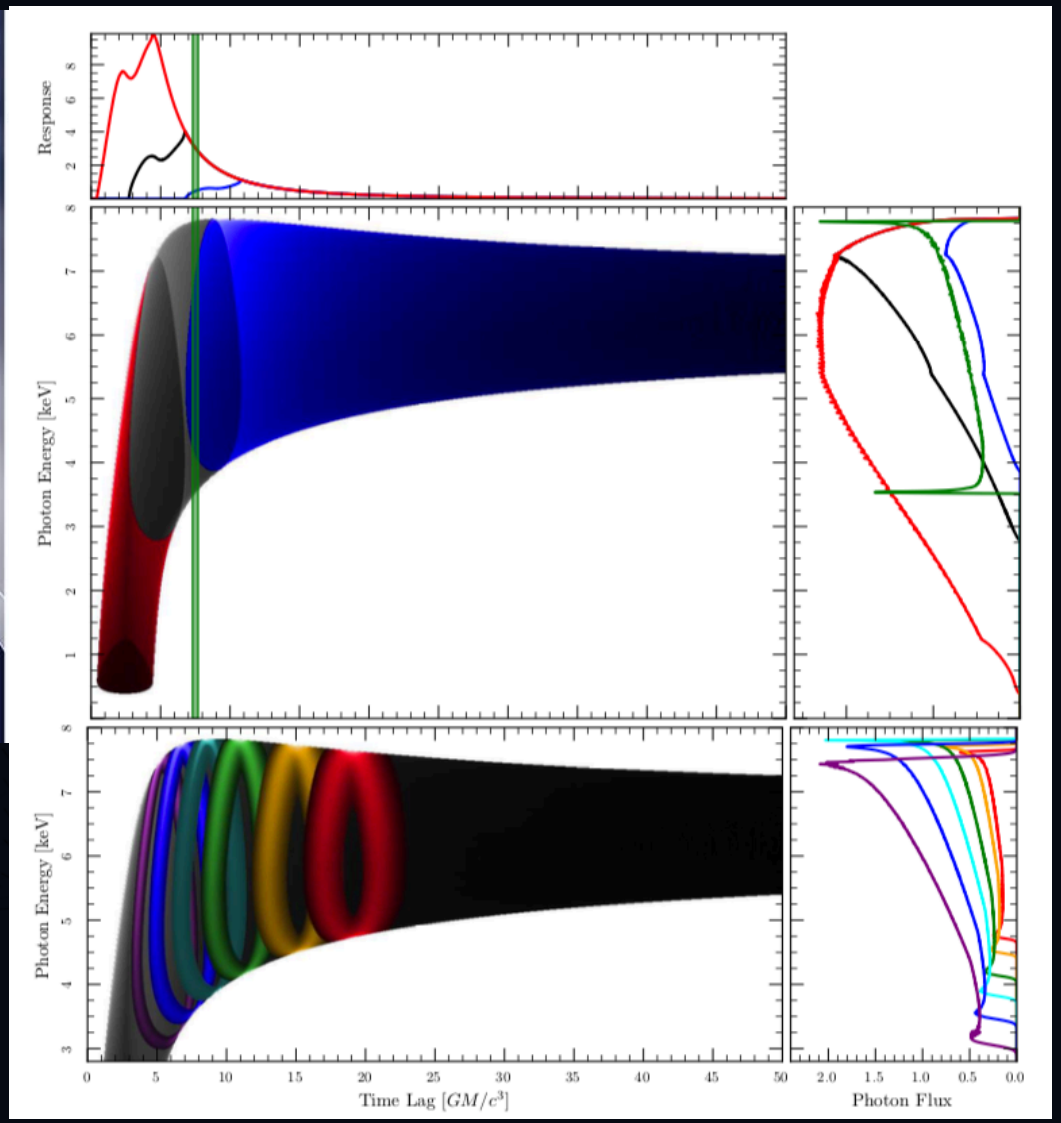
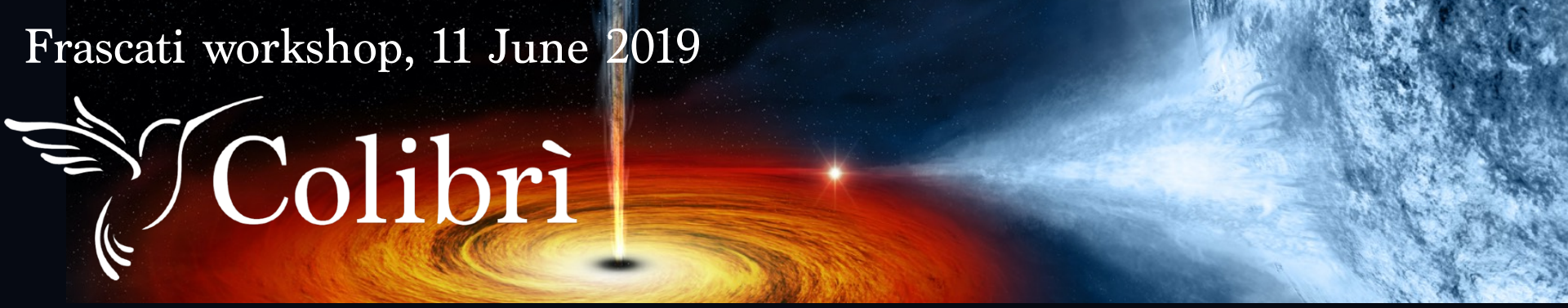




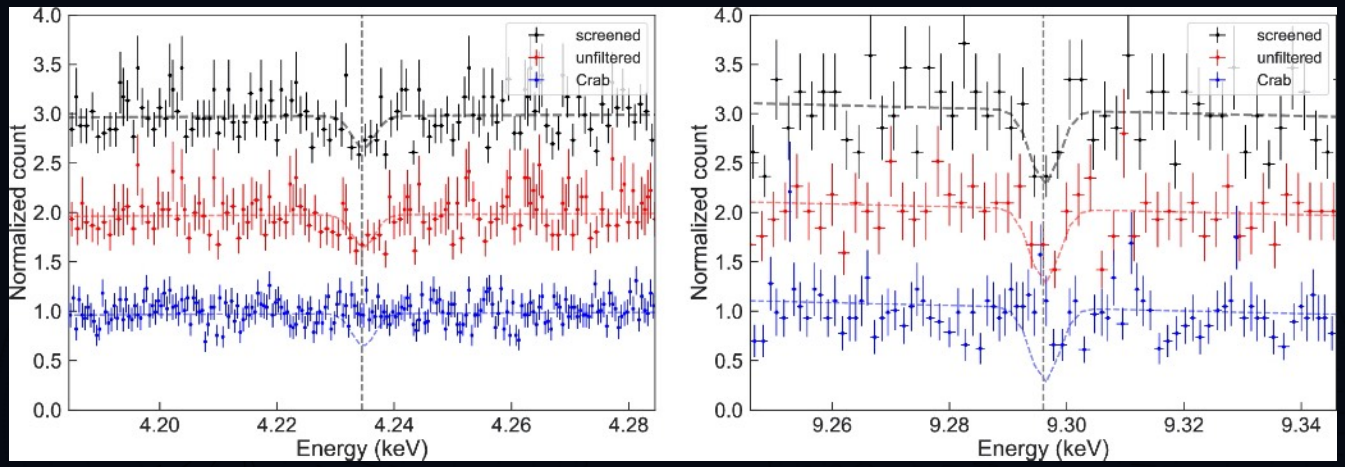


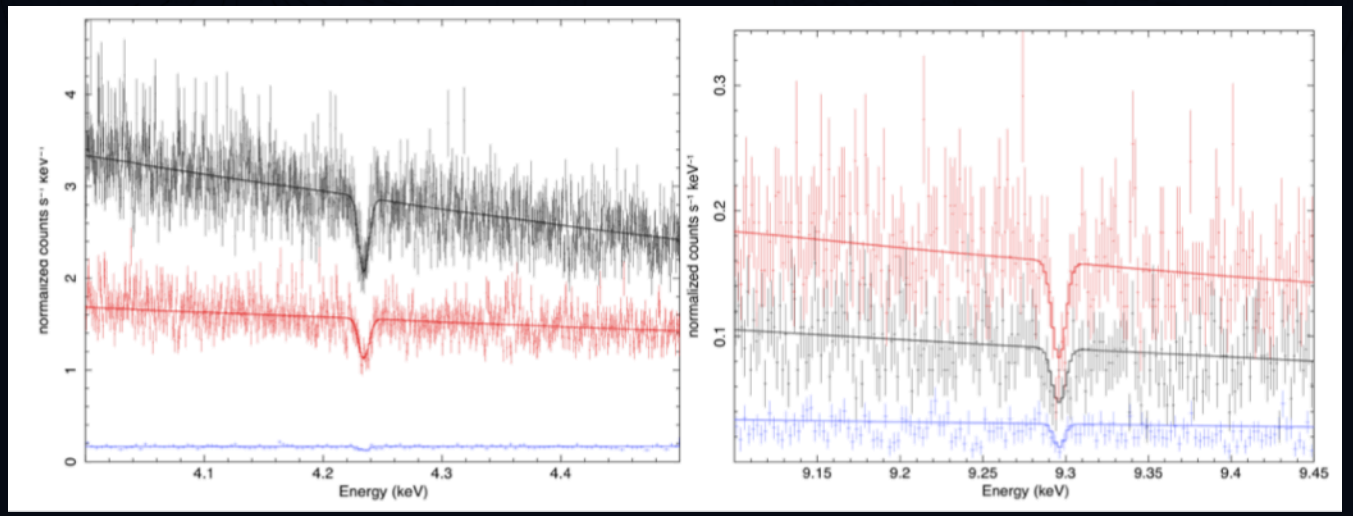
Science - Neutron Stars

- Neutron Star Reverberation Mapping
- Quasi periodic oscillations
- Lines/Spectroscopy of Isolated Neutron stars: G21.5-0.9 Hitomi
- Mass and Radius estimates with Pulse Profiles using NICER targets (Rotation powered pulsars, accretion powered millisecond period pulsars)
- Thermonuclear Bursts
- Magnetars in outburst – Spectral Features

Hitomi Collaboration 2018 observations of G 1.5-0.9 for 165 ks with SXS. PSR J18331034 lies at the center of the SNR.

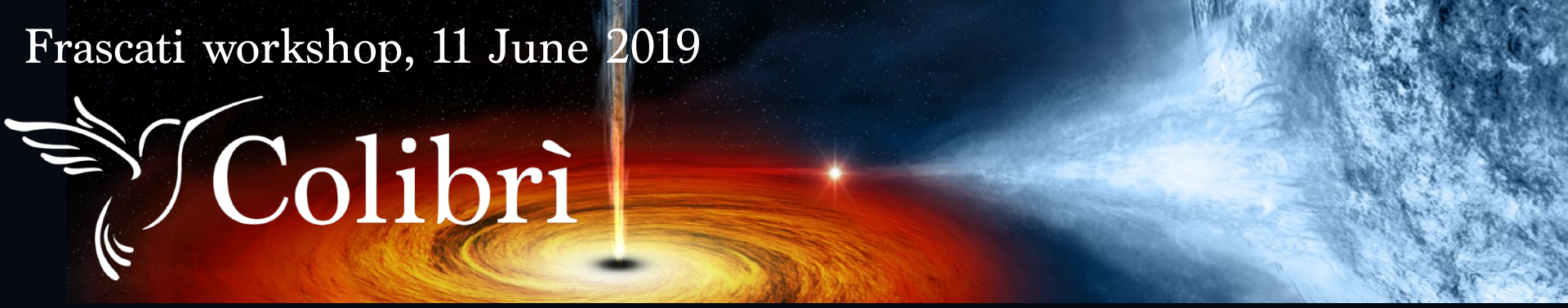
Hitomi





Colibrì

Hitomi



Stay tuned!
www.colibri-telescope.ca

Reach out!
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