

Crossing the Impossible: Quantum Tunneling From Theory to Nobel Laureates



Organized By : The Vedanta Physics Society, Department of Physics
Institution : NSCBM Government College Hamirpur
Date & Time : Friday, 17 October 2025, 10:00 am Onwards
Resource Person : Prof. Lavli Rana, Assistant Professor, Deptt of Physics
Participants : UG and PG Students of Physics

1. INTRODUCTION AND OBJECTIVES

The Vedanta Physics Society of the Department of Physics successfully organized a one-day workshop on the highly contemporary theme, "Crossing the Impossible: Quantum Tunneling from Theory to Nobel Laureates", on October 17, 2025. The event was specifically designed to bridge the gap between abstract quantum mechanics and its cutting-edge technological manifestations.

The workshop's primary objective was to provide students with a deep understanding of the quantum phenomenon of tunneling and to connect it directly to the recent Nobel Prize in Physics 2025 awarded to John Clarke, Michel H. Devoret, and John M. Martinis, whose work revolutionized the field of macroscopic quantum phenomena.

The poster features a central illustration of two figures pushing a ball over a barrier, representing quantum tunneling. The text on the poster includes:

- Logos:** National Digital Library of India (MHRD), The Vedanta Physics Society, and NSCBM Government College Hamirpur.
- Title:** One Day Workshop on "Crossing the Impossible: Quantum Tunneling from Theory to Nobel Laureates"
- Organized By:** Vedanta Physics Society, Department of Physics
- Date & Time:** Friday, 17 October 2025, 10:00 am Onwards
- Location:** NSCBM Government College Hamirpur
- YouTube Link:** <https://youtube.com/@profrana?si=qNsBMnq7oF4lOuXa>
- Nobel Prize Winners in Physics 2025:**
 - John Clarke:** For the discovery of asymmetric quantum conductors revealing new ways to create quantum devices.
 - Michel H. Devoret:** For the discovery of macroscopic quantum circuits revealing new ways to create quantum devices.
 - John M. Martinis:** For the discovery of low-energy quantum circuits revealing new ways to create quantum devices.

2. EVENT PROCEEDINGS

The workshop commenced at 10:00 AM in Room no. 142, Department of Physics.

TECHNICAL SESSION BY PROF. LAVLI RANA

The session was expertly delivered by Prof. Lavli Rana, Assistant Professor in the Department of Physics and Convener of the Vedanta Physics Society. The presentation was structured in two core parts, catering effectively to both the foundational needs of UG students and the advanced interests of PG scholars:

- **Theoretical Foundation of Quantum Tunneling:** Prof. Rana explained the concept of quantum tunneling, a purely quantum mechanical effect where particles have a non-zero probability of passing through an energy barrier, even if their kinetic energy is insufficient to overcome it classically. The session involved a clear explanation of the wave function and the Heisenberg Uncertainty Principle in the context of tunneling.
- **Macroscopic Quantum Tunneling and Nobel Work:** The discussion seamlessly shifted to the work of the 2025 Nobel Laureates. Prof. Rana detailed how their experiments in the mid-1980s proved that this bizarre quantum effect could be observed on a macroscopic scale in electric circuits, particularly in Josephson Junctions. This discovery of Macroscopic Quantum Tunneling (MQT) and energy quantization laid the crucial foundation for the development of Superconducting Qubits (Quantum Bits).

Nobel Prize Winners IN PHYSICS – 2025

For the discovery of macroscopic quantum mechanical tunnelling and energy quantisation in an electric circuit



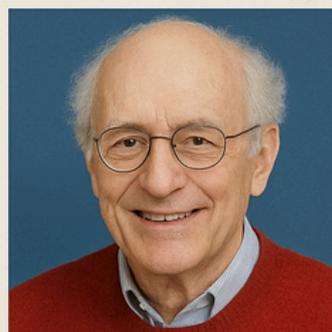
John M. Martinis

Demonstrated energy quantization and quantum tunnelling in a superconducting Josephson circuit



Michel Devoret

Helped build superconducting circuits that behave as single quantum objects and observed quantum effects at macroscopic



John Clarke

Led early experiments showing that macroscopic circuits can tunnel through energy barriers and display quantised energy levels

3. INTERACTIVE SEGMENT

The technical session was followed by an engaging interactive segment. Students from both UG and PG levels raised queries on the practical challenges of controlling quantum coherence in qubits, the role of tunneling in modern electronics (like flash memory), and the future direction of quantum computing research. Prof. Rana addressed all questions, ensuring conceptual clarity and fostering scientific inquiry among the participants.



4. CONCLUSION AND IMPACT

The one-day workshop was a profound success, providing a timely exploration of one of the most exciting areas in contemporary physics.

- **Relevance:** The direct link established between the college curriculum and the recent Nobel Prize in Physics 2025 served as a powerful motivator, demonstrating the real-world impact of theoretical concepts.
- **Knowledge Diffusion:** The session successfully diffused complex ideas about macroscopic quantum phenomena among a diverse group of UG and PG students, igniting interest in research and advanced studies.

The session culminated with a group photograph of all attendees and the organizing team, commemorating the successful and intellectually enriching day.



ACKNOWLEDGEMENT

On behalf of The Vedanta Physics Society and the Department of Physics, I extend my heartfelt gratitude to everyone who contributed to the success of this workshop.

My deepest appreciation goes out to all the students and teachers who participated—both those who attended physically in the normal mode and those who joined virtually in the hybrid mode. Your enthusiastic presence and interest were the driving force behind this workshop's success.

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