- RAY ASTRONOMY 2019

Current Challenges and New Frontiers in the Next Decade

Opening

Günther Hasinger, ESA Director of Science

CNR/INAF Bologna, 9.9.2019

Towards Space19+

In Memoriam Riccardo Giacconi

Riccardo at the Bologna 2009 X-ray conference

Father of X-ray Astronomy

Consequently pursued his dream of resolving the X-ray background …

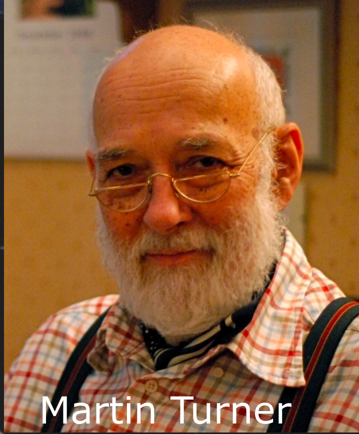
… and understanding galaxy cluster evolution

Nobel Prize in Physics 2002

Giacconi Memorial at STScI

Grandfathers of ATHENA

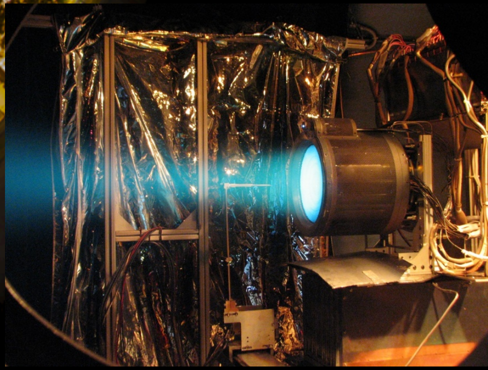
- Professor at University Bologna
- XEUS idea
- Integral Mission Scientist
- Director of Astronomy Dep. 2006-2009



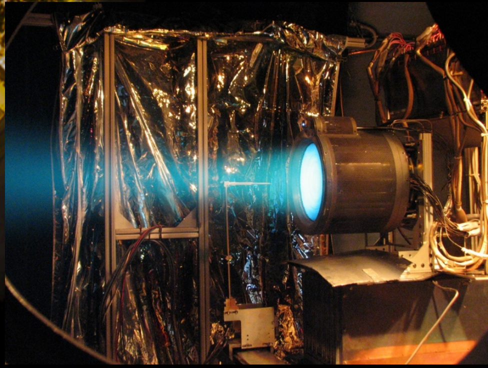
XEUS - the X-ray evolving universe spectroscopy mission

A. N. Parmar[a], M. Arnaud[b], X. Barcons[c], J. Bleeker[d], G. Hasinger[e], H. Kunieda[f], G. Palumbo[g], T. Takahashi[f], M. Turner[h], P. de Korte[e], R. Willingale[h], N. Rando[i], A. Lyngvi[i], P. Gondoin[i], D. Lumb[i], M. Bavdaz[i], P. Verhoeve[i]

Textbook Launch for BepiColombo

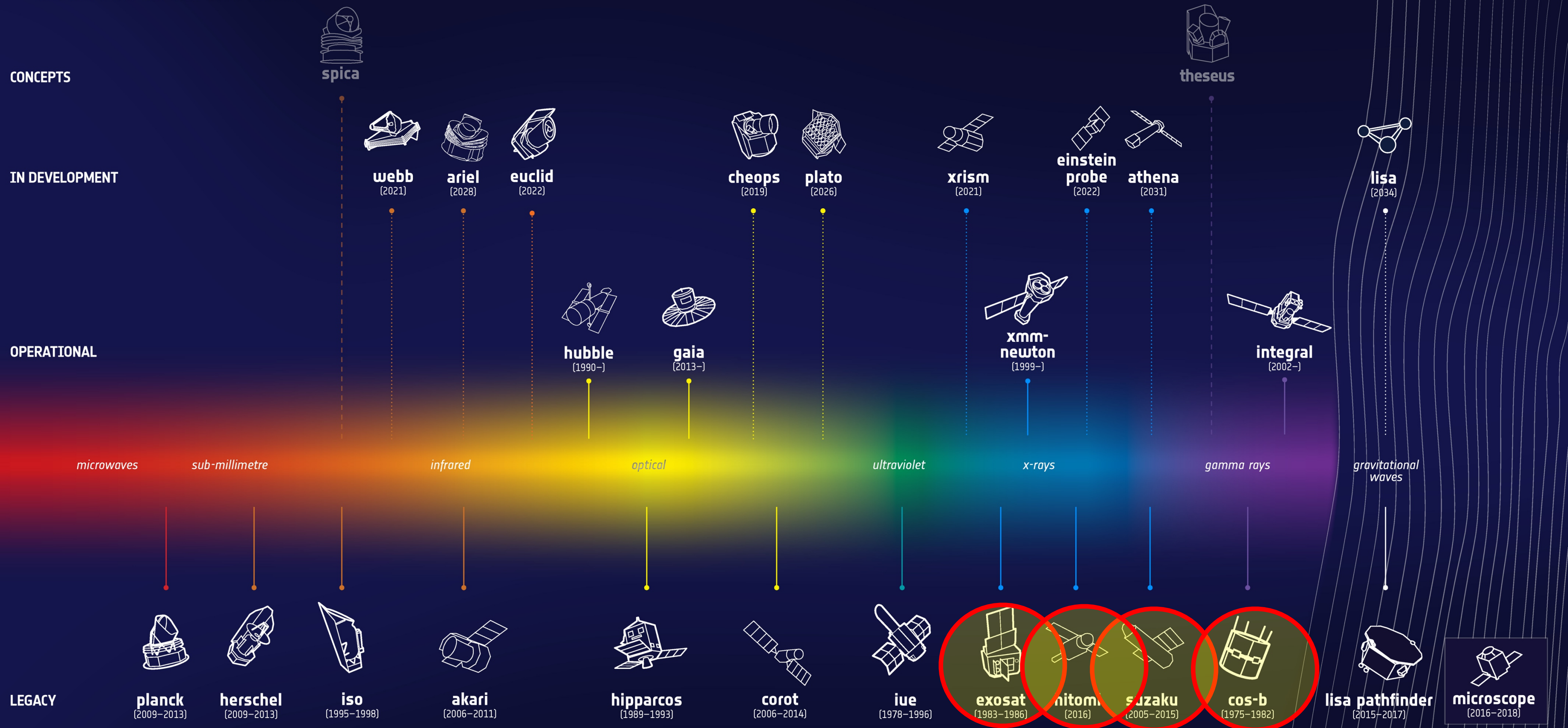


Textbook Launch for BepiColombo



The ESA Fleet for Astrophysics

→ COSMIC OBSERVERS

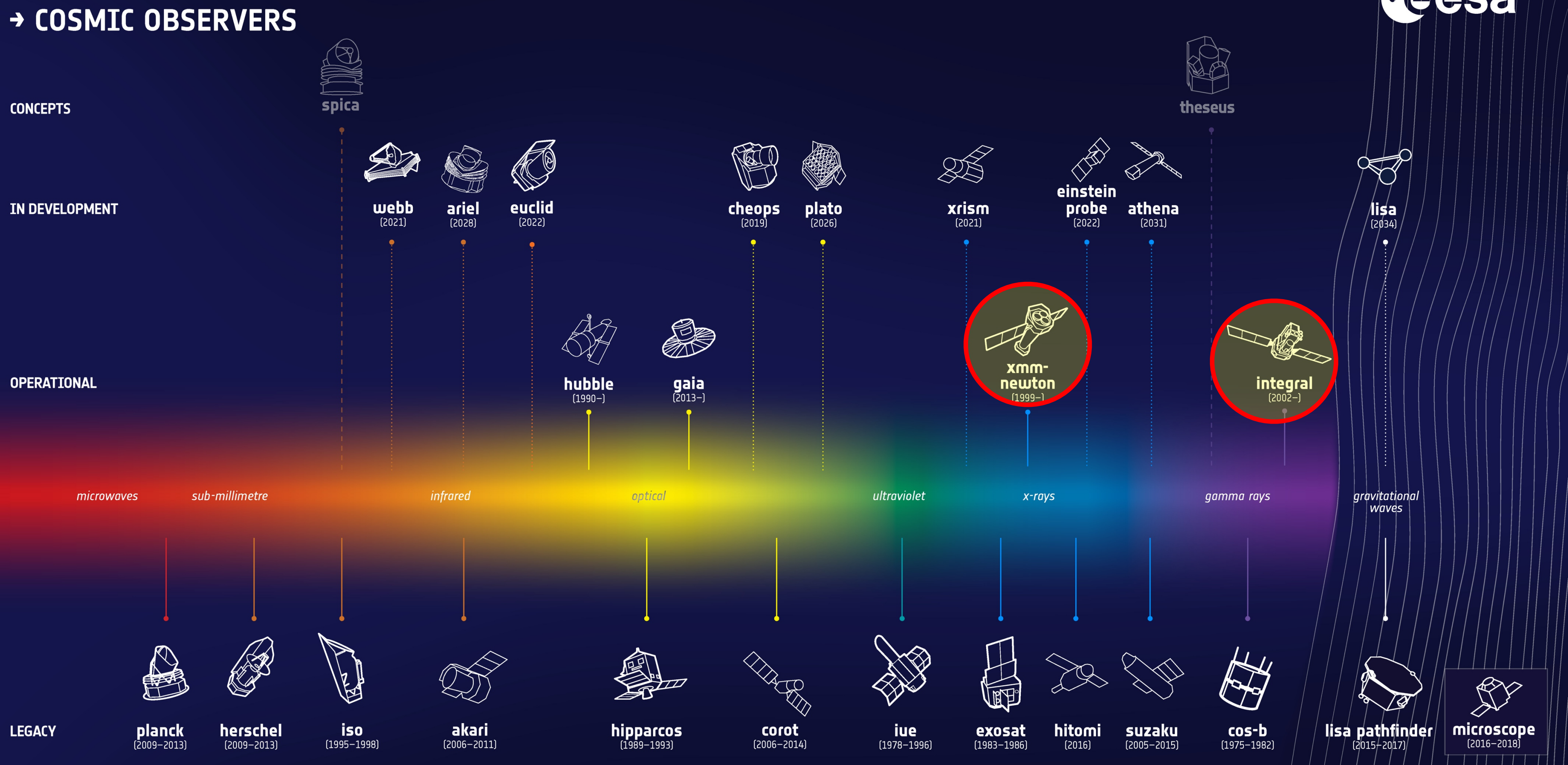


#Space19plus

+ international partner's ROSAT, GRO, Chandra, Swift, NuStar, Spektr-RG ...

Space19

The ESA Fleet for Astrophysics



#Space19plus

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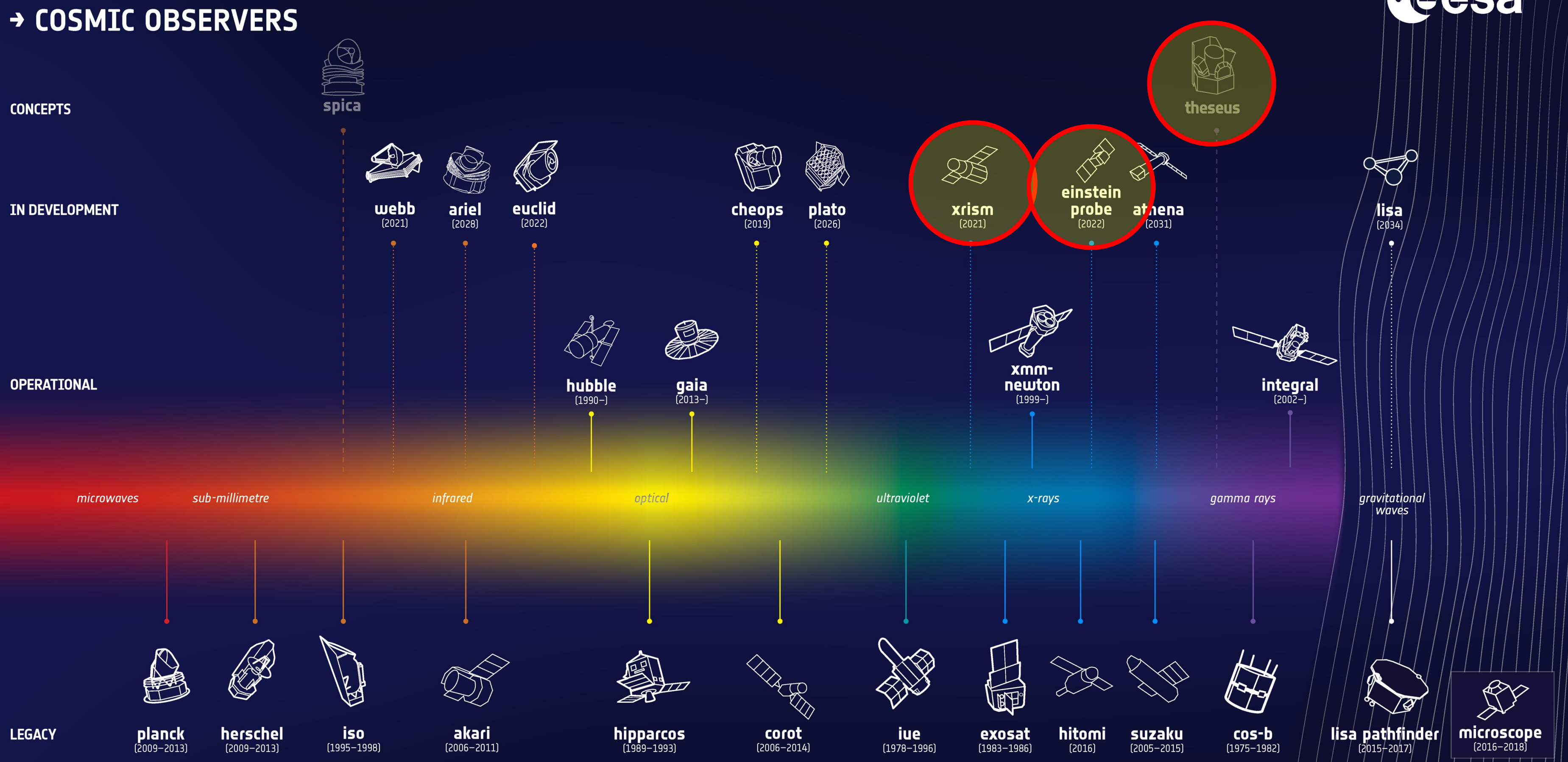

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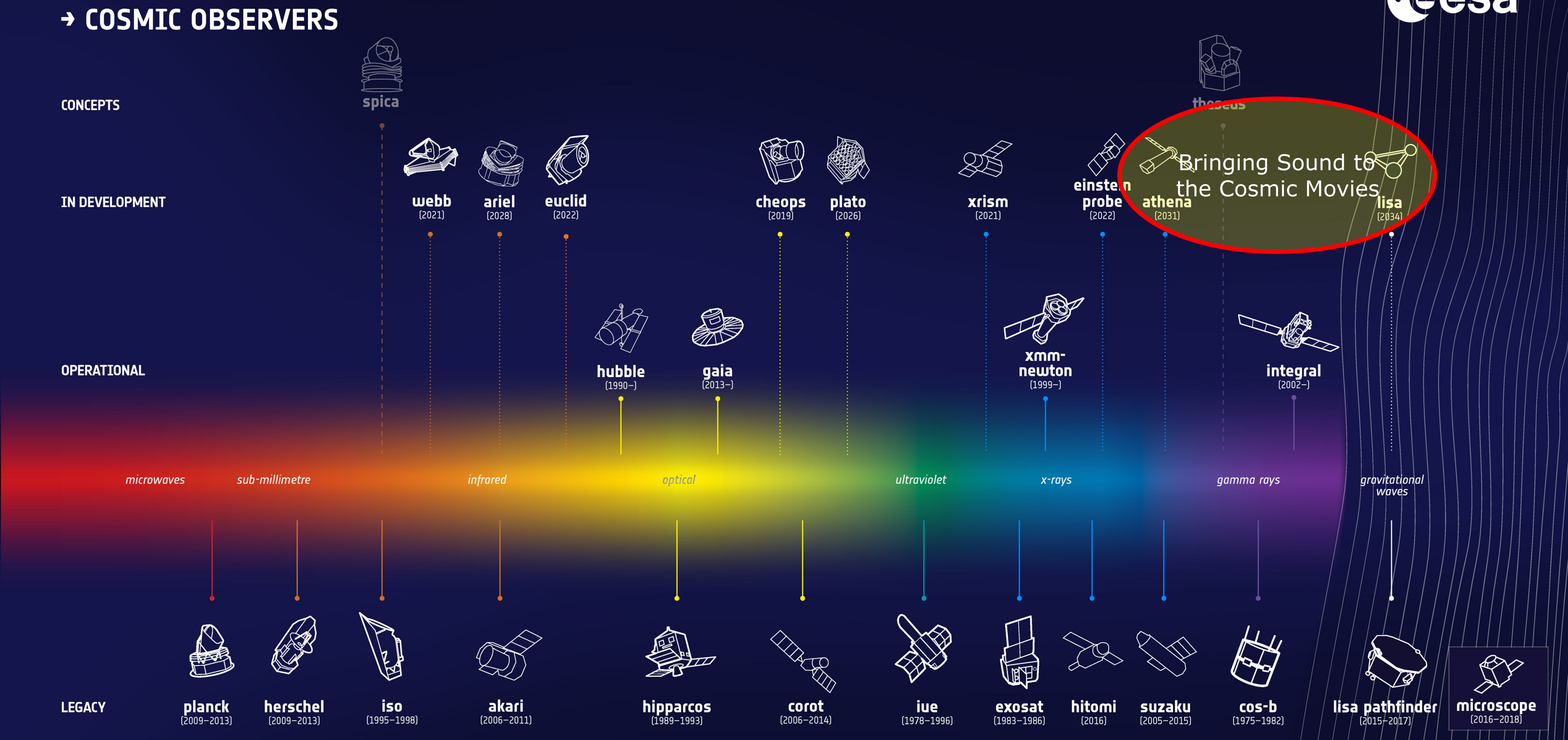

#Space19plus

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Space19

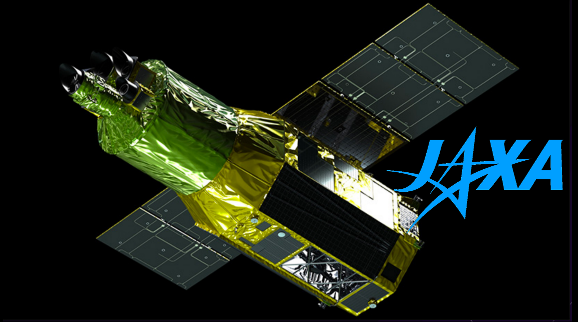
ESA Missions of Opportunity

Corot	Exoplanets	France
Microscope	Fundamental physics	France
Hinode	Solar physics	Japan
Proba-2	Plasma physics	TEC/Belgium
Hitomi	X-ray astronomy	Japan
ExoMars	Planetary science	HRE/Russia
IRIS	Solar physics	NASA
Proba-3	Solar physics	TEC/Belgium
XRISM	X-ray astronomy	Japan
Einstein Probe	X-ray astronomy	China
MMX	Planetary science	Japan
WFIRST	NIR Astronomy	NASA
LiteBIRD	Cosmic Microwave	Japan/France
eXTP	X-ray Astronomy	China
Taiji	Gravitational Waves	China
ULTRASAT	UV All-Sky Survey	Israel
HERA	Asteroid deflection	TEC/OPS/Safety
Lagrange L5	Space Weather	OPS/TEC/Safety
Lunar Gateway	Planetary science	HRE

ESA is THE partner of choice for international cooperation

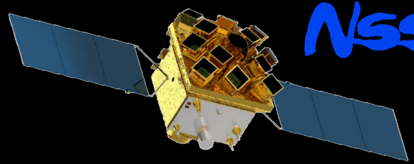
XRISM

High resolution X-ray spectroscopy



Einstein Probe

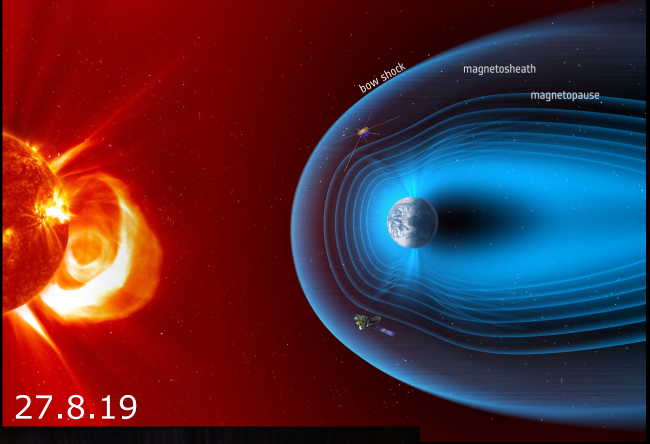
X-ray transients, multi-messenger

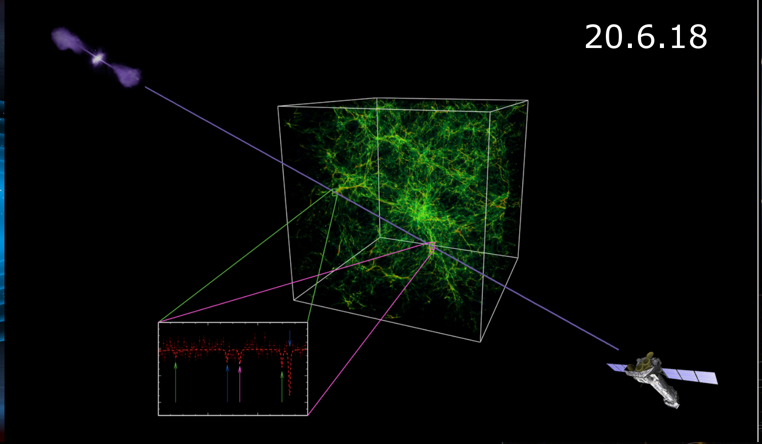


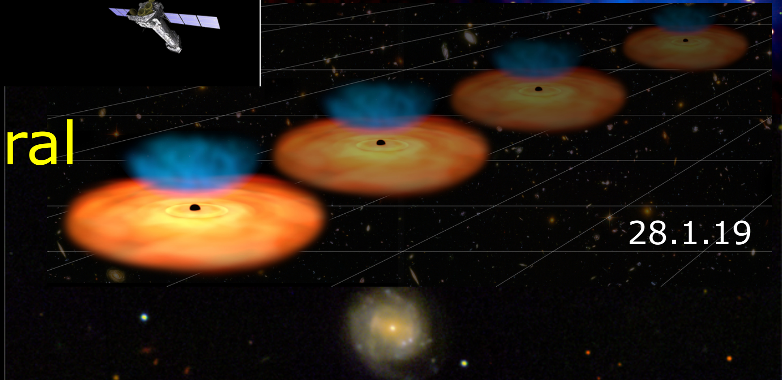
XRISM Agreement Signature by JAXA President and ESA DG

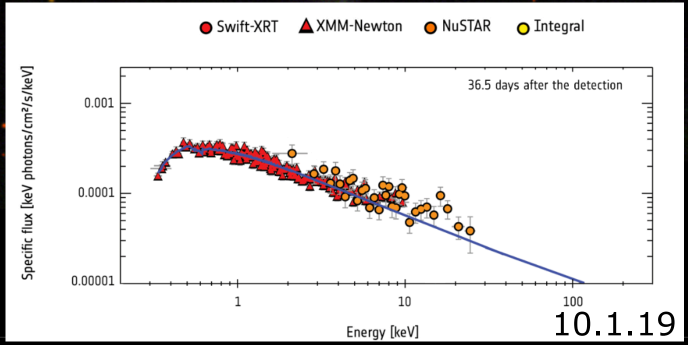
282. Council Meeting
ESOC, 14.6.2019

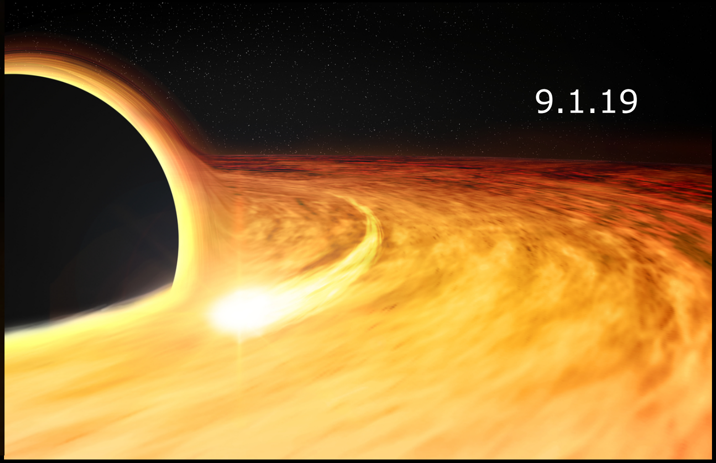
XMM-Newton & Integral Highlights











Fundamental new physics in the making!

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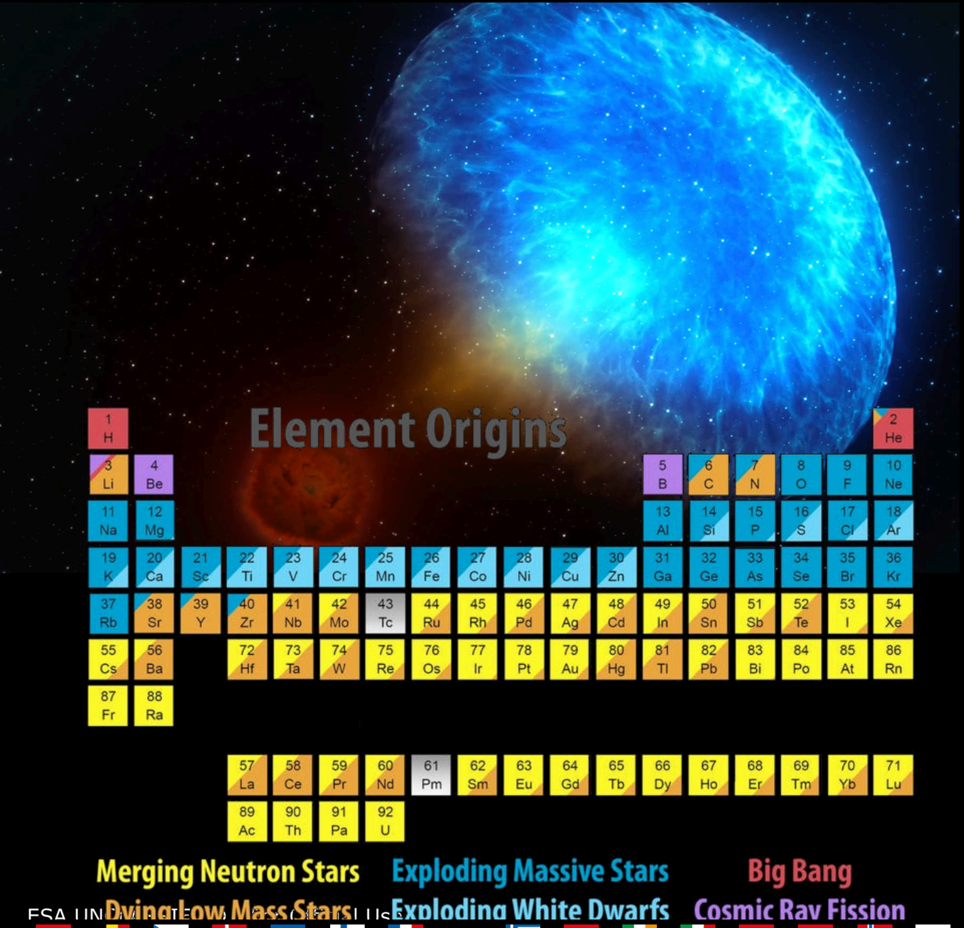
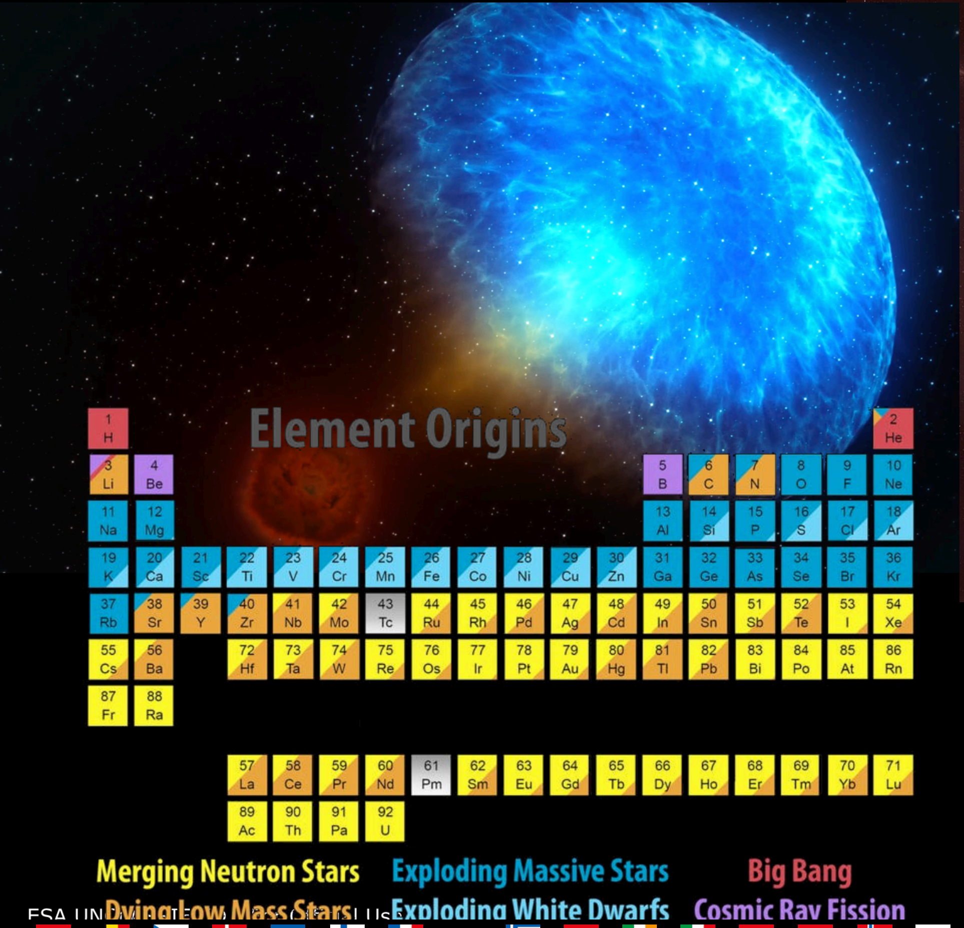
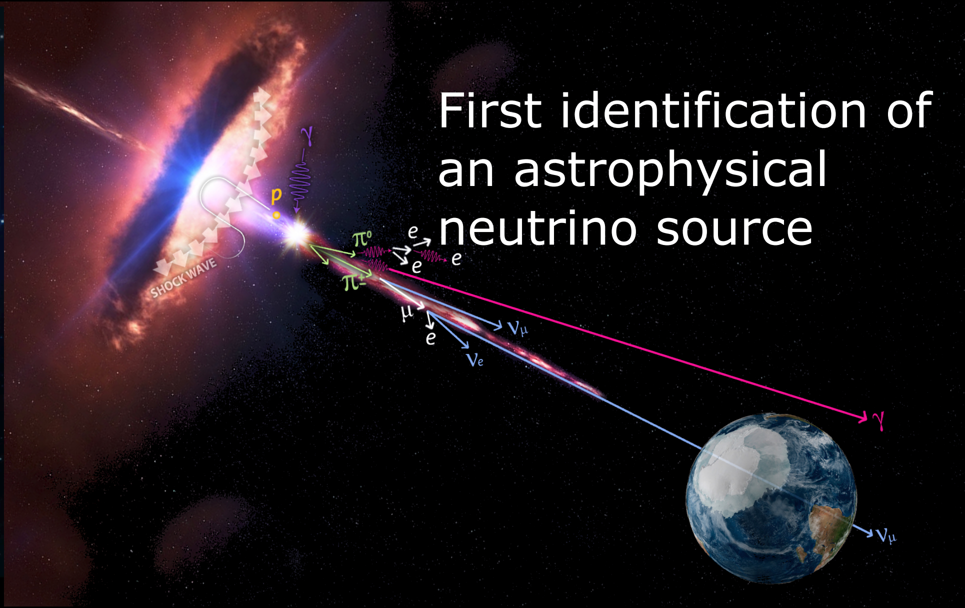


We are not only star-dust, we are also neutron star dust!

… and 10% from the Big Bang

Fundamental new physics in the making!





First identification of an astrophysical neutrino source

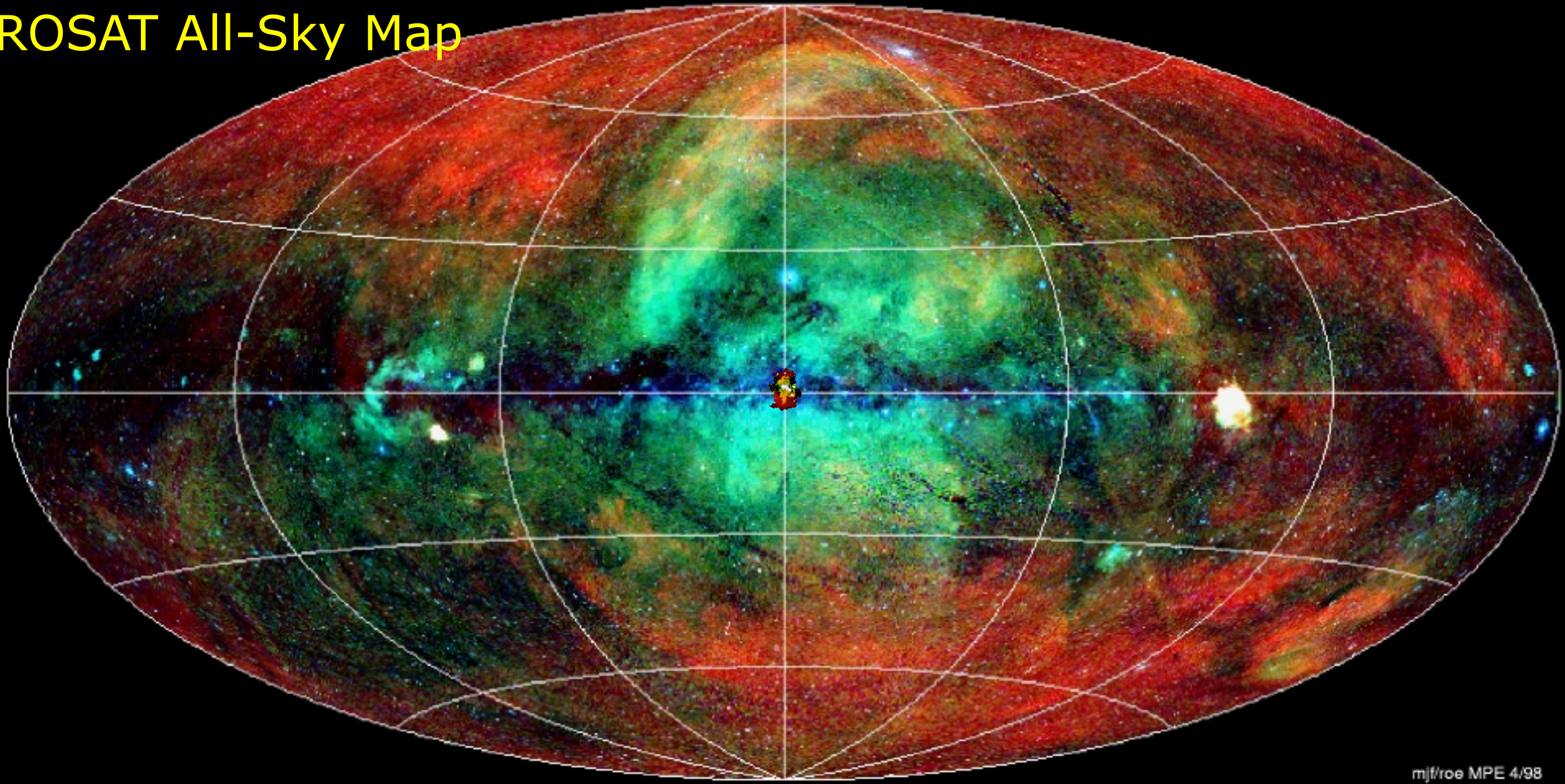
New windows into our understanding of the Universe require global-scale collaboration!

A rapidly changing jet in the Black Hole V404 Cygni

4 weeks continuous INTEGRAL observations!

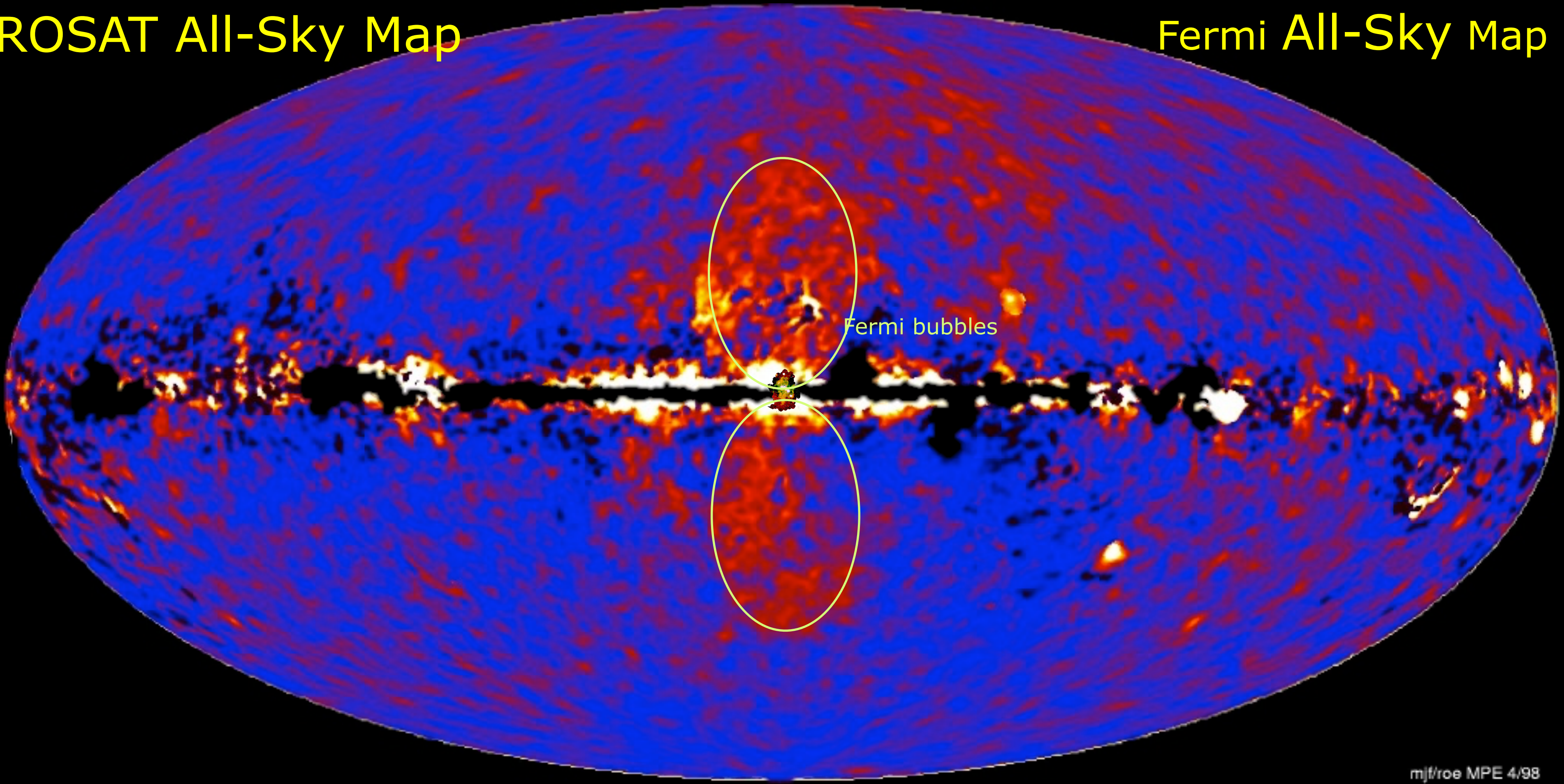
J.C.A. Miller-Jones et al., 2019 Nature

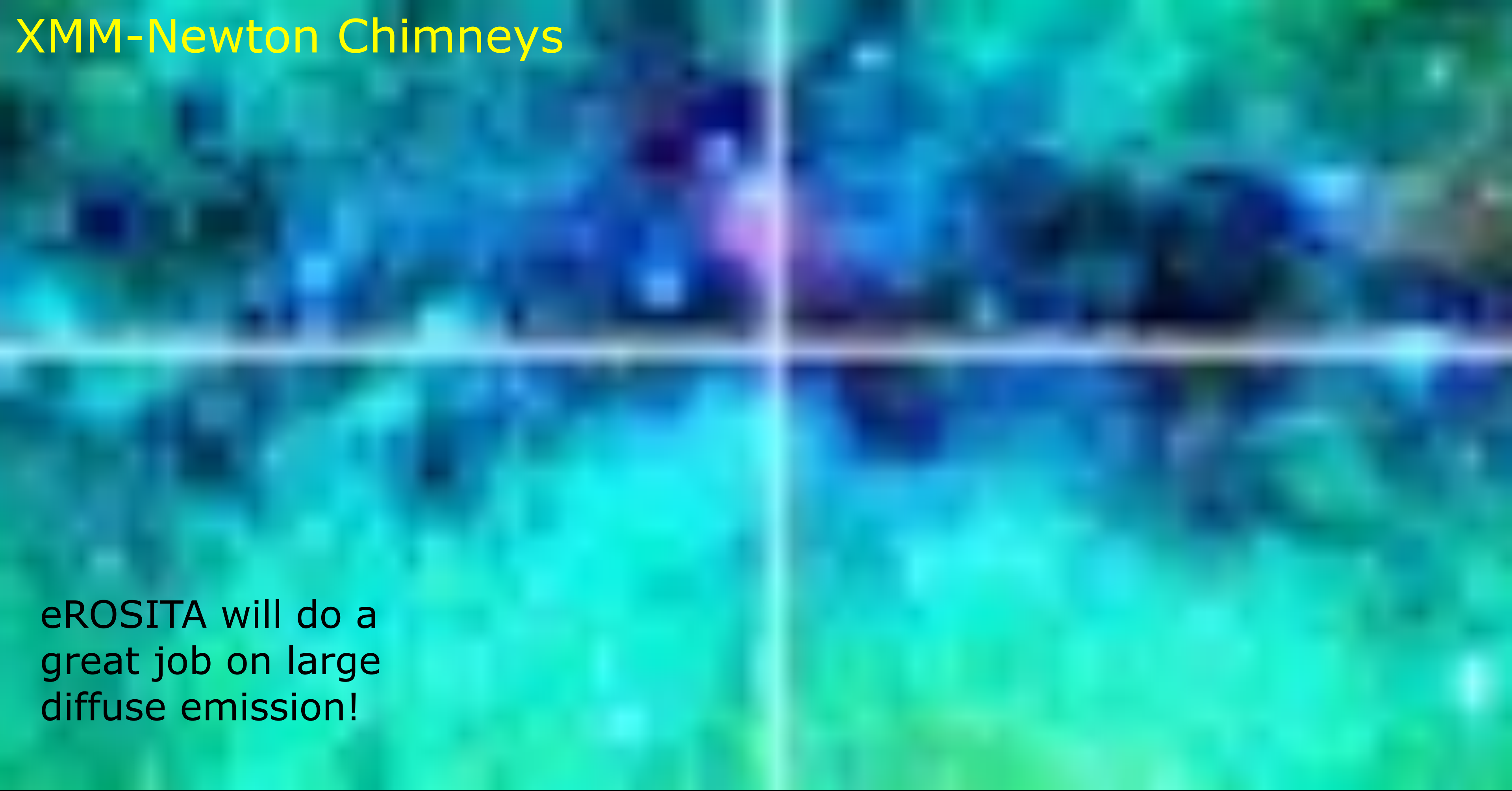
ROSAT All-Sky Map



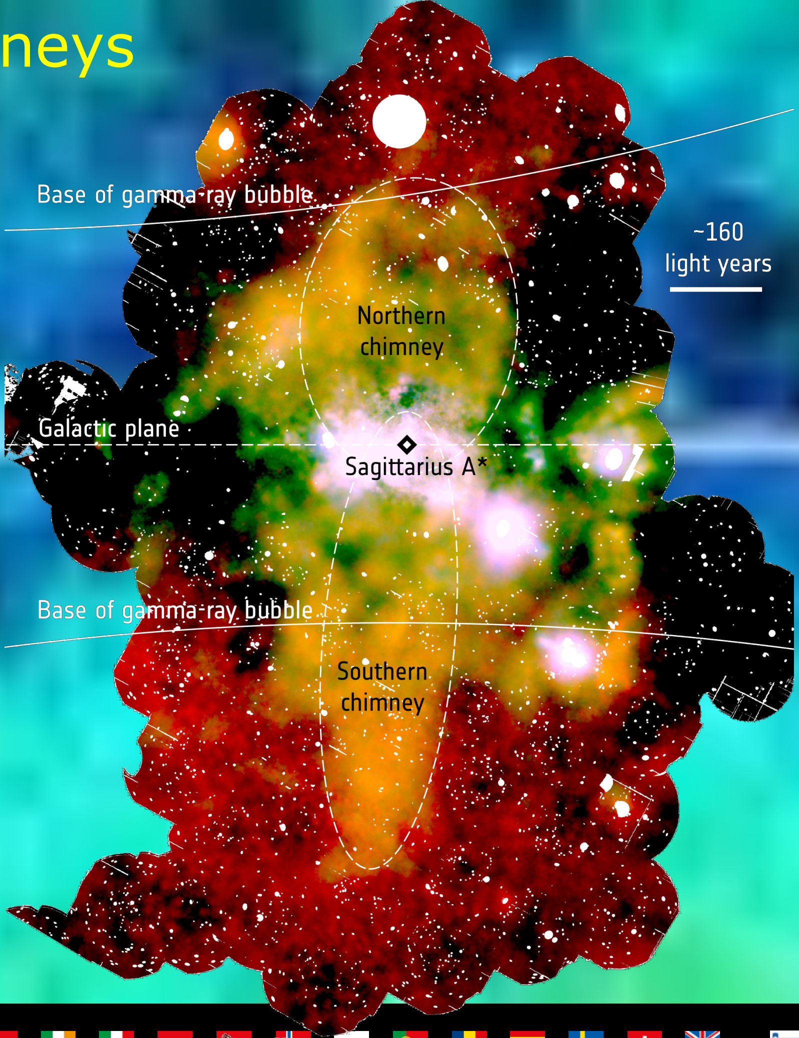
ROSAT All-Sky Map

Fermi All-Sky Map




XMM-Newton Chimneys
eROSITA will do a great job on large diffuse emission!

XMM-Newton Chimneys



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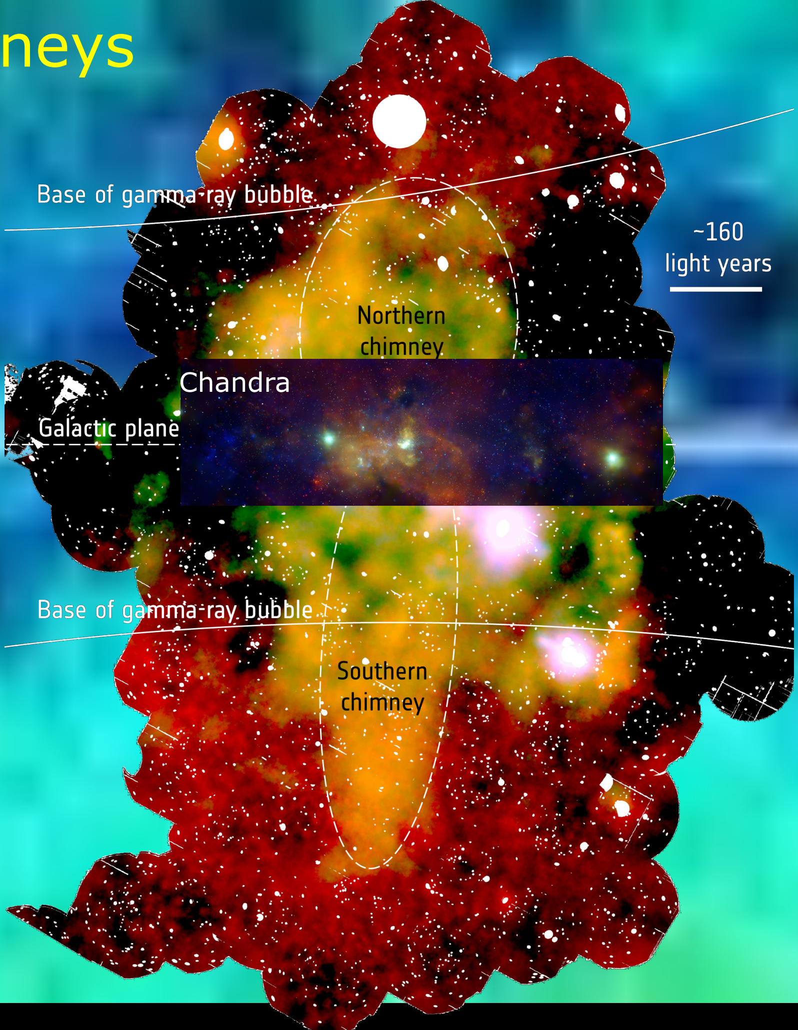
XMM-Newton Chimneys

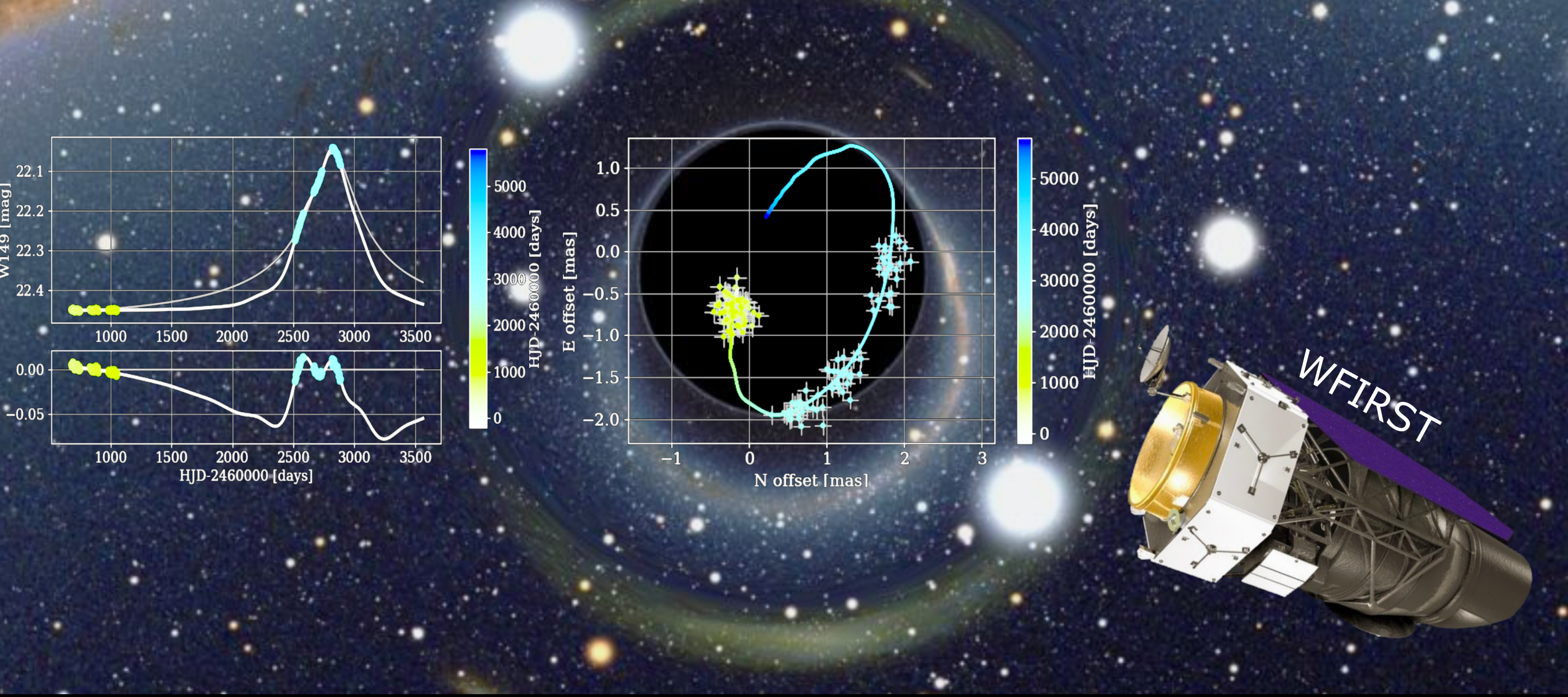


eROSITA will do a great job on large diffuse emission!

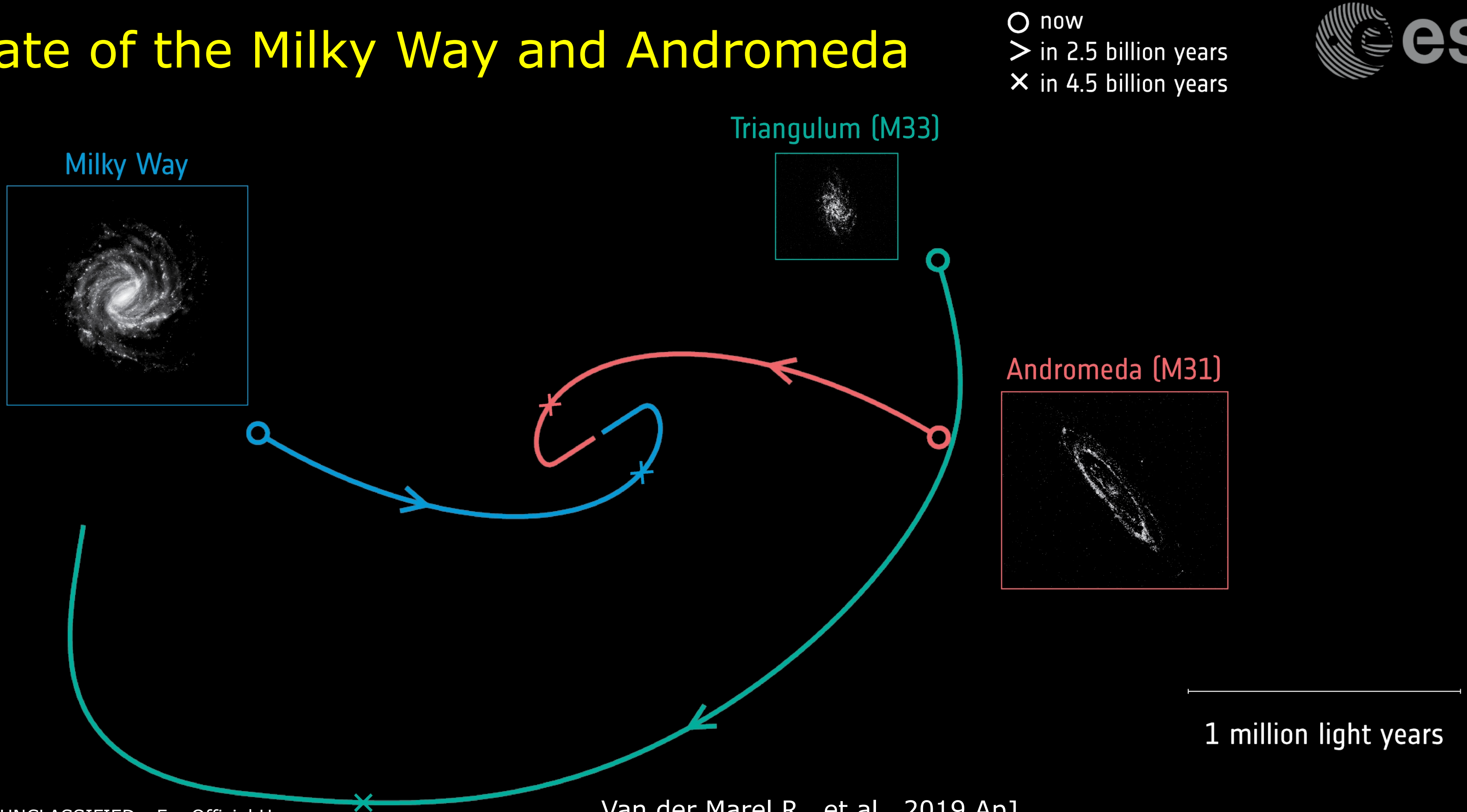
Multi-Messenger Quest for the first Black Holes

Microlensing by 10 M_{sun} Black Holes

Are Black Holes the Dark Matter?

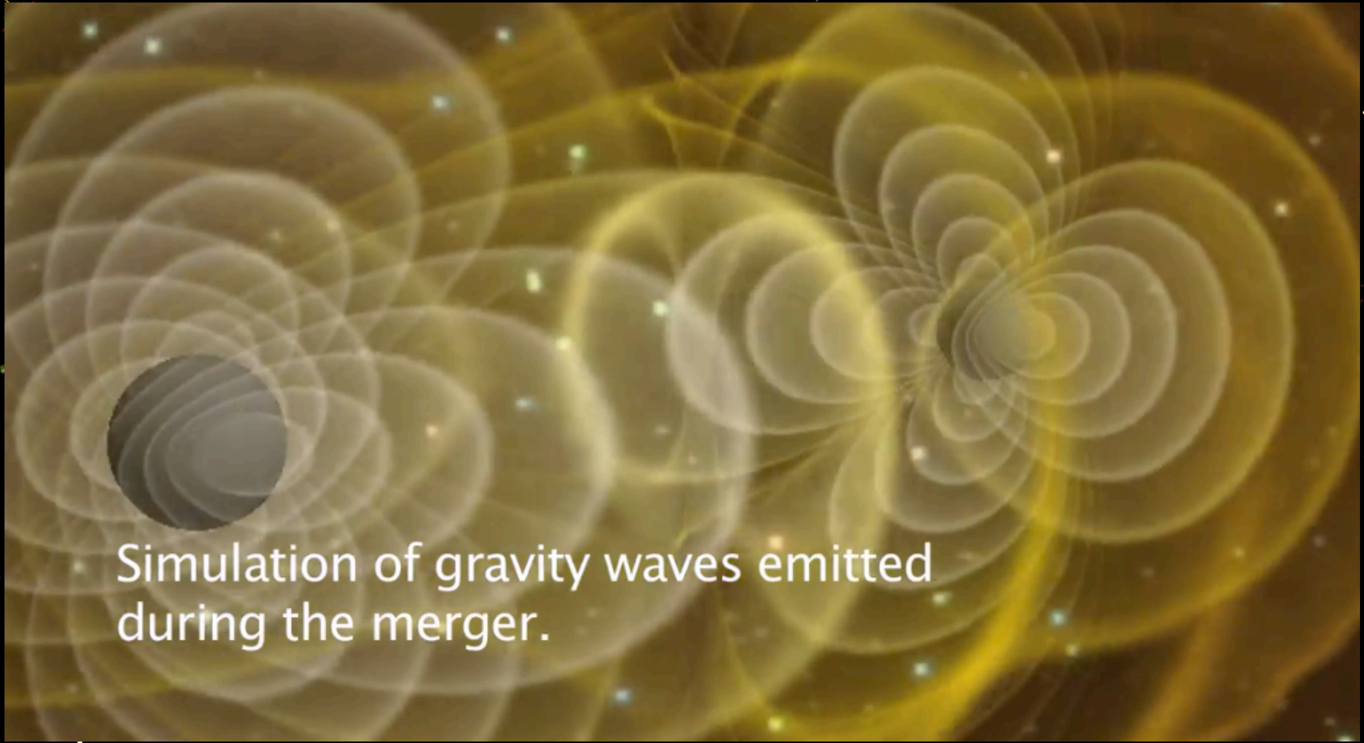


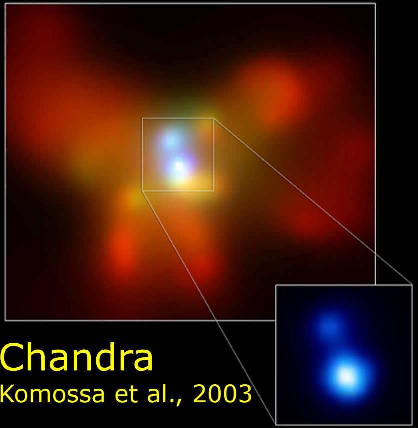
Fate of the Milky Way and Andromeda



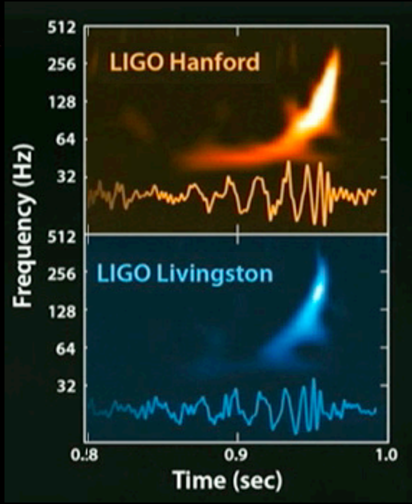
Van der Marel R., et al., 2019 ApJ

What happens to the Black Holes in a Merger?

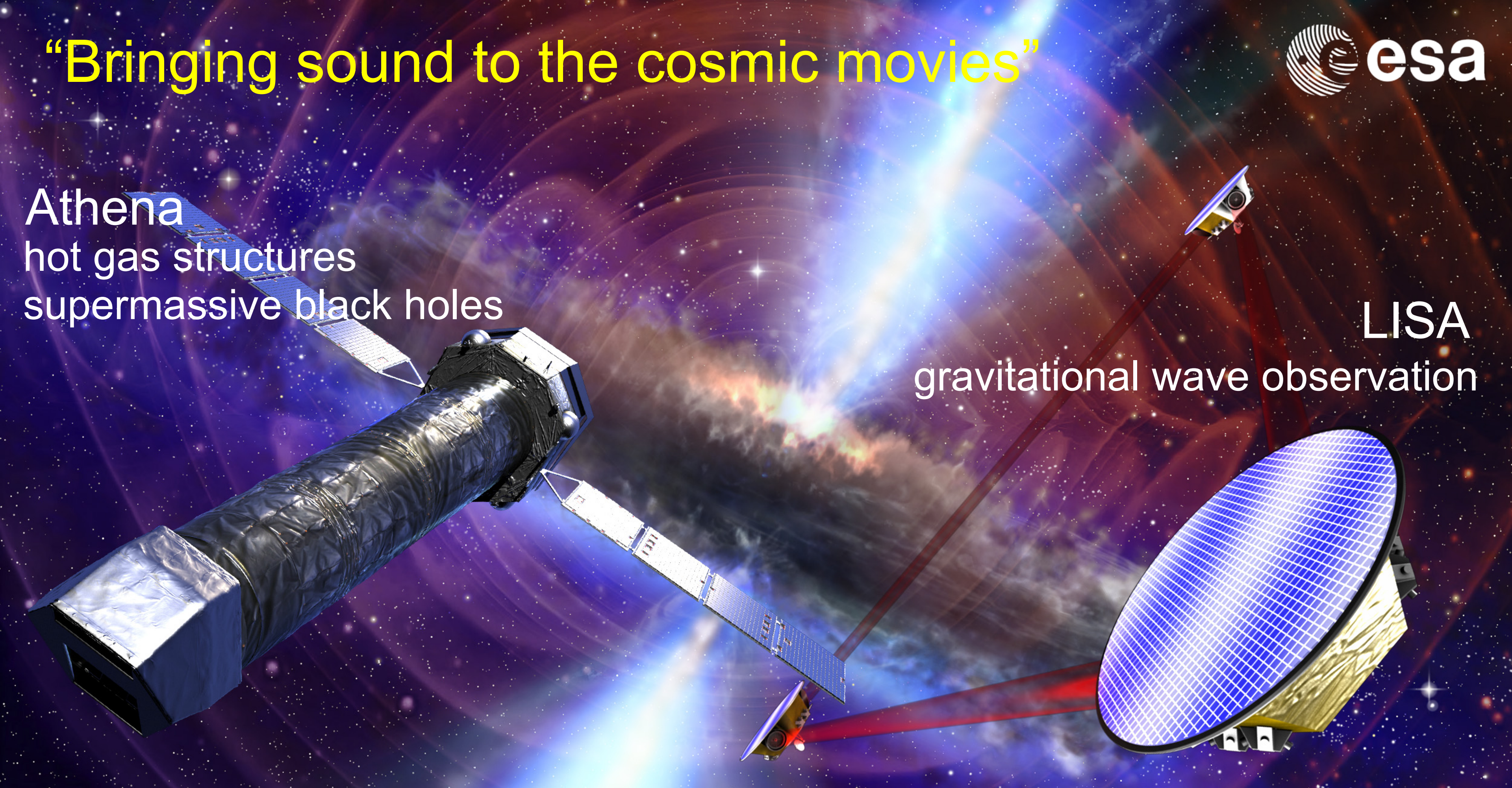




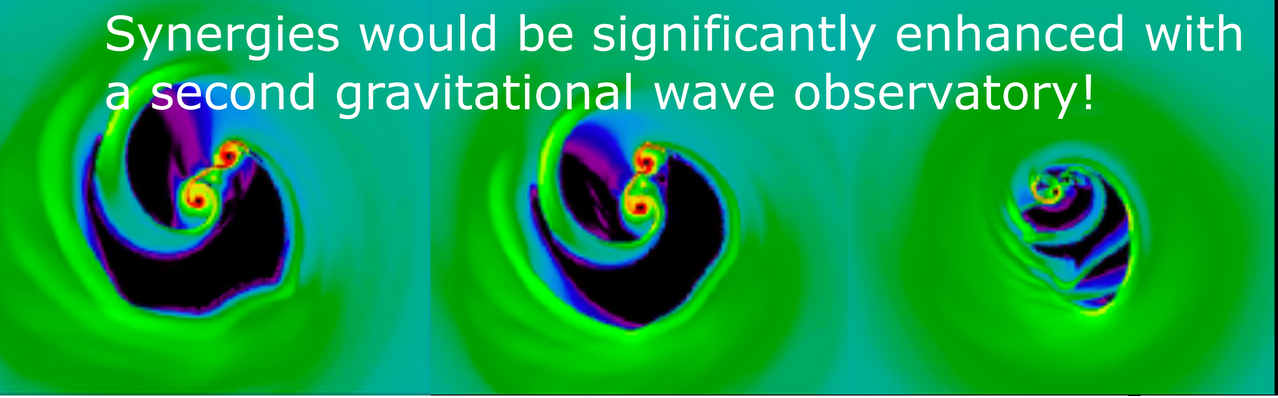
Chandra
Komossa et al., 2003



“Bringing sound to the cosmic movies”

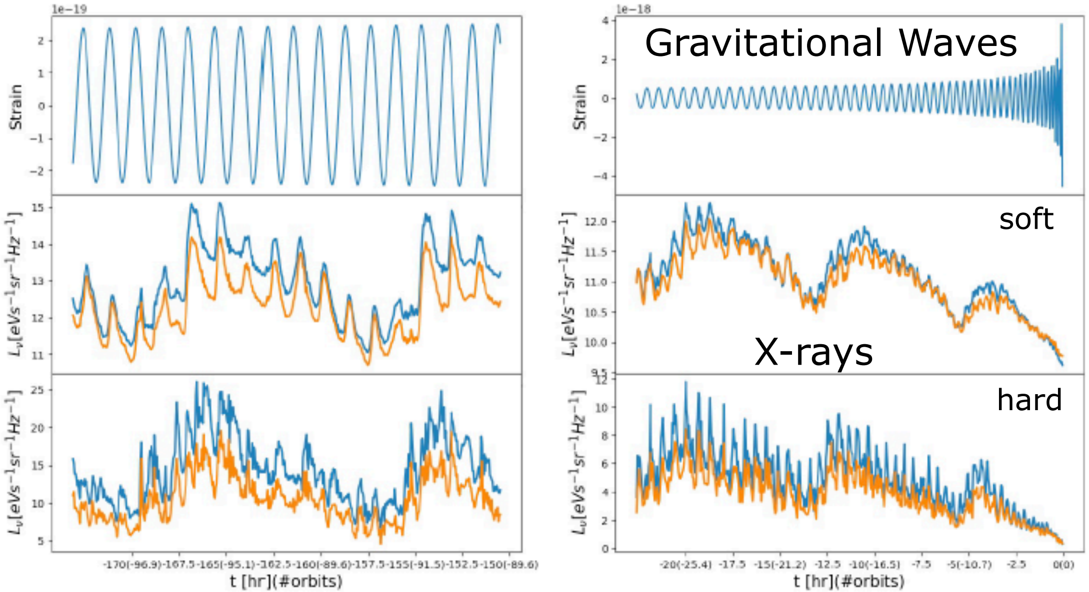


Synergies would be significantly enhanced with a second gravitational wave observatory!

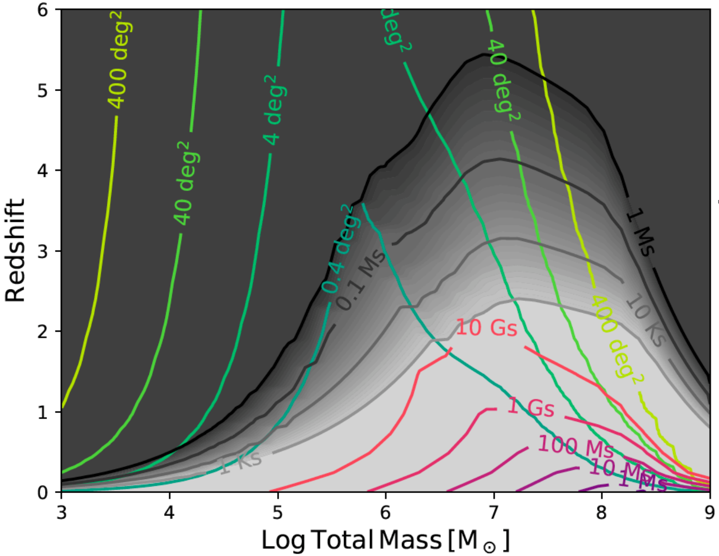


Athena / LISA Synergies

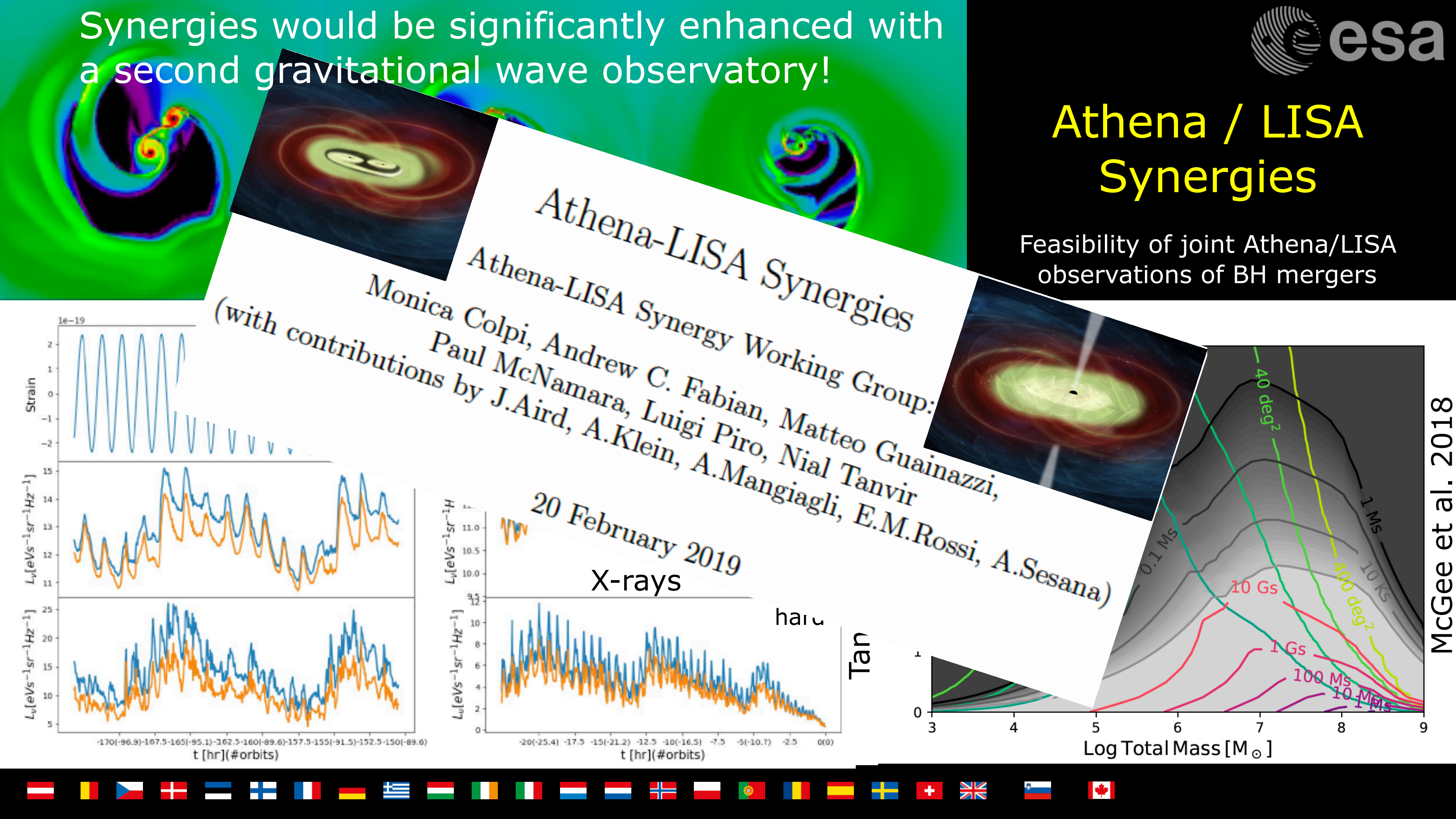
Feasibility of joint Athena/LISA observations of BH mergers



Tang et al. 2018

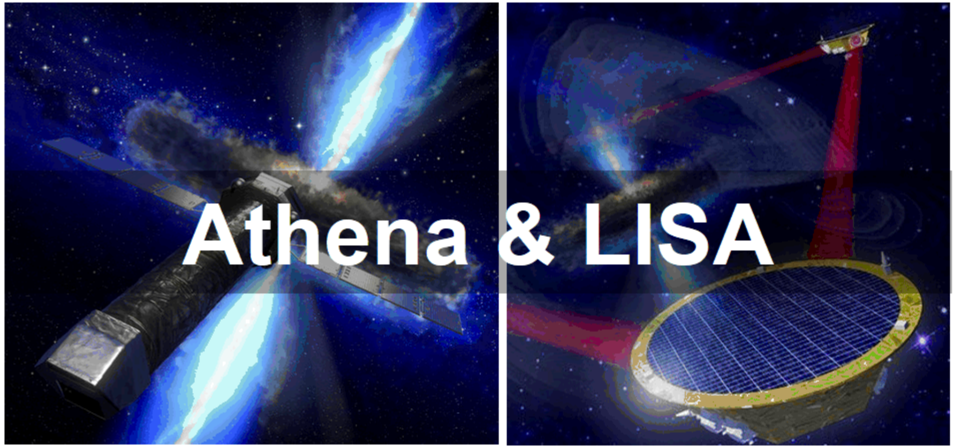


McGee et al. 2018


Synergies would be significantly enhanced with a second gravitational wave observatory!
esa
Athena / LISA Synergies
Feasibility of joint Athena/LISA observations of BH mergers
Athena-LISA Synergies
Athena-LISA Synergy Working Group:
Monica Colpi, Andrew C. Fabian, Matteo Guainazzi,
Paul McNamara, Luigi Piro, Nial Tanvir
(with contributions by J.Aird, A.Klein, A.Mangiagli, E.M.Rossi, A.Sesana)
20 February 2019
X-rays
Strain
t [hr](#orbits)
40 deg²
400 deg²
1 Ms
10 Ks
0.1 Ms
10 Gs
1 Gs
100 Ms
10 Ms
1 Ms
Log Total Mass [M⊙]
McGee et al. 2018

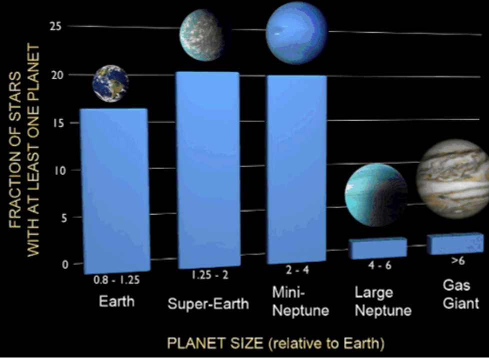
Space Science at Space19+

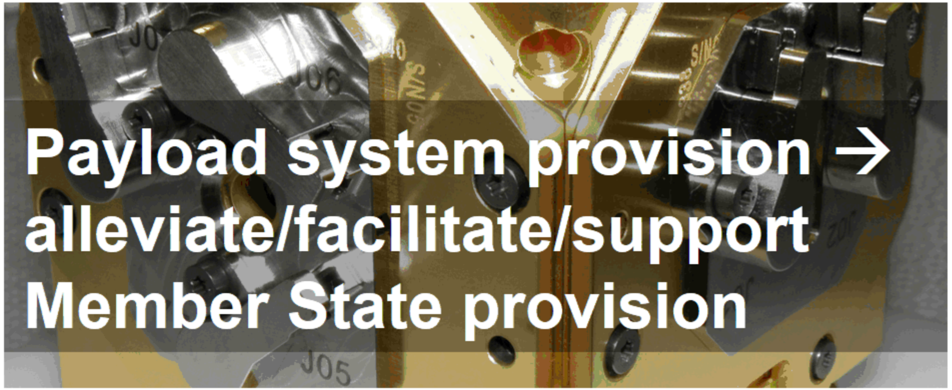
esa



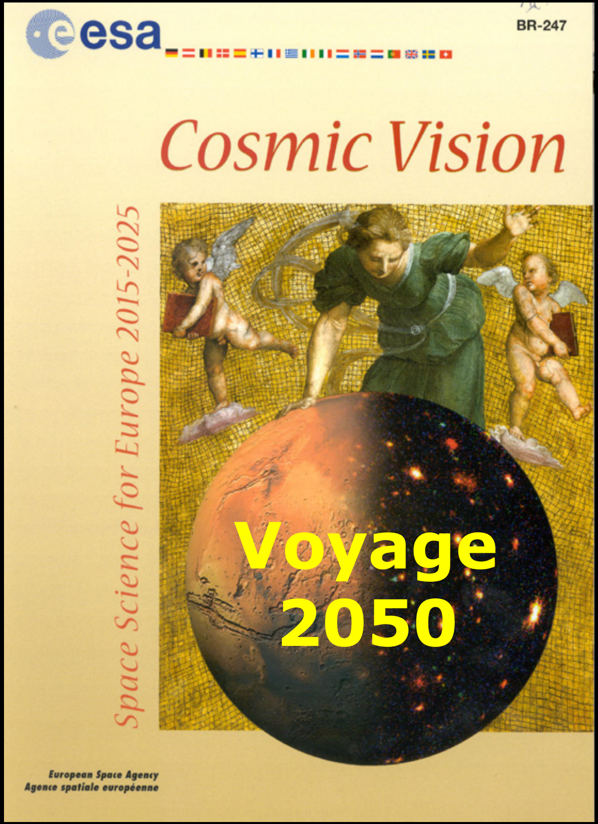
<u>F-missions</u> in sync with M-missions (joint launch) → new line of opportunities with special emphasis on novel implementations

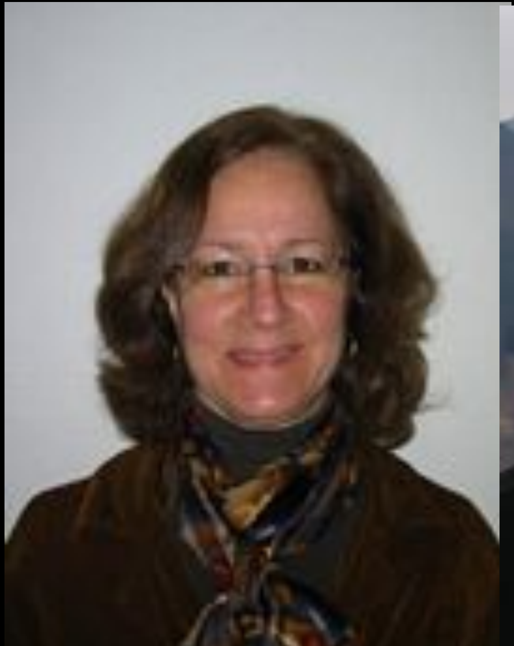
Unique celestial opportunity to explore Ice Giants





Preparation of next strategic plan: Voyage 2050



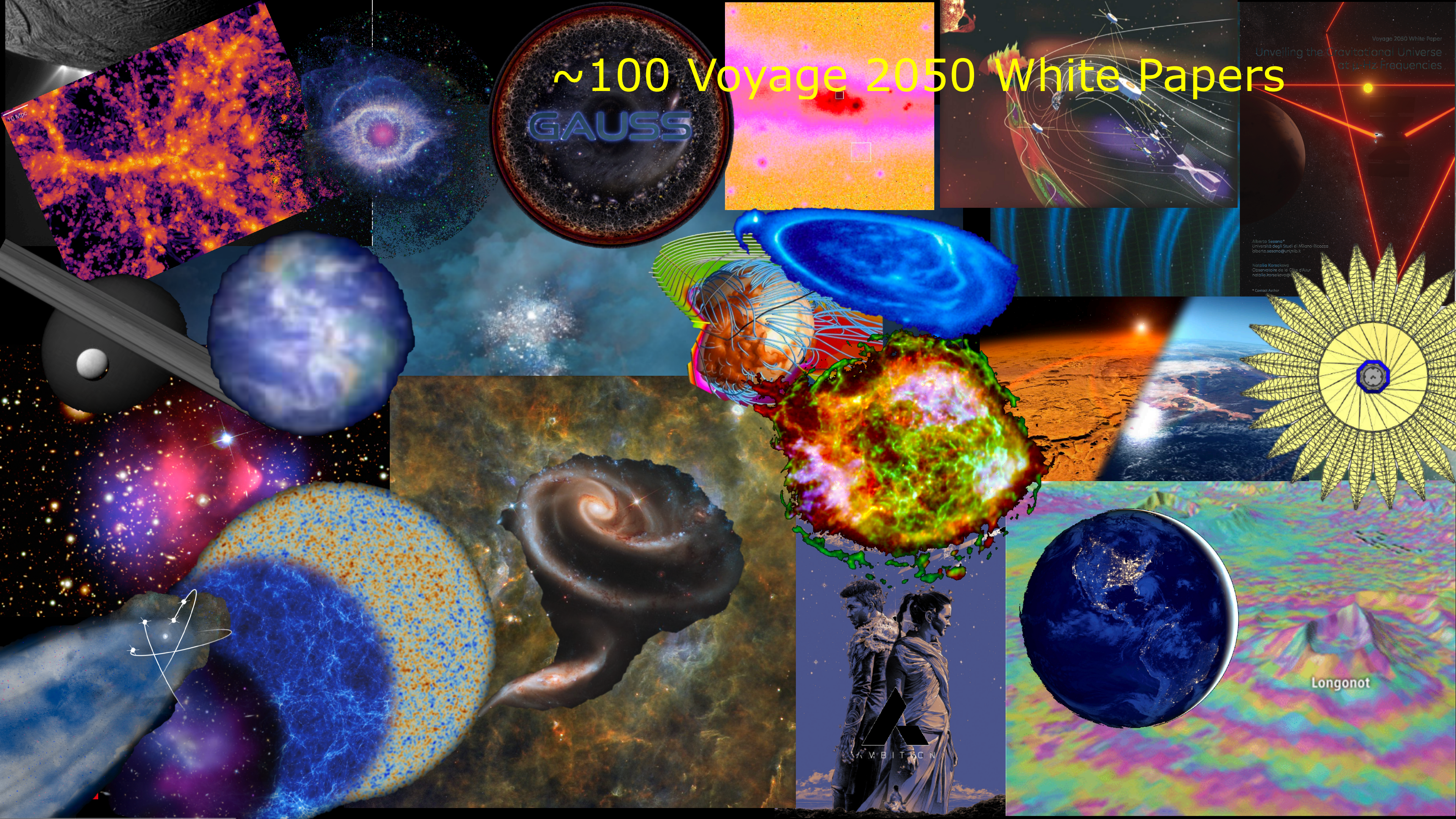


Linda Tacconi

Chris Arridge

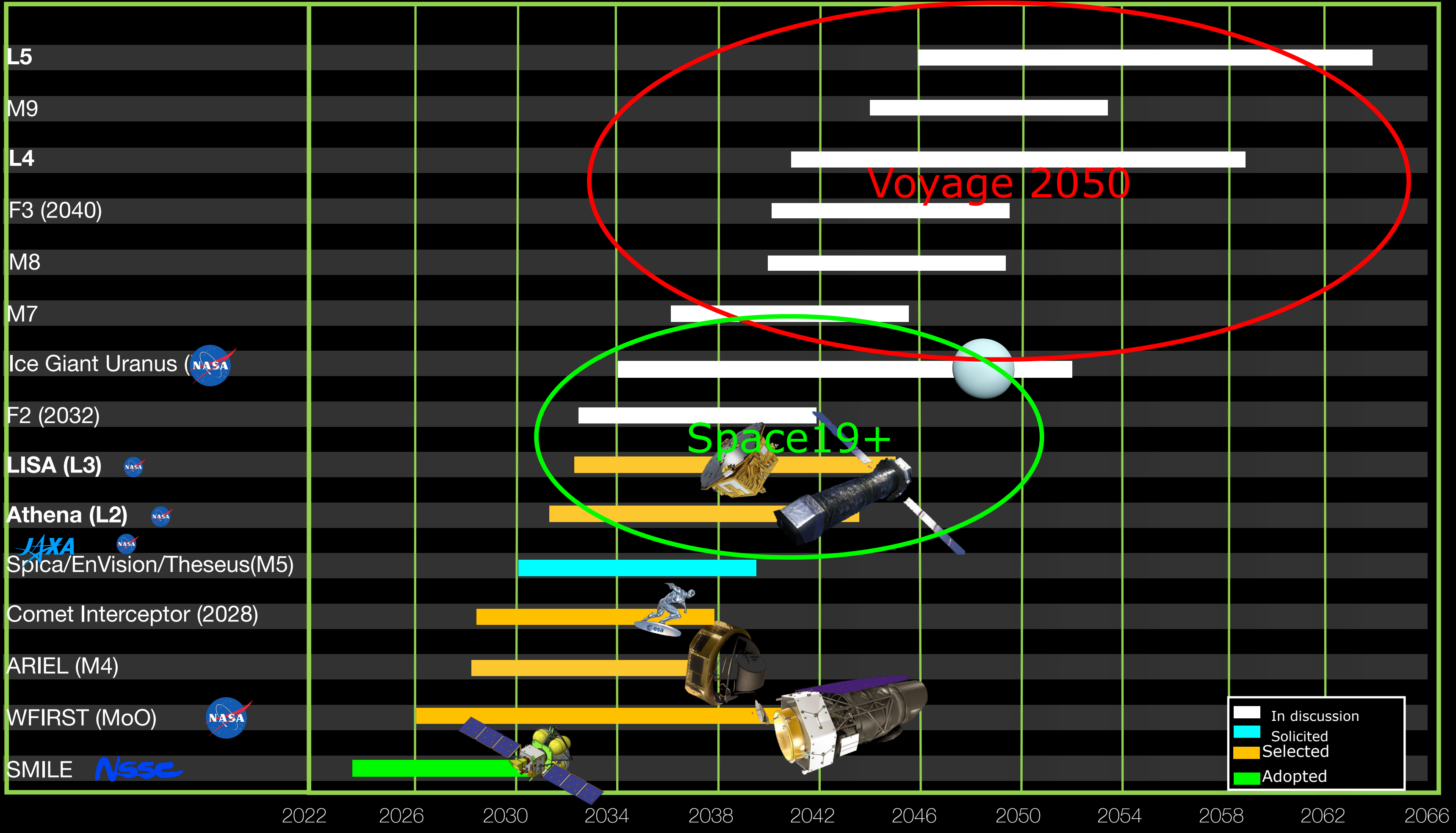
Advisory Structure is involved in various roles.

Call for topical teams nominations and white papers, as well as Community Engagement Survey released in 03/19, deadlines 06/19 & 08/19.


~100 Voyage 2050 White Papers
GAUSS
Longonot


~100 Voyage 2050 White Papers
GAUSS
Presentation to the community
October 29-30, 2019, CSIC Madrid.
Register at
https://www.cosmos.esa.int/web/voyage-2050-workshop
Longonot

Future ESA Space Science Missions



Last update: December 2018

Thank you very much!

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