

# LISA: The Mission, The Consortium, Women Scientists' Involvement

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Institute of Space Science - Subsidiary of INFLPR, Bucharest-Magurele  
PhD Student in Automatic Control and Computer Science, UNSTPB, Bucharest



# About me



## Faculty of Aerospace Engineering

- Internship at the Romanian Space Agency
- 3 courses graduated at ESA Education Training Centre – ESEC Galaxia, Belgium



## ASPAC-Q

### Scientific Research Assistant – Institute of Space Science, INFLPR Subsidiary, Romania

- DDPC
  - System-team-RO
  - Product Assurance / Quality Assurance
- LISA Consortium Core Member
  - LISA Monday Calls
  - LISA Early-Career Scientist
  - Instrument Simulation WG



## PhD Student in Automatic Control and Computer Science, UNSTPB, Bucharest

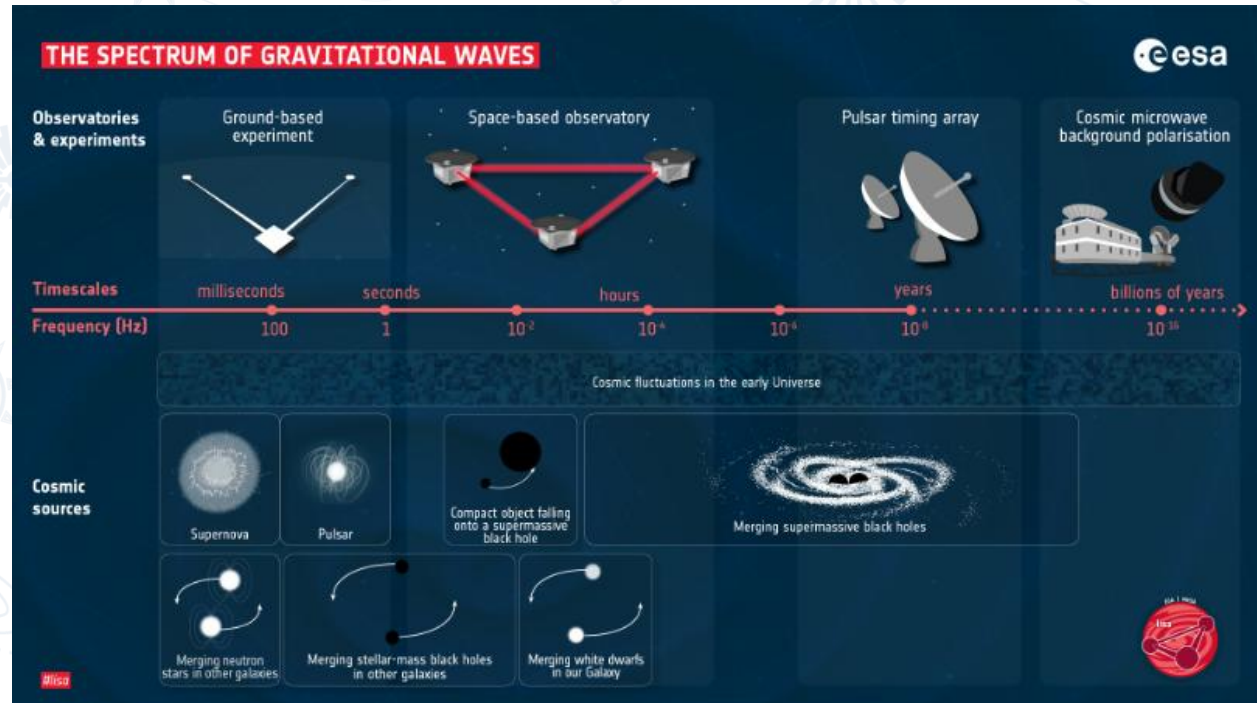
- Enhancing the Analysis of Complex Space Mission Data using High-Performance Computing

# LISA Mission – Brief Overview

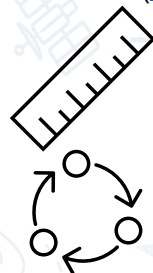
**Laser Interferometer Space Antenna (LISA)** will be a large-scale space mission designed to detect gravitational waves.

The **first space-based gravitational wave observatory**.

LISA was adopted by the European Space Agency (**ESA**) and **NASA** in January 2024.



Led by ESA, the LISA mission is a collaboration between ESA, NASA, and an international consortium of scientists ([the LISA consortium](https://www.lisamission.org/))



3 x 2.5 million km

3 Spacecraft

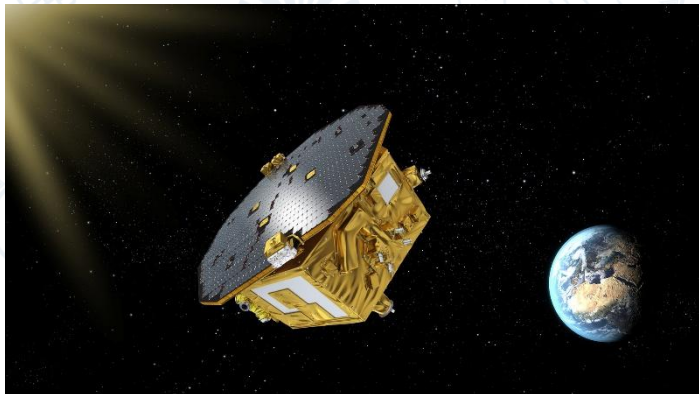
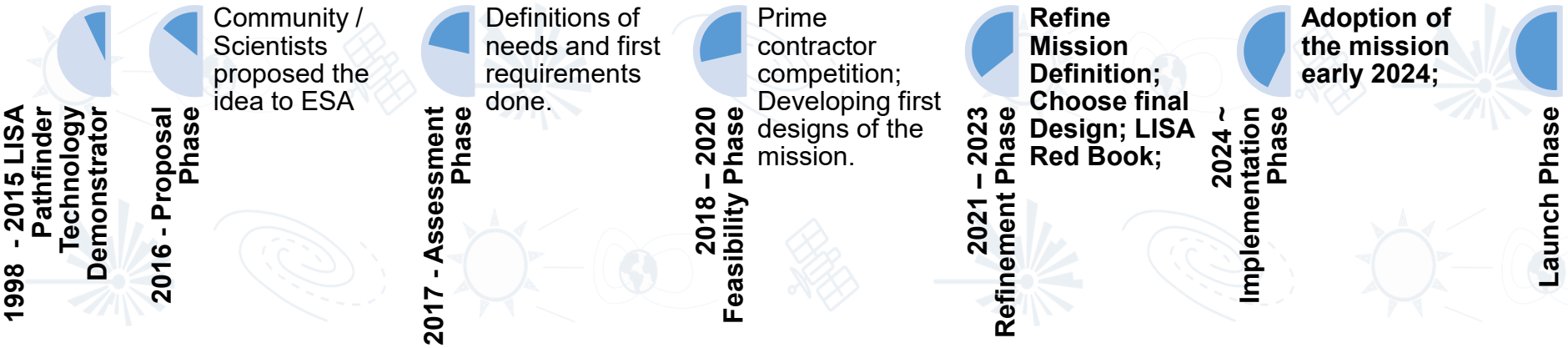


0.1 mHz – 0.1 Hz



4 Years +

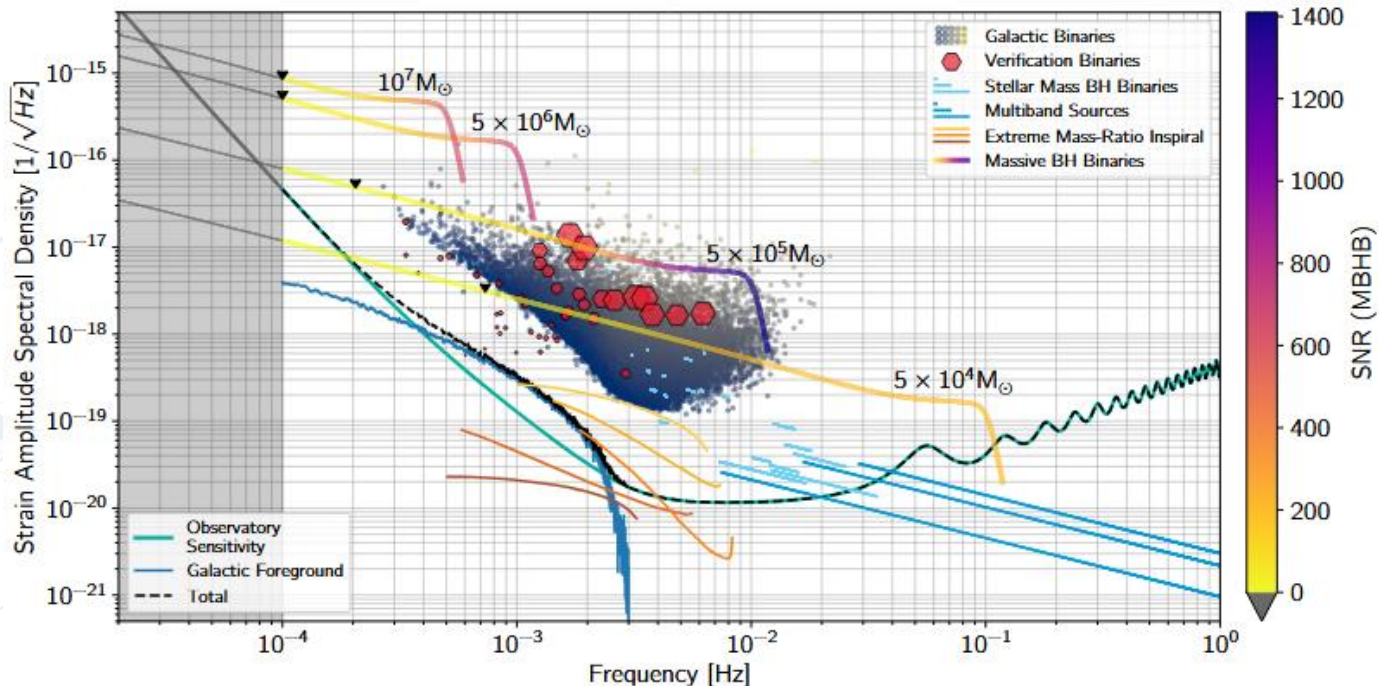
# Mission Phases



**LISA Pathfinder** tested in flight the concept of low-frequency gravitational wave detection: it placed two test masses in a near-perfect gravitational free-fall and controlled and measured their motion with high accuracy in a technique known as ‘precision metrology’.

# LISA Science Objectives

- SO1:** Study the formation and evolution of **compact binary stars** and **the structure of the Milky Way Galaxy**
- SO2:** Trace the **origins, growth and merger histories** of **Massive Black Holes**
- SO3:** **Probe the properties and immediate environments of Black Holes** in the local Universe using **EMRIs and IMRIs**
- SO4:** Understand the astrophysics of **stellar-mass Black Holes**
- SO5:** Explore the **fundamental nature of gravity and Black Holes**
- SO6:** Probe the **rate of expansion of the Universe** with standard sirens
- SO7:** Understand **stochastic GW backgrounds** and their implications for the early Universe and TeV-scale particle physics
- SO8:** Search for **GW bursts and unforeseen sources**



# LISA Science Observations

During its mission, LISA will produce vast amounts of data. Storing, collating and analyzing this data is a task which will require the development of data analysis pipelines and the construction of new data processing centres.

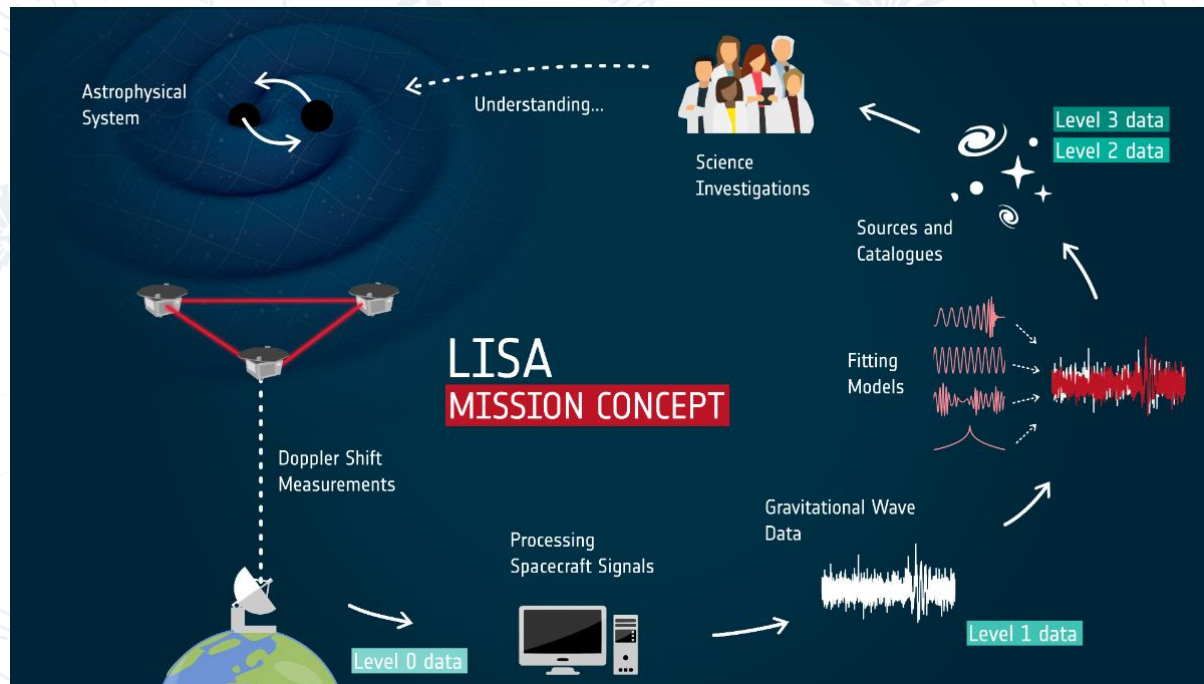
**L0** (Raw): *demultiplexed and time-ordered telemetry* from the spacecraft.

**L0.5**: Synchronized data converted to a common astronomical timescale and physical units (fully releasable to the public).

**L1**: Calibrated and noise corrected *Time-Delay Interferometry (TDI)* data streams (the analysable products for scientific interpretation).

**L2**: Output from the global fit pipelines, providing Probability Density Functions (PDFs) for identified sources and reconstructed waveforms.

**L3**: **The mission's end product** - catalogue of *GW source candidates* with detection confidence, estimated astrophysical parameters and their strain time series  $h(t)$ .



# LISA Concept and the beginning of the LISA Consortium

The concept for a space-based GW observatory employing laser interferometry was **first proposed** in the **mid 1970s** and developed in academic institutions through the 1980s and 1990s.

The first **mission concept studies** were carried out by ESA from 1993-2000 and by NASA in 1997, resulting in **the establishment of the joint NASA/ESA** LISA study.

LISA Mission as it is known today originated in the proposal made to ESA by the **LISA Consortium** which was the basis for Mission Selection in 2016.

## VISION

**LISA Consortium = scientific collaboration working together to maximize the scientific return of LISA.**

The Consortium will **support all aspects of the LISA mission** throughout the mission lifecycle.

The LISA Consortium is committed to **promoting the long-term growth and development of the LISA Scientific Community**, by providing a supportive and **inclusive environment** that offers **training, mentoring and opportunities for scientists** at all stages of their careers, in particular, early career scientists.

The Consortium will also **engage with the wider scientific community** to foster interest in, and support applications of the LISA data.

# LISA Consortium Membership

**LISA Consortium is comprised of individual members**

**Core Members** – active members who are committed to supporting working group deliverables

**Community Members** – passive members who want to be informed about the LISA Consortium activities, but are not committed to working on deliverables

LISA Consortium - apply online via the LISA Consortium website. The Membership Committee reviews applications and makes preliminary decisions on the admission of new members.

# LISA Consortium Work Areas

## Decisions and policy

- Consortium Council
  - Spokesperson
  - LST Representative
  - Chair of Council and WG
  - Ombudsperson

## Management and Strategy

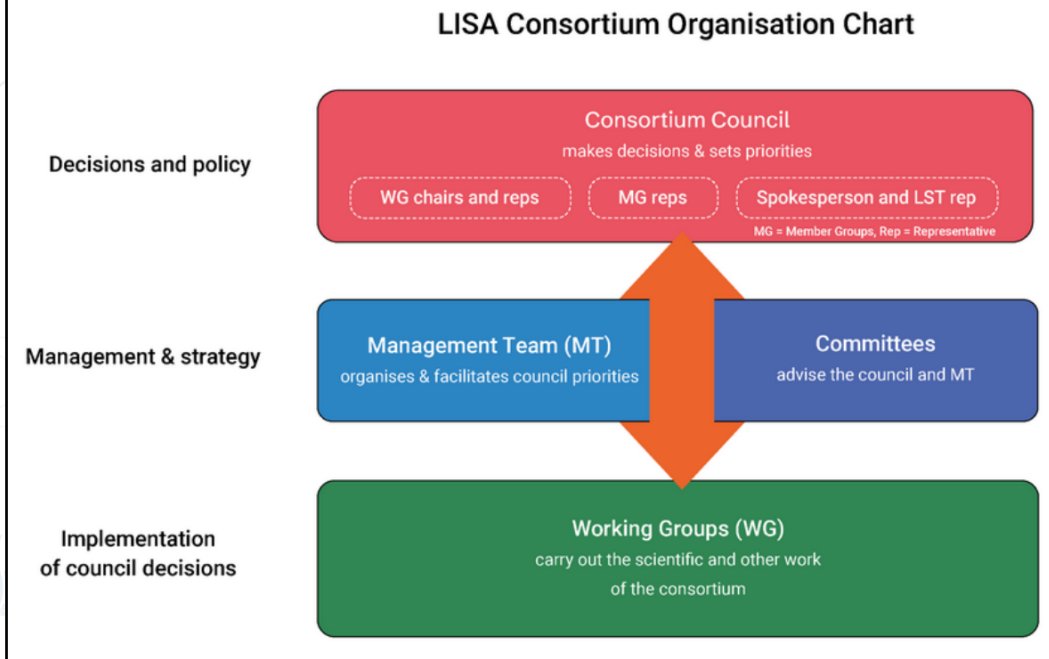
- COMMITTEES
  - Appointments and Elections (A&E)
  - Membership Committee
  - Bylaws Committee
  - Diversity, Equity and Inclusion Committee
  - Communications Committee
  - Publication and Presentation Committee

- Management Team (MT)

## Implementation of council decisions

- WORKING GROUPS
  - Astrophysics Wg
  - Cosmology Wg
  - Fundamental Physics Wg
  - Instrumentation WG
  - Instrument Simulation And Processing Wg
  - Waveform Wg
  - Data Analysis R&d Wg
  - Communication Implementation Wg
  - Early Career Scientists Wg

## Organisation of the LISA Consortium



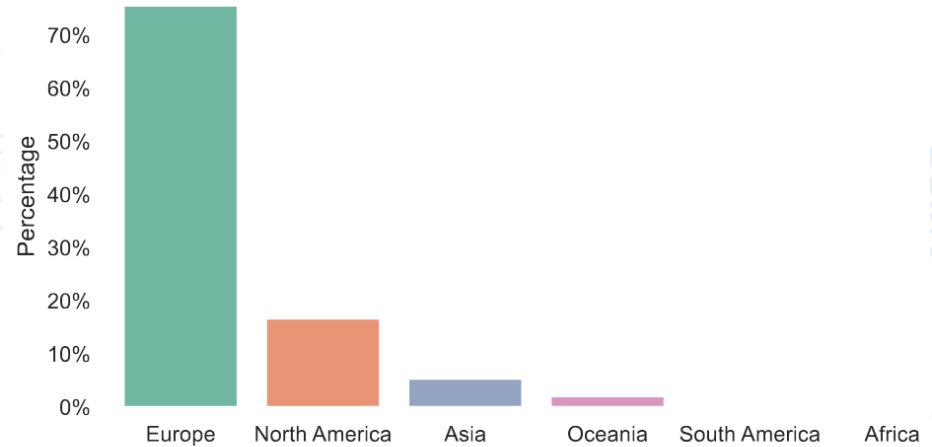
*Women are regularly elected to leadership roles as WG co-chairs (past and present).*

*Diversity, equity, and inclusion (DEI) committee supports diversity in decision making of the Consortium. As an example, when the Appointments and Election Committee hold calls for appointments to committees and WG co-chair elections, the DEI committee can ask the A&E committee to hold the call open for longer if they feel the pool of applicants are not sufficiently diverse.*

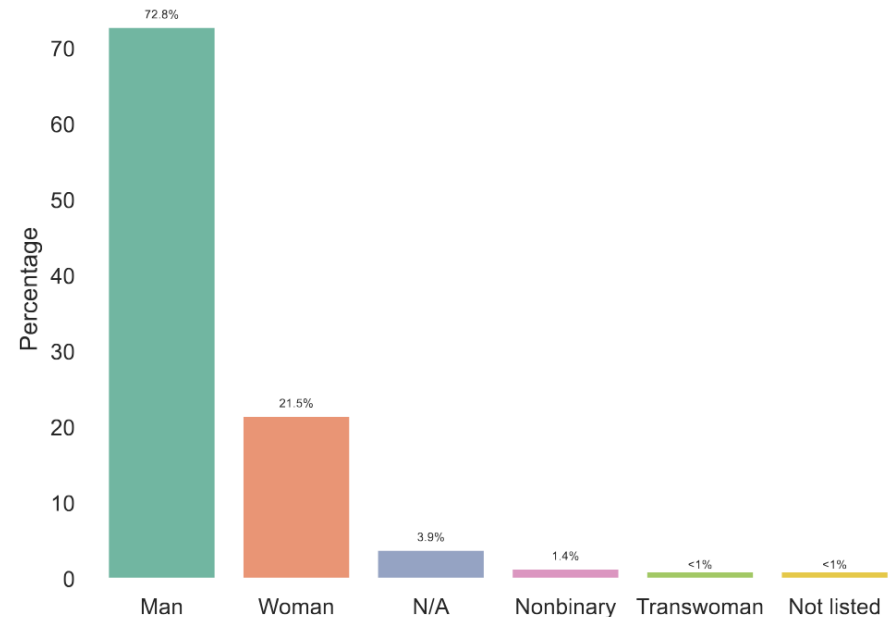
# LISA Consortium Council Demographics

Country	Number of Members
Italy	11
Netherlands	7
Norway	1
Australia	1
Belgium	2
Canada	3
Chile	1
Czech Republic	2
Denmark	1
Estonia	1
Finland	1
France	8
Germany	12
Ireland	4
Poland	1
Portugal	3
Romania	3
Singapore	1
Spain	7
Switzerland	3
United Kingdom of Great Britain and Northern Ireland	11
United States of America	15
Vietnam	1

Affiliation countries by continent [Core members only]



Gender identity [Core members only]



# Contribution from Women Scientist

**Ana Caramete**



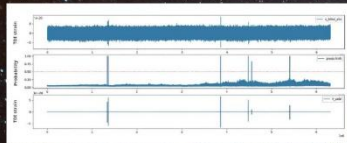
Researcher



Ana is a Researcher at the  
Institute of Space Science,  
Romania



#HumansOfLISA



Ana is part of the  
LISA Distributed  
Data Processing  
Center (DDPC).

"In DDPC, I am the **deputy of the PA/QA Core Team** and the **Romanian representative** of the Distributed Computing Center (**Ro-DCC**). I am also part of the **Low-Latency Alerts Coordination Unit (CU L2A)**, where my main contribution is the development of **AI-based low-latency pipelines** for the **fast processing** and **characterization of signals detected by LISA**.

Before my work on LISA, I was involved in **ESA's EUCLID** and **PROBA-3/APSIICS** space missions, and did my PhD in the context of the **Planck Mission**."

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Ana's hobbies  
and interests

"I am **involved** in the **mentorship activities** organized by the **Association of Women in Engineering, Science and Technology**, **inspiring** and **helping women in Romania to pursue** their **STEM careers**.

I also like **computer games & travelling**."



# Contribution from Women Scientist

**Debnandini Mukherjee**



Postdoc

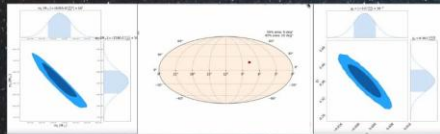


Debnandini Mukherjee is a  
Postdoc at  
University of Birmingham



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Debnandini is working in  
gravitational wave data analysis and  
searches for massive black holes



"I work on designing searches for **massive black hole mergers** that would be detectable by LISA. This includes **pre and post merger searches**. I am working on significantly **developing the science ground segment for LISA** and contributing to the **'global fit' of overlapping gravitational wave sources**."

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Debnandini's hobbies  
and interests

"I listen to **audio stories** and **podcasts** about **mysteries**, unsolved cases, detective literature etc. I also **paint** and **write**, both **stories and poetry**. I go on short weekend trips to **explore culture and history** and do some **amateur photography** and make **short films and documentaries**."

# LISA Consortium Updates

Get the latest news, consortium activities, upcoming conferences and call for applications

<https://www.lisamission.org/news/>

First LISA Consortium Newsletter edition:

<https://www.lisamission.org/newsletter/>

[FAQ](#)

# Greetings from Romania





**THANK YOU!**

**ANY QUESTIONS?**