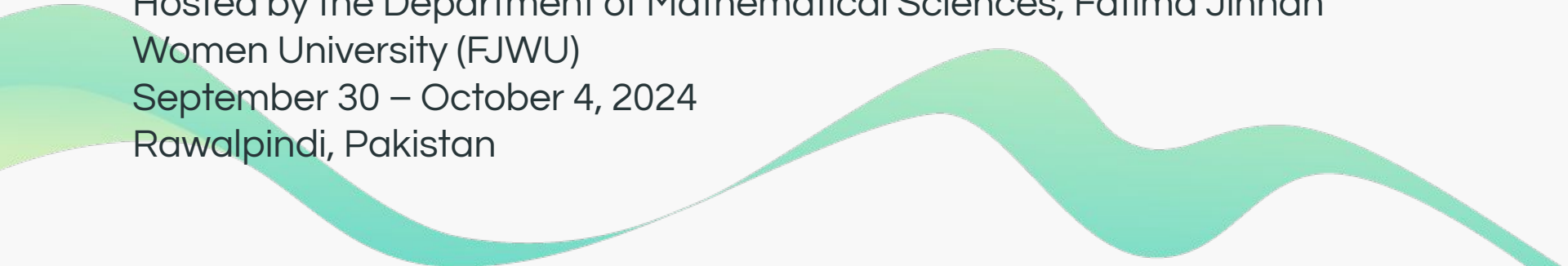




# Physics Without Frontiers: Pakistan *Introductory Workshop on Black Holes*



Hosted by the Department of Mathematical Sciences, Fatima Jinnah  
Women University (FJWU)  
September 30 – October 4, 2024  
Rawalpindi, Pakistan

# Organizers and Participants of the *Introductory Workshop on Black Holes*



# Activity Poster

## PHYSICS WITHOUT FRONTIERS: PAKISTAN INTRODUCTORY WORKSHOP ON BLACK HOLES

### Lecturers

Dr Damián Galante, King's College London, UK

Dr. Tibra Ali, BRAC University, Dhaka, Bangladesh

### Organising Committee

Dr. Sadia Hina, Fatima Jinnah Women University, Rawalpindi

Dr. Saba Inam, Fatima Jinnah Women University, Rawalpindi

Dr. Shamsa Kanwal, Fatima Jinnah Women University, Rawalpindi

Mr. Imran Parvez Khan, Fatima Jinnah Women University, Rawalpindi

### Department of Mathematics, Fatima Jinnah Women University

30 September - 4 October, 2024,

Register: [tinyurl.com/PWFPakistan](https://tinyurl.com/PWFPakistan)

Indico: [indico.ictp.it/event/10768/](https://indico.ictp.it/event/10768/)



The Abdus Salam  
International Centre  
for Theoretical Physics  
Physics Without Frontiers





# Physics Education and Research in Pakistan



- Pakistan has a rich history in Theoretical Physics, since Abdus Salam won the Nobel Prize in 1979.
- Programs like ICTP's Physics Without Frontiers (PWF) are extremely helpful in making advanced research topics more accessible.
- While the research in Black Holes is quite established in Pakistan, the latest research in Black Hole Thermodynamics is still lacking. Apart from being a very interesting area in itself, its relevance to cutting edge research in String Theory makes it further exciting.





# Objectives of the Workshop

- **Bridge gaps** in advanced physics education in Pakistan.
- Introduce students to **advanced research in black hole thermodynamics** .
- Emphasize **problem-solving techniques** in theoretical physics.




- Expose participants to the **problem of quantum gravity** .
- Target senior undergraduate and master's students in **Mathematics and Physics** .
- Foster **student interest** in Black Hole Thermodynamics and Quantum Gravity.





Students actively listening and engaging with the lecture



The background features decorative, wavy green shapes in the corners. On the left, a light green shape curves from the top towards the bottom. On the right, a darker green shape curves from the top towards the bottom. The text is centered in the white space between these shapes.

# **Workshop Team and Partners**



# *Fatima Jinnah Women University, Rawalpindi*

## Organized by :

- Dr. Sadia Hina (HoD, Department of Mathematical Sciences);
- Mr. Imran Parvez Khan (Founder, IPKI).

## In Collaboration with :

- *ICTP Physics Without Frontiers (PWF) Program*

## Distinguished Speakers:

- **Dr. Damián Galante** – Theoretical Physicist, Stephen Hawking Research Fellow, King's College London
- **Dr. Tibra Ali** – Theoretical Physicist, BRAC University, Dhaka



**Dr. Damián Galante:** Enriched the workshop through his invaluable expertise in Black Hole Thermodynamics.





rose


spare

$$- dt^2 \left( 1 - \frac{2M}{r} \right) + \frac{dr^2}{\left( 1 - \frac{2M}{r} \right)}$$

Dr. Damián Galante



**Dr. Tibra Ali :**  
Enlightened the students with his expertise in String Theory and Quantum Information.



# Lectures and Problem-Solving Sessions

5-day event with **six in-depth lectures** and **eight problem-solving sessions**.



*Dr. Damián  
Galante*



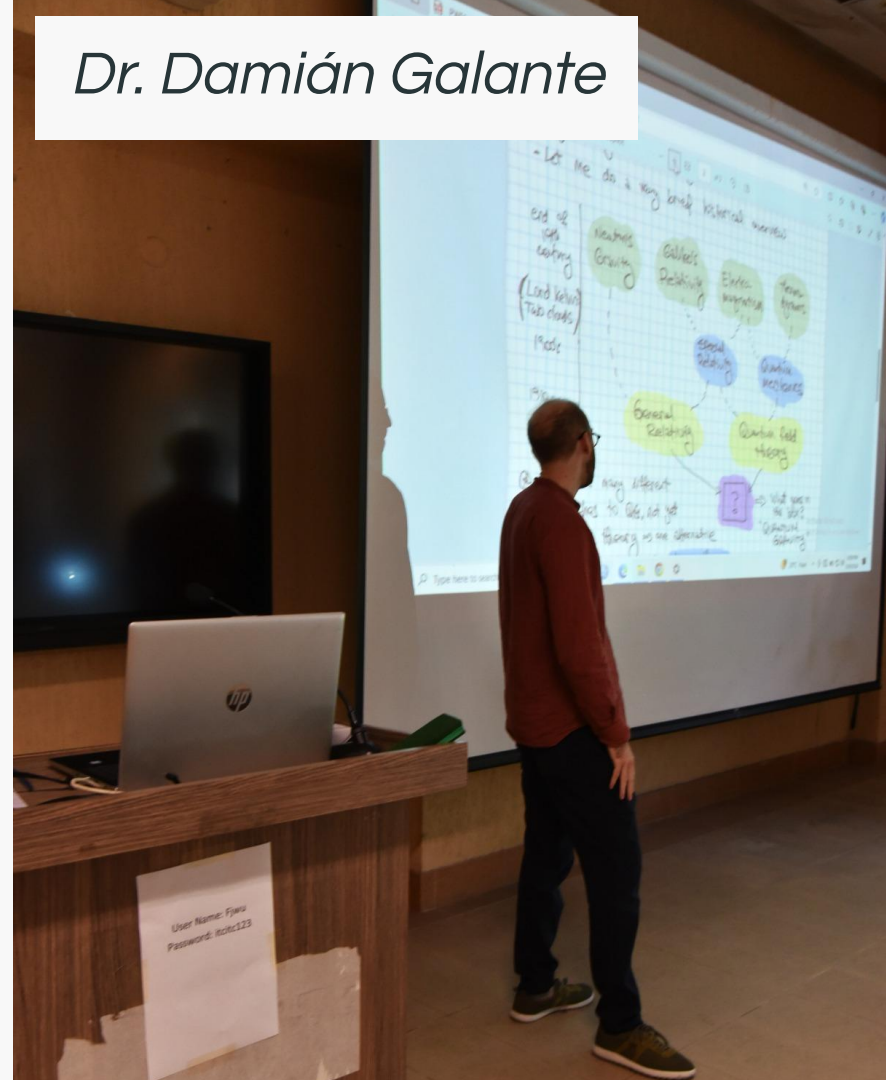


*Dr. Tibra Ali*

The insightful lectures bridged the gap between students knowledge and advanced research level

Interactive teaching using **multimedia** and **traditional methods** were used for enhanced engagement.

*Dr. Damián Galante*



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# Significance of the Workshop



Participants from universities in **Rawalpindi, Islamabad, and Lahore** gained insights from internationally renowned experts



- Discussion sessions where we discussed everything from Cosmological Inflation to Rabindranath Tagore!
- Both students and faculty found the lectures extremely useful.
- ***Exposure of local students to foreign professors who are unable to go abroad***







- Encouraged future collaborative research to align Pakistan's scientific efforts with global advancements.
- Contributed to enhancing Pakistan's academic reputation in the international physics community.



# Feedback and Outcomes



- Students valued **learning** advanced theoretical physics topics.
- **ICTP PWF Certificates** awarded for successful participation.
- Many students got motivation to **pursue further research** in Black Hole Thermodynamics and Quantum Gravity.
- Workshop inspired potential **joint research initiatives** .



According to one **participant**  
*"The Quantum Information lectures  
were paced optimally, covering basic  
concepts before delving into  
complexities. The problems were  
solvable and fun to do."*

Another **participant** noted  
*"This workshop has been the most  
productive session in terms of  
learning. The professors are simply  
awesome, and the discussion on the  
Euclidean Black Holes was  
particularly fascinating."*

One **participant** also said  
*"The workshop sparked my interest in  
General Relativity and Feynman  
Diagrams. It motivated me to explore  
these fields further."*



The background features decorative, wavy, light green shapes in the corners, creating a modern and clean aesthetic.

# Future Plans and Takeaways

## Visit to Jinnah (Founder of Pakistan) Park

- Plans to hold **more ICTP PWF workshops** in Pakistan, exploring additional areas of theoretical physics.
- Importance of **collaboration** and adapting complex topics to suit local educational contexts.
- Aiming to **strengthen** physics research in Pakistan and increase student engagement in advanced physics topics.





# *Visit to Pakistan Monument*





- Workshop Material

***<https://tinyurl.com/PWF2024PAK>***



***Thank you!***

- In **General Relativity** , we covered the basics and then moving on up till the Thermodynamics of the Schwarzschild Black Hole.
- Since the activity is planned for both Mathematics and Physics students, the **Quantum Information** lectures will serve primarily as an introduction aimed at the Mathematics students. In this vein the lectures will begin from the basics and after discussing quantum information and entanglement, and some famous algorithms in quantum computation.