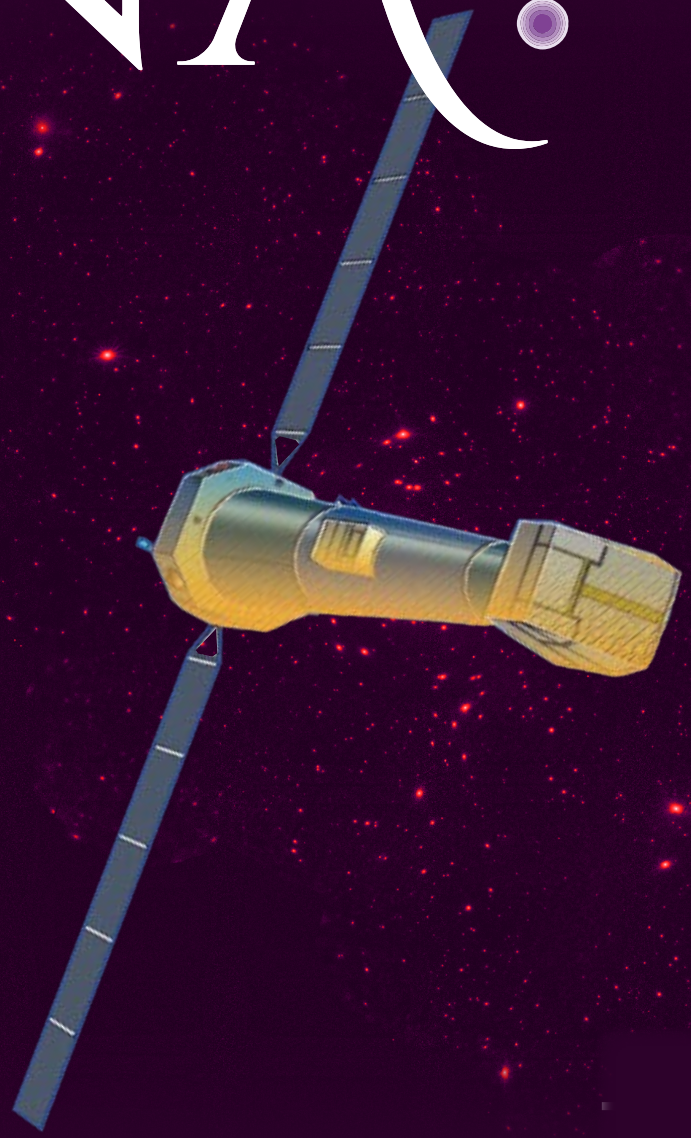
ATHENA

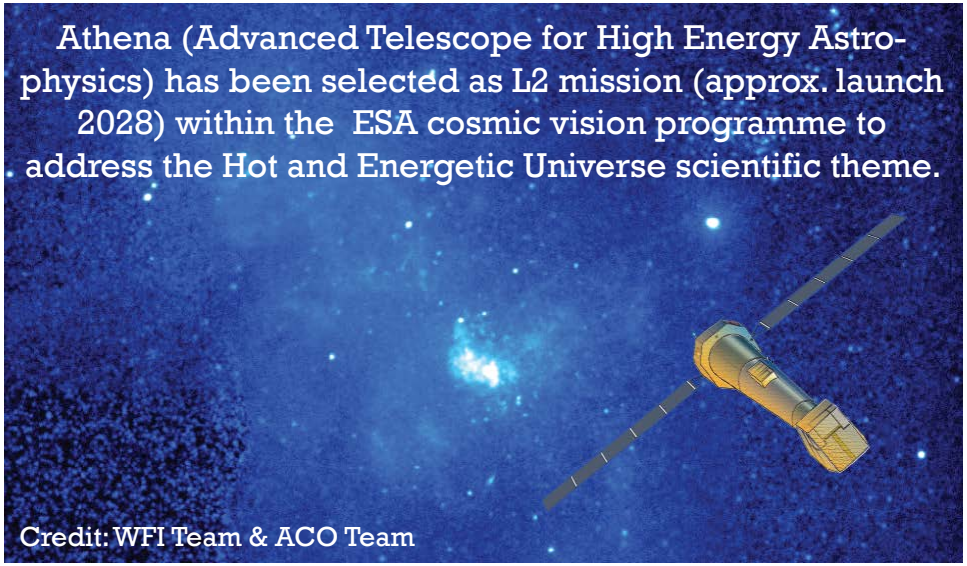
M31 WFI/SIXTE simulation
Credit: WFI Team & ACO Team

2018 Calendar



40′

Athena (Advanced Telescope for High Energy Astrophysics) has been selected as L2 mission (approx. launch 2028) within the ESA cosmic vision programme to address the Hot and Energetic Universe scientific theme.



Credit: WFI Team & ACO Team

INSTRUMENTATION

Athena will consist of a large-aperture X-ray telescope with two focal-plane instruments: the Wide Field Imager (WFI) providing sensitive wide field imaging and spectroscopy and high count-rate capability and the X-ray Integral Field Unit (X-IFU) delivering spatially resolved high-resolution X-ray spectroscopy

Athena will study how ordinary matter assembles into groups and clusters of galaxies, determine its chemical enrichment across cosmic time, and characterise the missing baryons residing in intergalactic filamentary structures

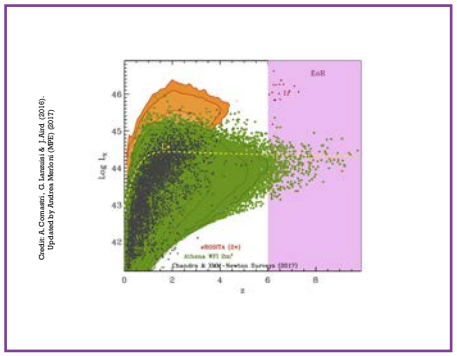
As an observatory, Athena will offer vital information for high-energy phenomena on all classes of astrophysical objects, from Solar System bodies to the most distant objects known

Athena will study the physics of accretion into compact objects, find the earliest accreting supermassive black holes and trace their growth even when in very obscured environments, and show how they influence the evolution of galaxies and clusters through feedback processes

Athena will have a fast target of opportunity observational capability, enabling studies of transient phenomena

With its unparalleled capabilities, Athena will be a truly transformational observatory, operating in synergy with other large space-based observatories in the late 2020s (ALMA, ELT, SKA, etc)

2018



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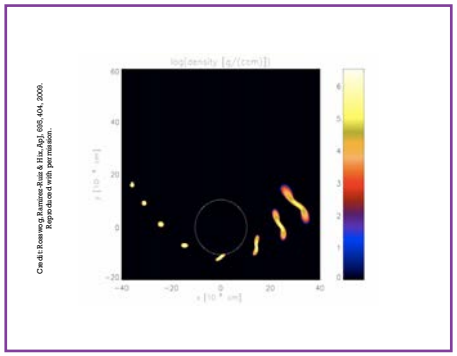

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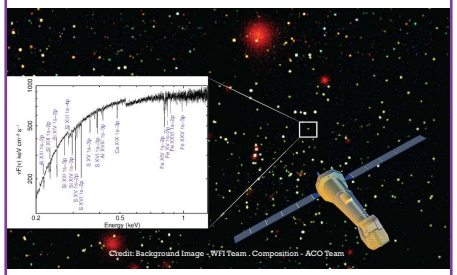

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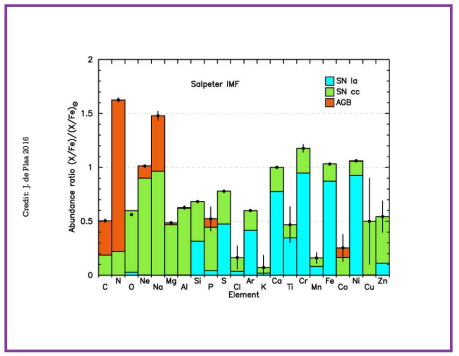
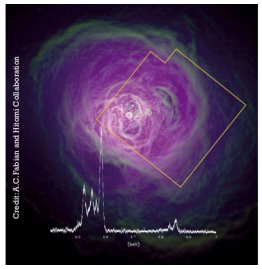
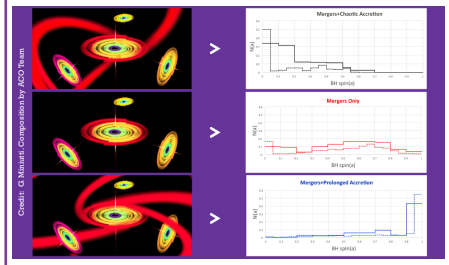


APRIL



MAY



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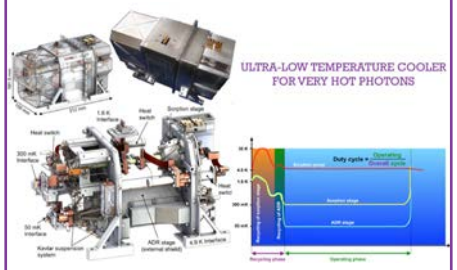

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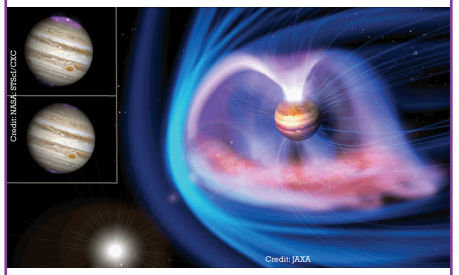
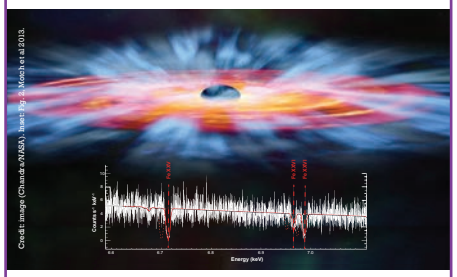


AUGUST



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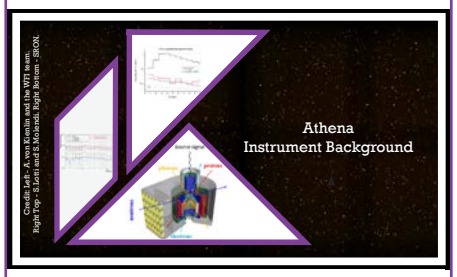
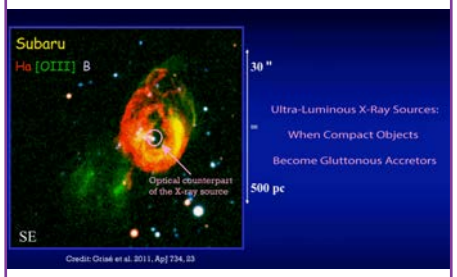
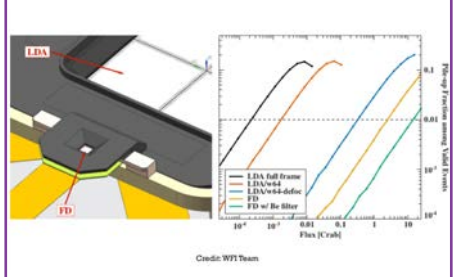


OCTOBER

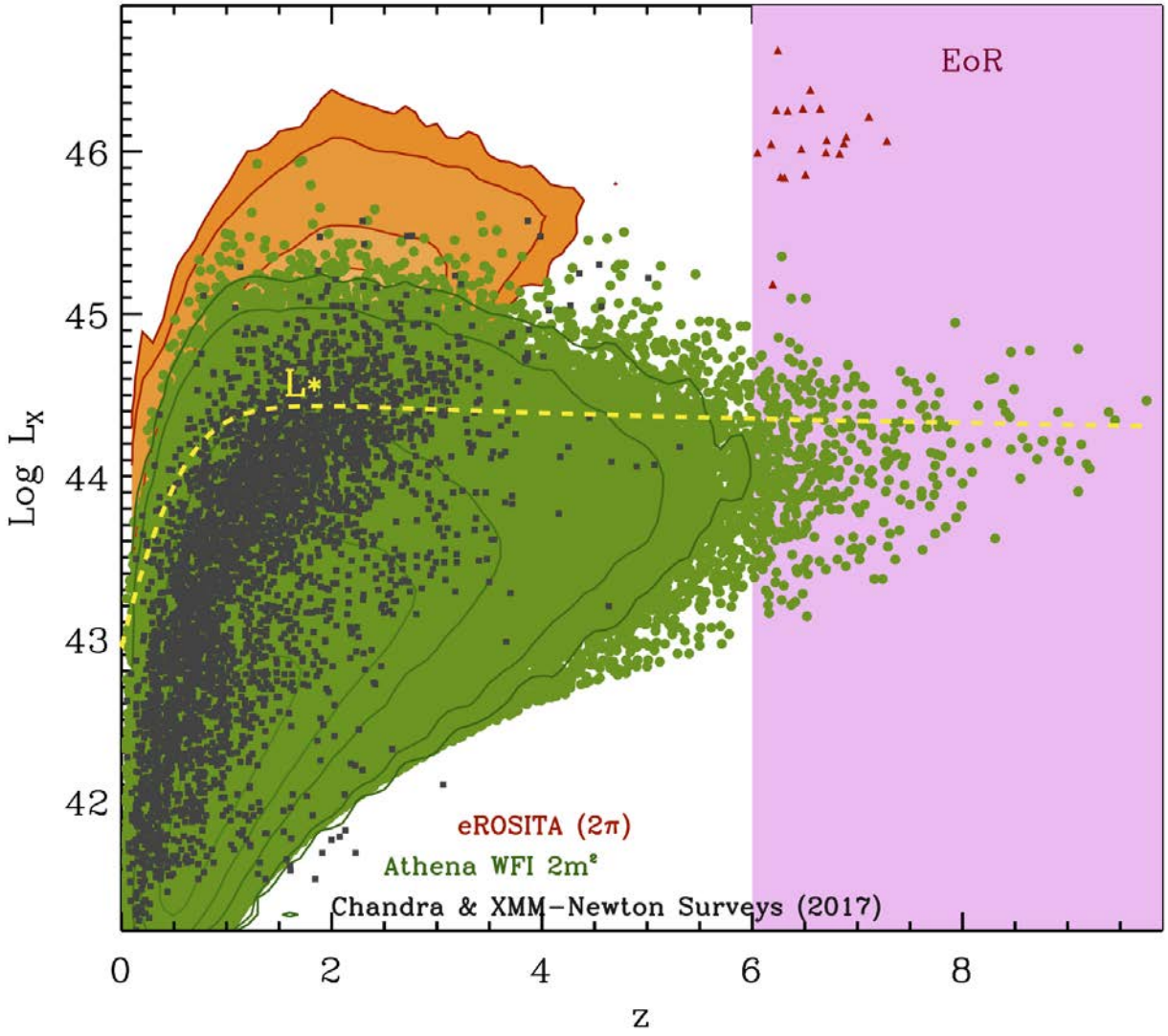


NOVEMBER



DECEMBER

Predictions for the redshifts and luminosities of ~600,000 AGN that will be identified with a multilayered 1-year Athena/WFI survey, including >400 sources at z > 6, compared to current Chandra and XMM-Newton surveys. Athena will identify AGN that are ~2 orders of magnitude fainter than current optical and near-IR surveys (e.g. SDSS) pushing the redshift limits much beyond that of the current record holder at z~7.1. Athena will discover more than 120 moderate luminosity AGN at z>7 and well within the Reionization epoch which, according to the most recent measurements, is found to lie in the redshift range ~7.5-9.5. The X-ray sources will provide an essential complement to the luminous quasars that will be identified by Euclid.[1]



Credit: A. Comastri, G. Lanzuisi & J. Aird (2016).
Updated by Andrea Merloni (MPE) (2017)

January 2018

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ATHENA

December 2017

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February 2018

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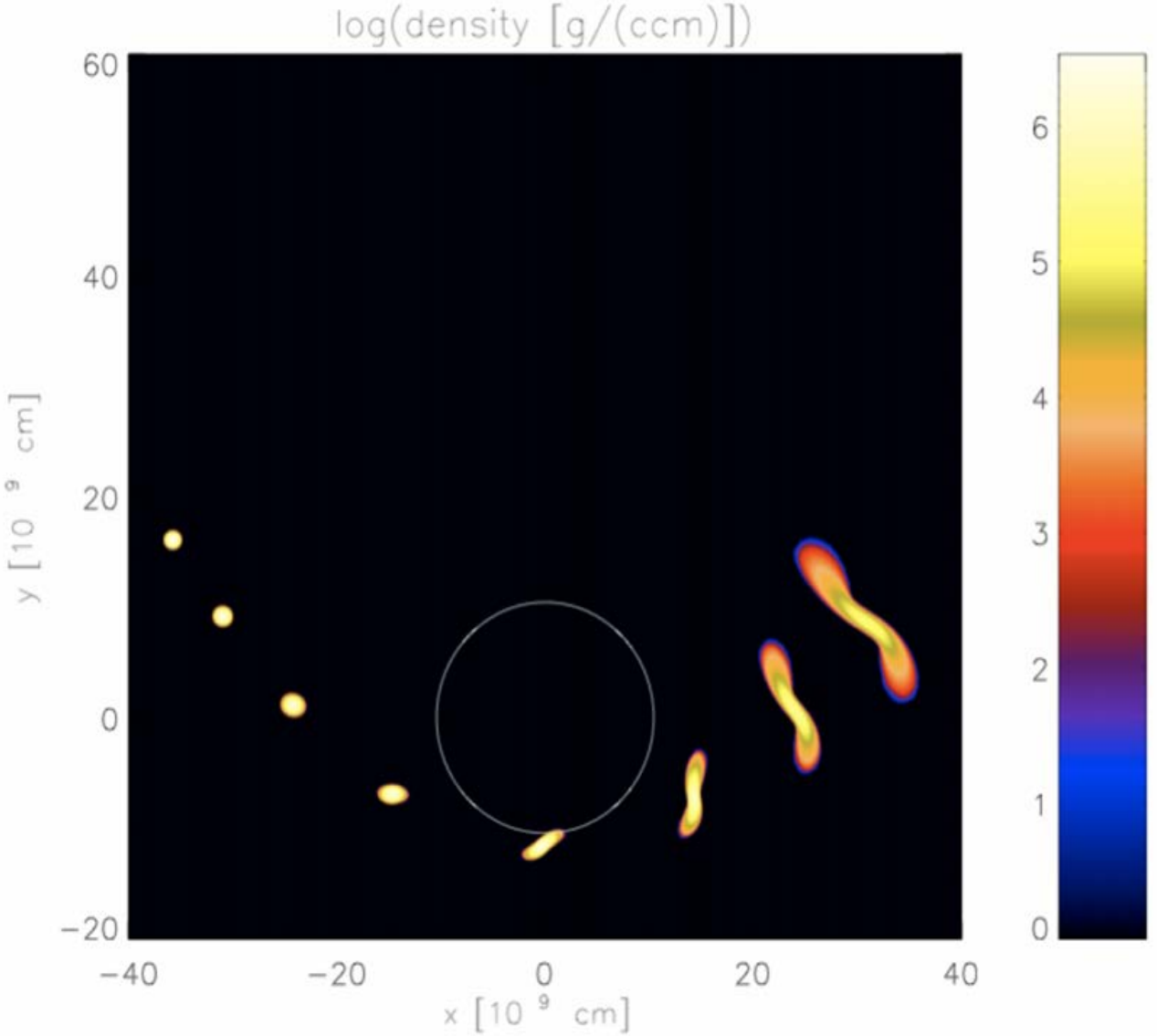
Notes:

Composite of eight stills from the simulation of the tidal disruption of a white dwarf star by an intermediate-mass black hole*. The location of the event horizon of the black hole is indicated by the white circle at position X,Y=0,0. The colour indicates the density of the material in logarithmic units of g/cm^3. (2)

* Rosswog, Ramirez-Ruiz & Rix (2009, DOI 10.1088/0004-637X/695/1/404, © AAS. Reproduced with permission)



Credit: Rosswog, Ramirez-Ruiz & Hix, ApJ, 695, 404, 2009.
Reproduced with permission.

February 2018

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ATHENA

January 2018

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March 2018

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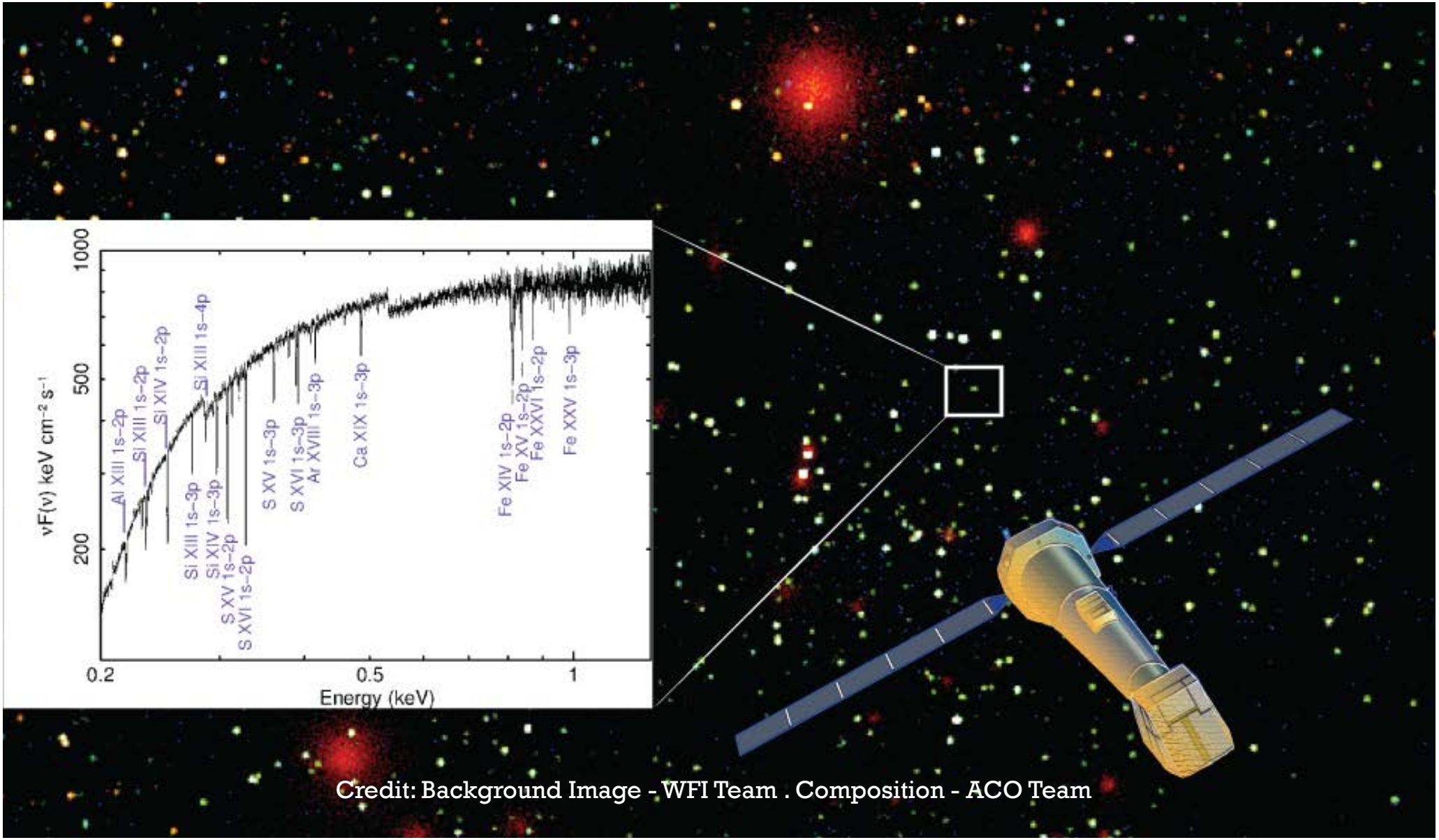
Notes:

A simulated Athena/X-IFU X-ray spectrum of a medium bright (fluence=4 x 10^{-7} erg cm^{-2}) Gamma-Ray Burst (GRB) afterglow at z=7, characterized by deep narrow resonant lines of Fe, Si, S, Ar, Mg, from the gas in the environment of the GRB.[3]



Credit: Background Image - WFI Team . Composition - ACO Team

March 2018

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ATHENA

February 2018

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April 2018

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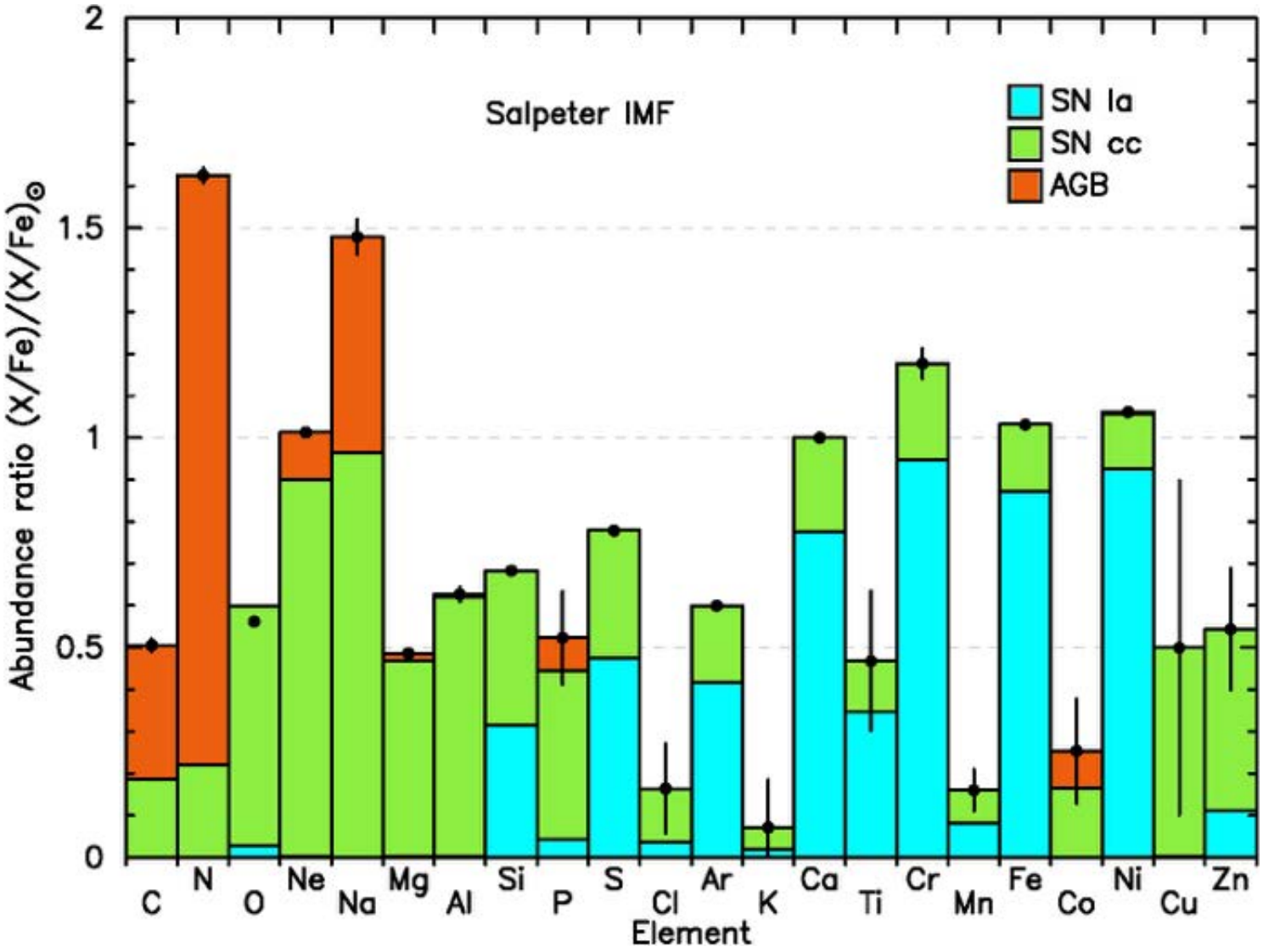
NOTES:

Expected abundances measured by Athena in a bright 'local' cluster of galaxies. The colour bars show which fraction of the element is produced by either core-collapse supernovae (SN cc, green), type Ia supernovae (SNIa, cyan) or Asymptotic Giant Branch stars (AGB, red). The error bars on the black data points show the expected statistical uncertainty on the measurement. [4]



Credit: J. de Plaa 2016

April 2018

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ATHENA

March 2018

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May 2018

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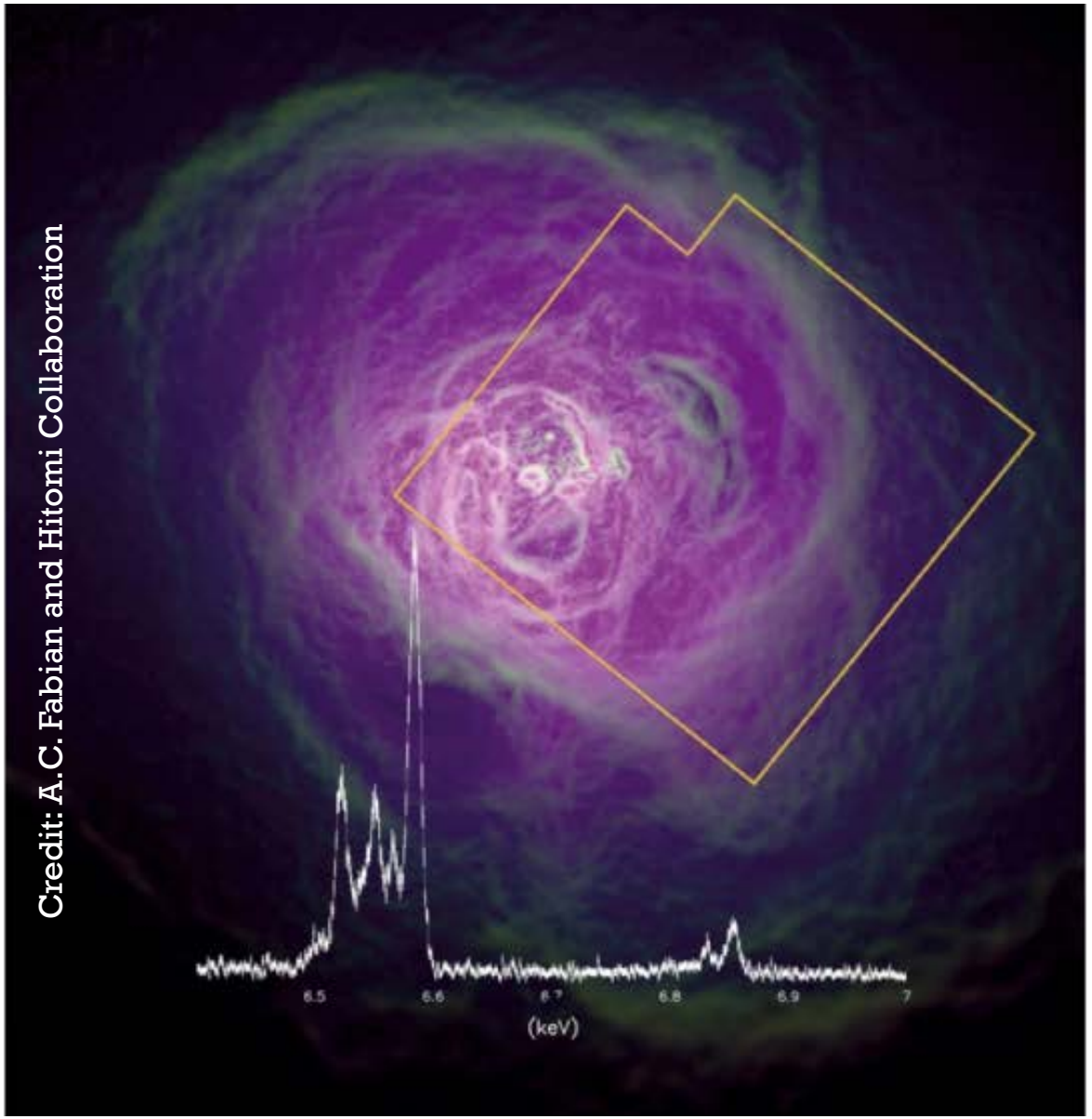
NOTES:

The Hitomi/SXS spectrum of highly-ionized iron ions is superimposed on an enhanced Chandra X-ray image of the Perseus cluster core. The nucleus of NGC1275 is at the centre. The yellow clipped square shows the field of view of the 35 pixel SXS. [5]



May 2018

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ATHENA

April 2018

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June 2018

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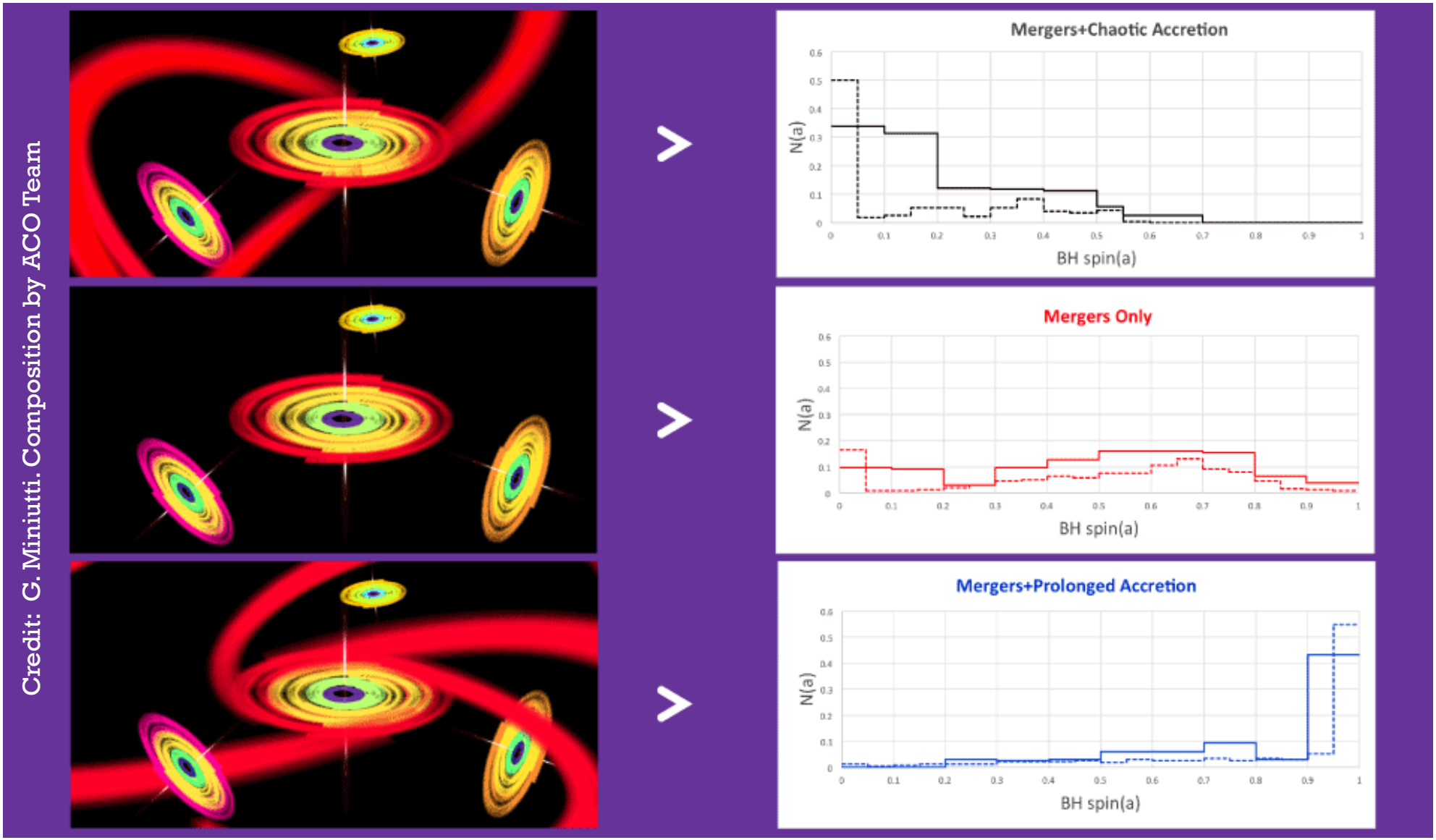
NOTES:

Spin as a probe of SMBH growth history. The distribution of black hole spins in the local Universe depends on whether they have accumulated their mass predominantly via mergers, steady accretion or chaotic accretion. The theoretical expectations for each SMBH growth scenario (dotted histograms) is shown and compared to simulated Athena measurements (solid histograms*), accounting realistically for all observational errors and spectral complexities.[6]

* Berti & Volonteri 2008



June 2018

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ATHENA

May 2018

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July 2018

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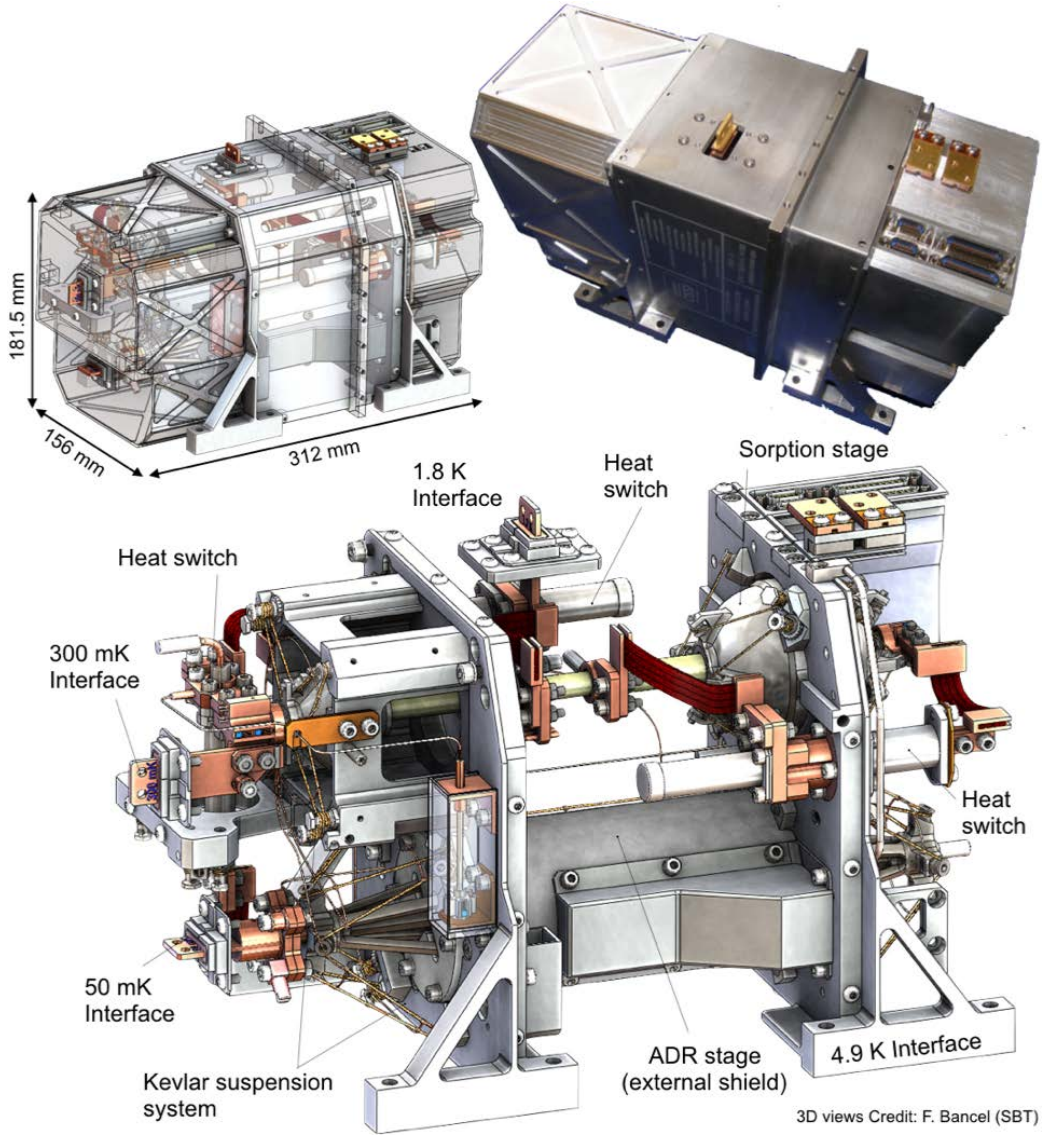
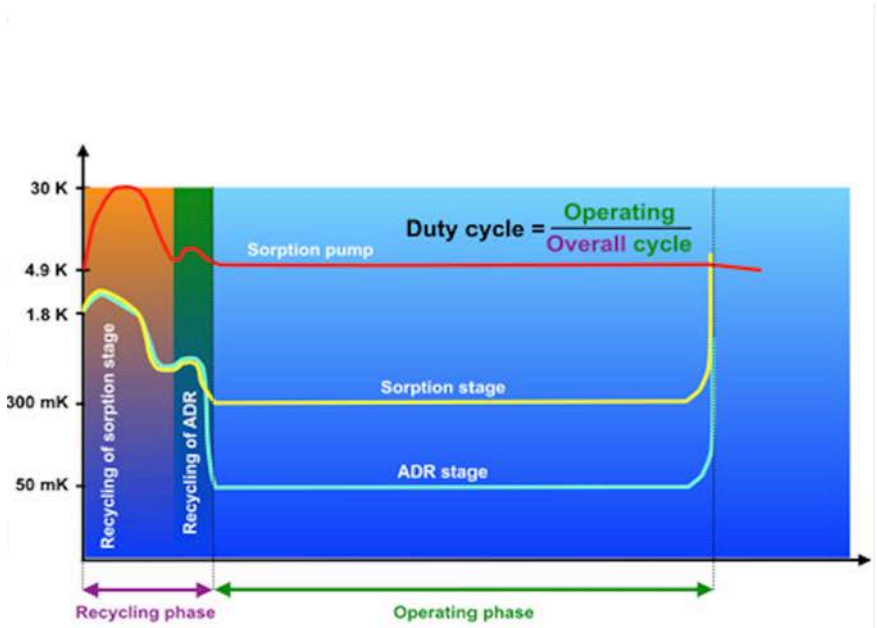
Notes:

Athena and other future space missions call for an extended lifetime and ultra-low temperature for some of their detectors. The image shows an engineering model cooler developed for the SAFARI instrument on-board the SPICA satellite. [7]

ULTRA-LOW TEMPERATURE COOLER FOR VERY HOT PHOTONS





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ATHENA

June 2018

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August 2018

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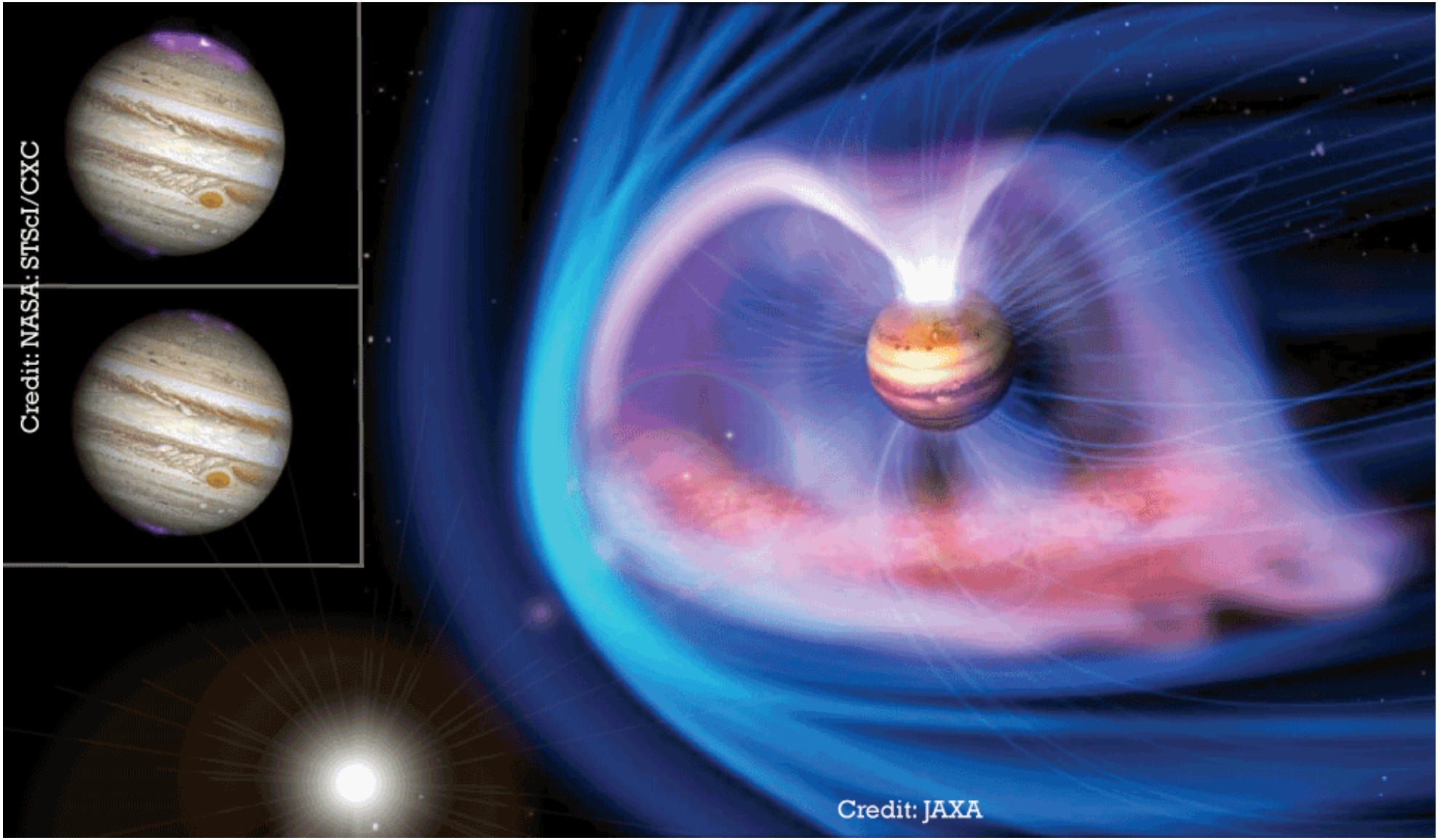
NOTES:

Right: Artist's impression of Jupiter's X-ray aurora and the magnetosphere. Left: Images of Jupiter's X-ray aurora during varying solar wind conditions in 2011* overlaid on visible images of Jupiter from the Hubble Space Telescope. *Top*: The X-ray emission (increasing intensity from blue to white) is enhanced after the arrival of a coronal mass ejection from the Sun. *Bottom*: Dimmer auroral X-ray emission one day later. [8]

* Dunn et al. 2016



August 2018

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ATHENA

July 2018

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September 2018

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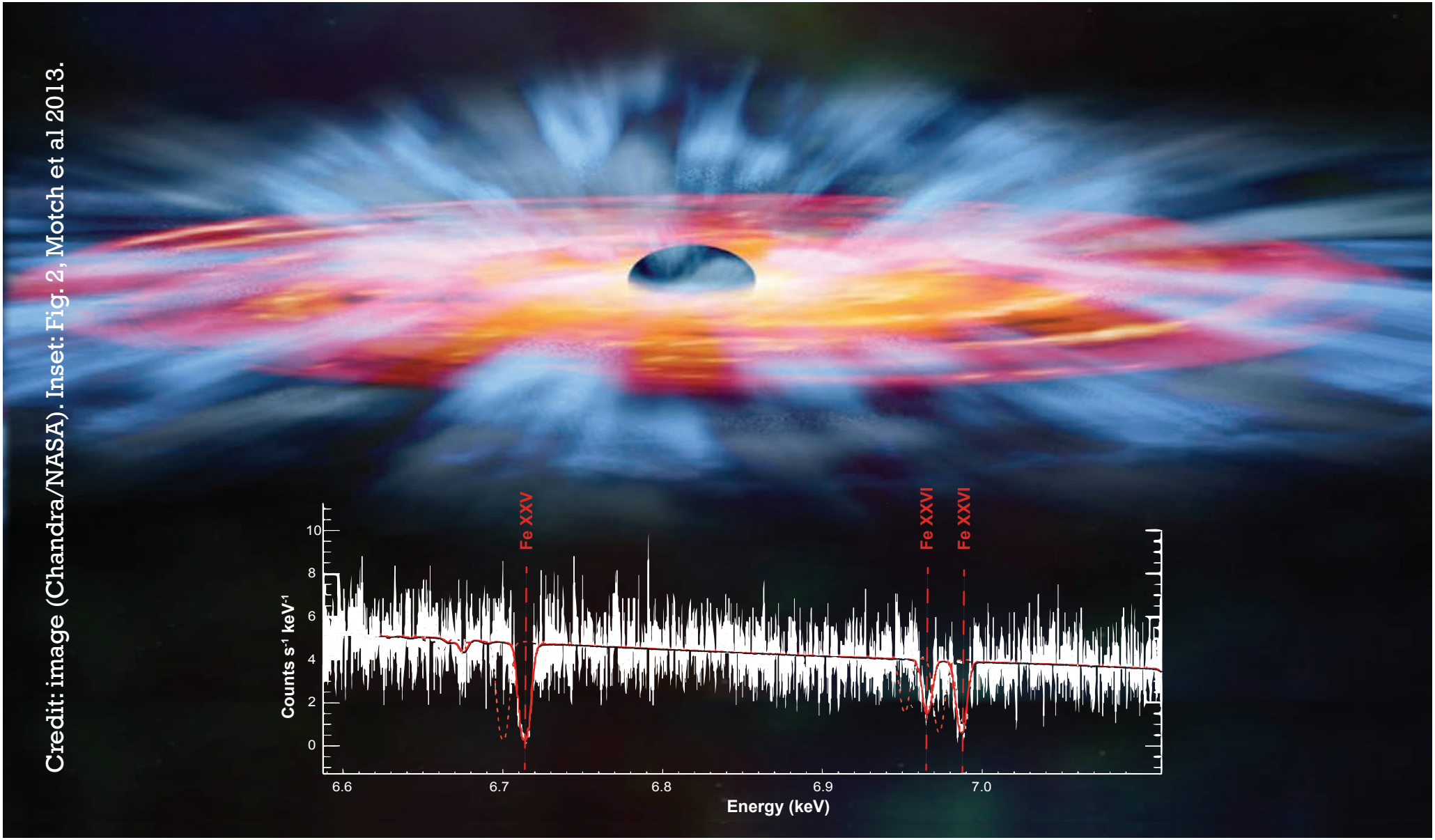
NOTES:

Artist's impression of an equatorial accretion disc wind as observed in X-ray binaries. Athena/X-IFU will allow the detection of weak lines and an unprecedented precision in the measurement of the width, position and depth of all the detected lines (see inset). This information will be used to disentangle the different components of the winds and to infer their characteristics to ultimately determine what powers them.[9]



Credit: image (Chandra/NASA). Inset: Fig. 2, Motch et al 2013.

September 2018

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ATHENA

August 2018

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October 2018

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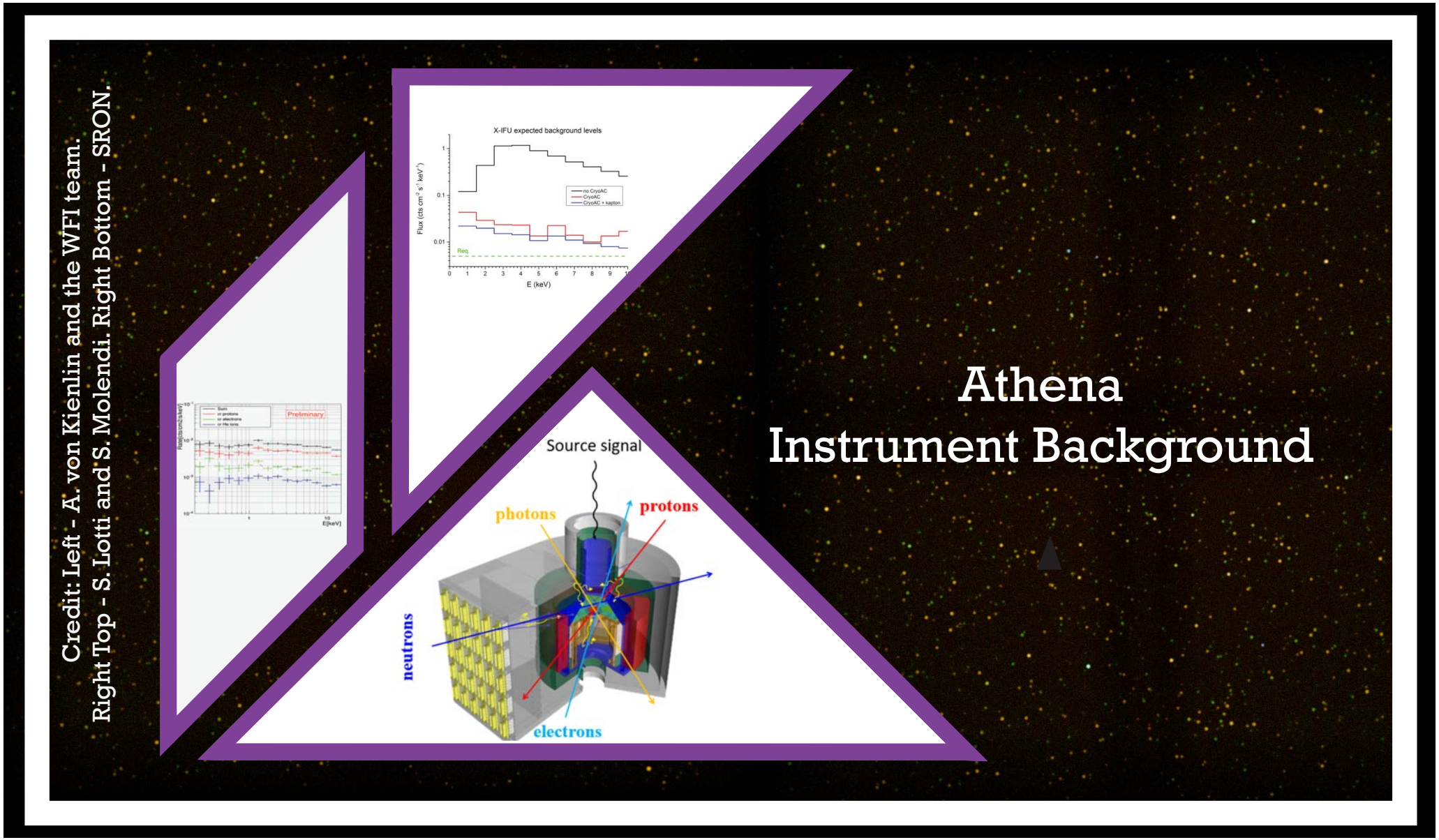
NOTES:

Preliminary spectra of the background in the Athena Instruments. Left: Athena/X-IFU background for different configurations of the Focal Plane Assembly. Right top: Athena/WFI background showing contributions from different particle populations. Optimizations are ongoing for both instruments. Right bottom: schematic view of the origin of the different components of the background in the Athena/X-IFU.[10]



October 2018

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ATHENA

September 2018

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November 2018

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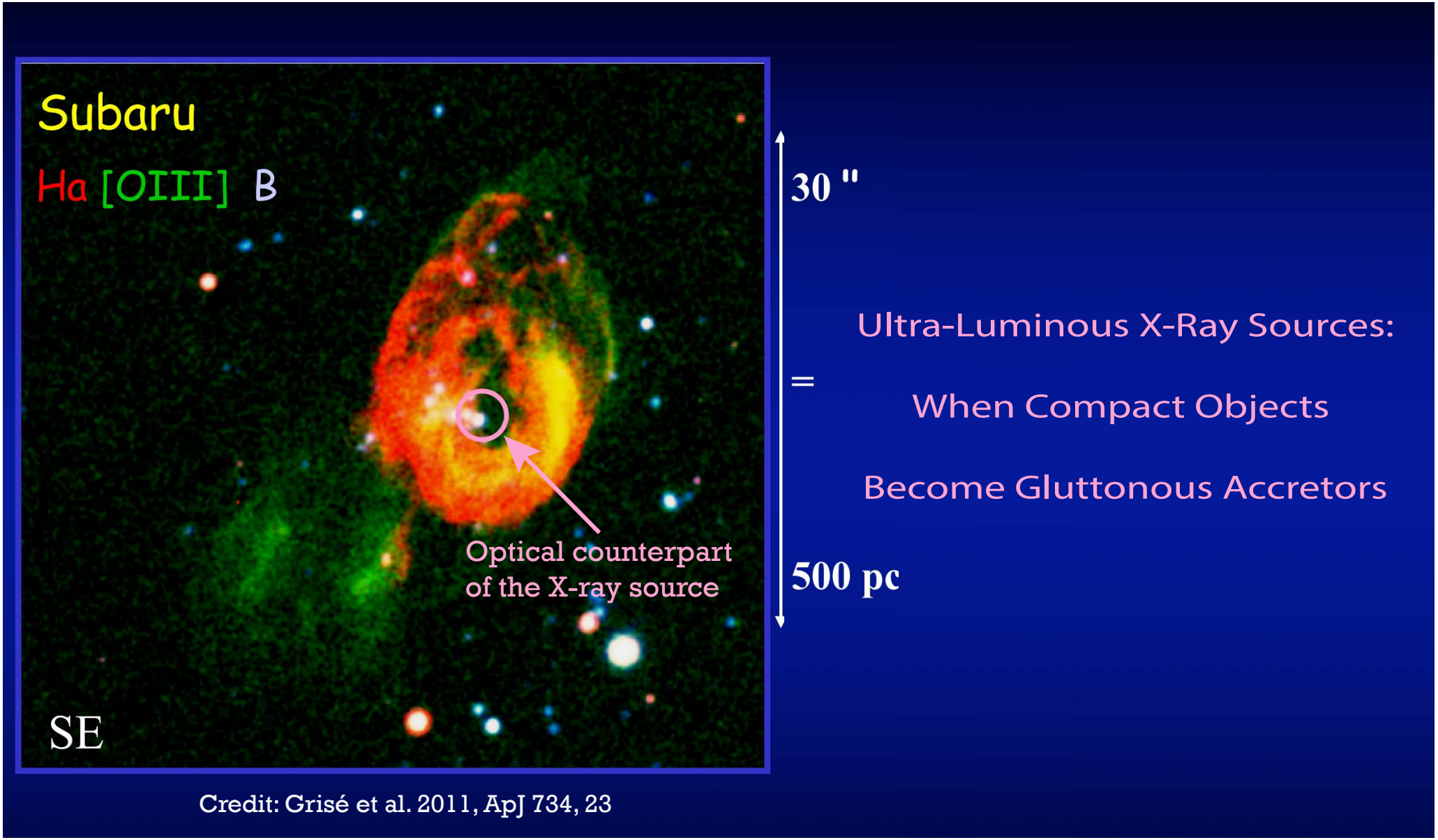
Notes:

A multicolour image of the shell-like bubble MH9-11 around the ultra-luminous X-ray source Holmberg IX X-1 which has a Lx ~ 10^{40} erg/s. The pink circle shows the position of the optical counterpart of the X-ray source which has blown the ~ 500pc diameter bubble around.[11]



Credit: Grisé et al. 2011, ApJ 734, 23

November 2018

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ATHENA

October 2018

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December 2018

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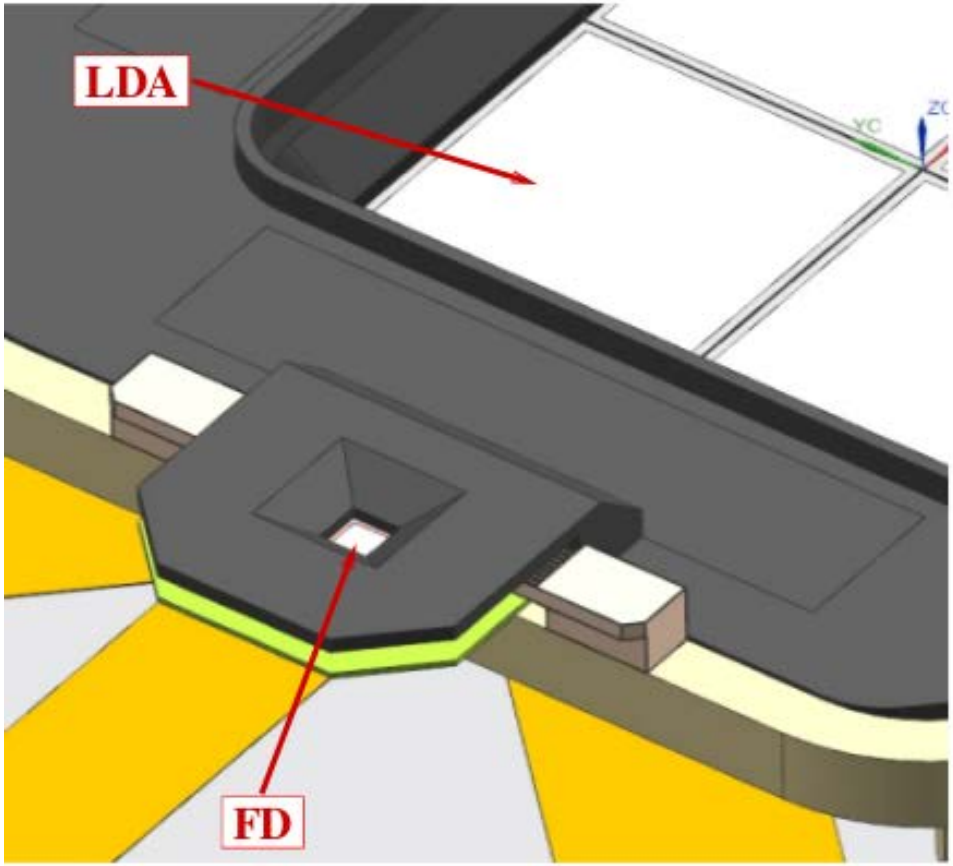
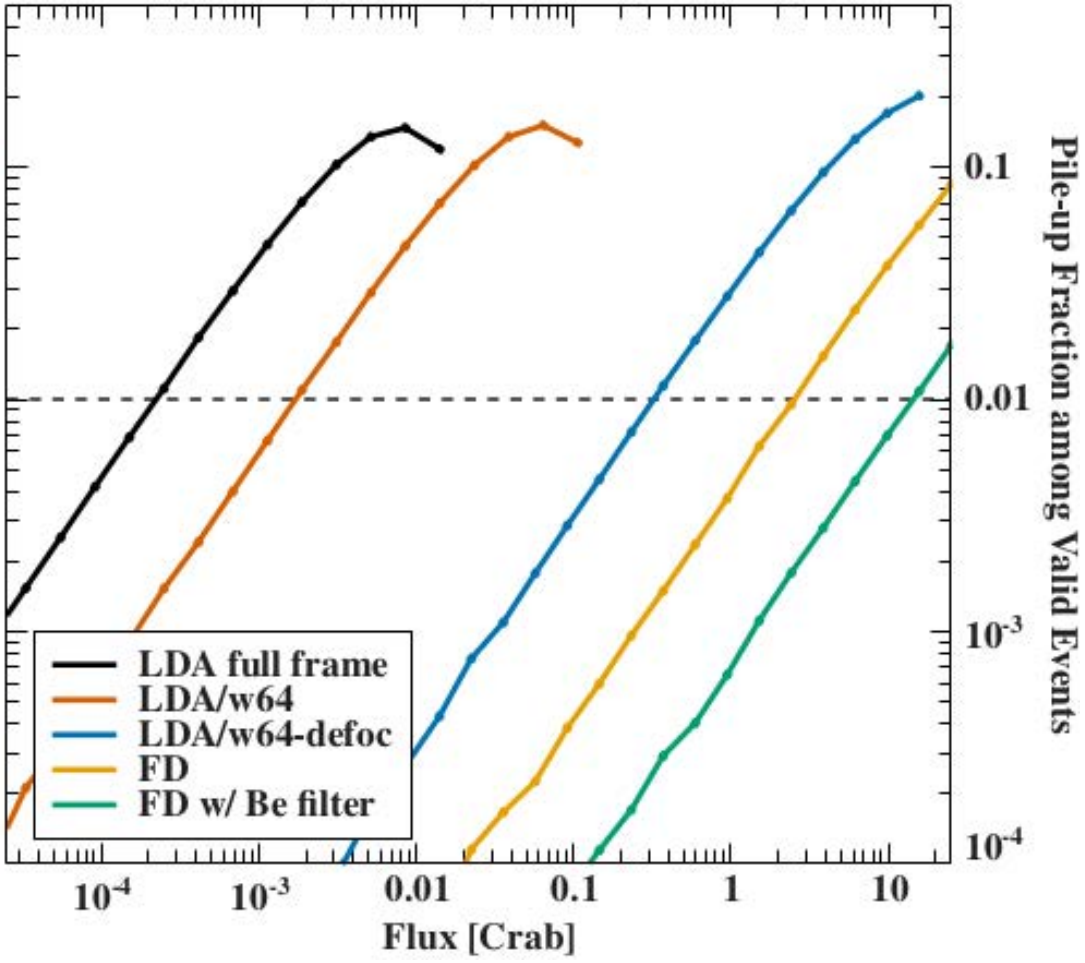
Notes:

Left: Schematic drawing of the Athena/WFI Fast Detector (FD) next to the Large Detector Array (LDA). Right: Fraction of events influenced by pile-up for a Crab-like X-ray source for different detector configurations.[12]





Credit: WFI Team

December 2018

Mon	Tue	Wed	Thu	Fri	Sat	Sun
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

ATHENA

November 2018

M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

January 2019

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

NOTES:

References

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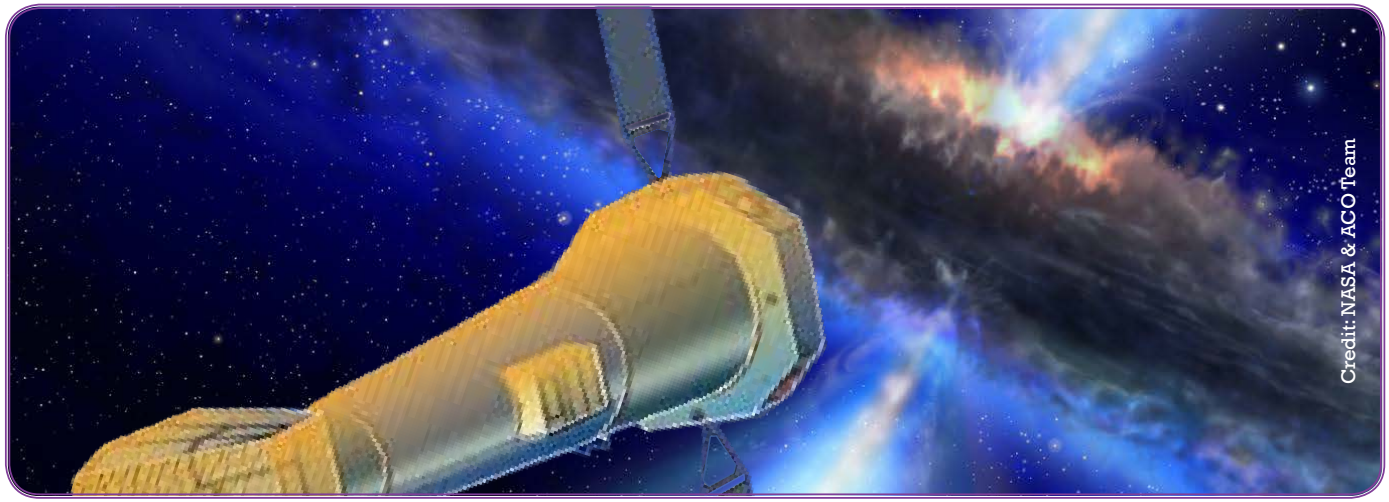
(10) 27-09-2017 #AthenaNugget 15 "Athena Instrument Background" by Simone Lotti (INAF/IAPS, Rome) and Silvano Molendi (INAF/IASF, Milan)

(11) 05-10-2017 #AthenaNugget 16 "Ultra-Luminous X-Ray Sources:When Compact Objects Become Gluttonous Accretors" by Christian Motch, Observatoire Astronomique Strasbourg, France

(12) 02-11-2017 #AthenaNugget 17 "Observing Bright Sources with the Athena-WFI" by Jörn Wilms(1), Thomas Dauser(1) and Arne Rau(2), (1)Remeis Observatory & ECAP, Universität Erlangen-Nürnberg, Germany, (2)Max-Planck Institut fuer Extraterrestrische Physik (MPE), Germany



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The Athena X-ray Observatory

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