Laser Interferometer Space Antenna: Science, status and sinergies with Theseus

Alberto Sesana (Universita` di Milano Bicocca)







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We see black hole binaries (BHB) coalescing for the first time (several Abbott+ 2016 2017)

First tests of GR in the strong field regime

Interesting astrophysical information (masses, spins) → Formation scenario?



[LIGO'S GRAVITATIONAL-WAVE DETECTIONS]

Black Holes of Known Mass



The parameter space of black holes



3G detectors: example reach of ET



-All LIGO-like BHBs in the Universe up to z~20 (~10⁵/yr) -All neutron star binaries (NSBs) to z~2-3 (~10⁴/yr) - intermediate mass Bhs (IMBHs) up to z~2 (???) -SNe? Rotating NSs?







characteristic amplitude

The Laser Interferometer Space Antenna



- \rightarrow Partnership with NASA (junior)
- \rightarrow Launch ~2034 (overlap with Athena?)
- \rightarrow Mission adoption expected ~2023



3 satellites trailing the Earth connected through laser links

Proposed baseline: 2.5M km armlength 6 laser links 4 yr lifetime (10 yr goal)

Amaro Seoane et al. 2017

The LISA Consortium

- Now a thriving community: 1100+ among full and associate members
- Several working groups connecting to the community: astrophysics, fundamental physics, cosmology, waveforms
- Several working packages defining deliverables
- 2 consortium meetings/yr, LISA symposium every 2 years, dedicated WG meetings every year News Multimedia Conferences Positions Papers Code of Conduct Cor LISA

https://www.lisamission.org/

LISA Consortium User Guide User guide
Groups
Getting help
Contributing

LISA Consortium User Guide Key information

Collaborative tools

- Development tools and guidelines
- Sharing data tools
- Computing resources

LISA Consortium User Guide

This User Guide goal is to gather all the information related to the LISA Consortium tools. Users are more than welcome to contribute to its improvement. To do so, see the HowToContribute page.

Key information

- LISA Consortium website
- Sign-up for the LISA Consortium
- Organisation
- LISA websites
- Key documents
- Next meetings (need to be logged to the wiki see LISA wiki)
- Acronyms
- Publication and Presentation Committee
- Inclusion and Diversity Committee
- Positions related to LISA

Collaborative tools

- LISA wiki
- LISA Document Management Sytem (DMS) Atrium
- Mailing lists
- Messaging on slack channels
- Audio / Video teleconferences

Development tools and guidelines



holes

Mailing lists

Consortium:consortium@lisamission.org

Management

- Consortium Lead : consortiumlead@lisamission.org
- Exec Board : exec_board@lisamission.org
- Board Member: board@lisamission.org
- Coordinator:coord@lisamission.org
- Coordination Group : coordination@lisamission.org
- Publication Committee : pubcom@lisamission.org
- Publication Committee Chairs: pubcom-chairs@lisamission.org

ESA: A unique experiment to explore black

What happens when two supermassive black holes collide? Combining the observing power of two future ESA missions, Athena and LISA, would allow us to study these cosmic clashes and their mysterious aftermath for the first time. 100

Search

LISA Consortium Internal

LISA Consortium Reboot

Portal here: https://signup.lisamission.org

We are now ready to reboot the Consortium and ask you to

apply. You will find all necessar information on the Application

- LISA Instrument Group : lig@lisamission.org
- LIG Performance Modelling WG: lig-pmwg@lisamission.org

- LIG-GRS:lig-grs@lisamission.org
- LIG SLWG Chairs: lig-slwg-chairs@lisamission.org
- LIG Performance Modelling WG Chairs: lig-pmwg-chairs@lisamission.org

- Simulation Working Groups Astrophysics Working Groups Cosmology Working Groups Eundamental Physics Working Groups Waveform Working Groups Advocacy and Outreach Working Groups
- Mailing lists Managemen

- Full Member Groups
- LISA Instrument Group
- LISA Data Processing Group LISA Science Group
- Associate and Full Members Groups
- LISA Data Challenge Working Groups

Full Member Groups

LISA Instrument Group

- LIG Core:lig-core@lisamission.org
- LIG-OB:lig-ob@lisamission.org
- LIG-PMS:lig-pms@lisamission.org
- LIG-OMS:lig-oms@lisamission.org
- LIG-Chairs: lig-chairs@lisamission.org

LISA Sources

Thousands of galactic binaries (WD NS BHs)





(EMRIs)

out to

z>2



Extragalactic stellar mass BH binaries



Stochastic GWBs?



LISA Science

ASTROPHISICS:

-origin of SMBHs

-SMBH growth along the cosmic history, spin evolution

- -relativistic dynamics of dense nuclei
- -MW studies with 20k+ WD binaries
- -contact binaries, mass transfer

-formation channels of stellar mass BHBs

COSMOLOGY:

-cosmography with standard sirens out to z>5 (SBHs, EMRIs and MBHs)
-probe of phase transition models

FUNDAMENTAL PHYSICS:

-the nature of BHs (ringdown spectroscopy, Kerr geometry) -insights onto dark matter? -GW propagation effects



Examples of LISA Sinergies



3G detectors: -multiband sources -full reconstruction of the BH population in the universe at all masses

Athena: -multimessenger observations of MBHBs



Sinergies with Theseus? -LISA sources are not explosive transients

-Counterparts limited to Eddington?

-There might not be occasions for direct multimessenger sinergies (but input and ideas are welcome)







Maybe we should look into complementarity

-LISA and Theseus can probe z~10 structures in very different ways (GRB vs seed BHs) (Courtesy of Marica)

-What benefits can we get by combining their information?