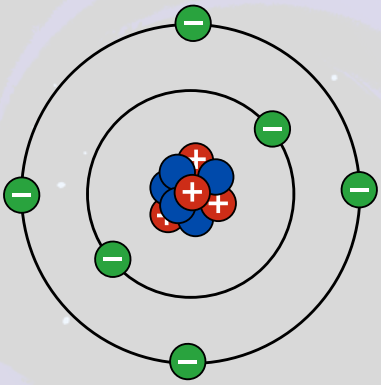
GUIDE TO BEING LIMITLESS

CLASS 6

THE OXFORD SCHOOL

JHIRI, BURHANPUR (M.P)

$E = mc^2$



WHY THIS BOOK MATTERS ?

Public speaking is an essential skill and helps a person leave an impression at every stage of their life.

EDUCATION

THEN v/s NOW

Exam-Centric Model, prioritizing high scores and rote memorization.

Dependent on school timetable; learning often stops after the final exam.

Limited opportunities, leading to high stage fear and interview nervousness after Class 12.

Confidence tied to marks; often hesitant to interact with "big personalities.

Skill-Centric Model, prioritizing essential life skills: Leadership, Time Management, and Problem Solving.

Cultivating a "**Life-Long Learning Habit**" and commitment to "**daily self-upgrade until the last breath.**"

Introduction of the **VR (Virtual Reality) Lab** (Currently in Progress) to provide high-stakes practice, eliminating fear and building the quality of a Great Speaker.

Confidence built on content and effective **communication**, allowing students **to hold discussions with national leaders** without fear.

VISION

The Oxford School envisions a generation of fearless pioneers defined not by their degrees, but by their intrinsic drive for perpetual growth and contribution. Our ultimate aspiration is to cultivate the Life-Long Learning Habit in every student, ensuring they are perpetually equipped to "daily upgrade themselves until their final breath." We aim to forge citizens of profound self-worth and confidence, empowering every child to achieve the quality of a Great Speaker ready to lead dialogues, execute innovative ideas brilliantly, and shape the nation's future with clarity and conviction.

Our Mission is to revolutionize education by establishing a Skills-Centric Pedagogical Model, moving definitively away from exam-only dependency. We are dedicated to the holistic development of essential competencies: Leadership, Effective Communication, Strategic Problem Solving, and Time Management. We achieve this through a rigorous curriculum that integrates UPSC/Competitive Exam Standards from Class VI, driven by the daily reading of articles and editorials. Recognizing that the ability to speak and present is the most powerful lever for lifelong success, we commit to leveraging cutting-edge tools, such as the new VR Public Speaking Lab. This builds unmatched confidence that ensures students can excel—from academic achievements and career success to ultimately influencing the next generation. We prepare students for every challenge life offers, ensuring their voice is always heard and respected.

THE PATH WE FOLLOW

Instilling the practice of reading 365 days, articles and editorials to build a rich content base across all subjects. You cannot change your future, but you can change your habits, and surely your habits will change your future.

DEFINING THE PATH:

THE ROAD AHEAD

DIRECTOR

Mr. Mayank Kamrani

"The Oxford School, Burhanpur, is built upon a profound and enduring philosophy: Future success is not determined by a single examination, but by the habits cultivated daily. Our vision extends far beyond achieving high scores; it is about forging individuals who are continuously self-improving, confident, and committed to "daily self-upgrade until their last breath."

PRINCIPAL

Mrs. Shilpa Jadwani

"We recognize a critical gap in conventional schooling: while students master written exams after 15 years of practice, they often falter in high-stakes personal interactions, such as college entrance interviews. This nervousness stems from a lack of practice and, crucially, content. When they go on vacation, they engage their families in discussions about current events and policies, demonstrating a well-rounded awareness that elevates their thinking and confidence.

Our students are not just studying; they are becoming informed thinkers."

THE OXFORD POST

VOL. I No.1

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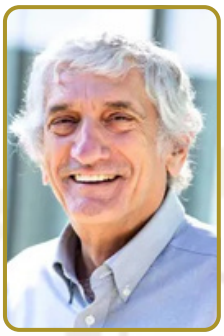
2025 NOBEL PRIZE IN PHYSICS ON QUANTUM TUNNELLING DEVICES

Who won & why





Winners: From Left to Right

John Clarke
(University of California, Berkeley)

Michel Devoret
(Yale University)

John Martinis
(University of California, Santa Barbara)

Awarded for:
Building a device that demonstrates quantum tunnelling a fundamental yet strange behavior in quantum physics.

What is Quantum Tunnelling?

- In classical physics, a particle (like a ball) cannot cross a barrier higher than its energy. Example : A cricket ball cannot pass through a wall.
- But in the quantum world (subatomic scale), particles sometimes “tunnel through” barriers, appearing on the other side without enough energy to climb over it.
- **It’s like:** A cricket ball occasionally disappears through the pitch instead of bouncing — totally impossible in our visible world, but possible in the quantum realm!

What did the Nobel trio do?

They built an electrical circuit to observe and control this tunnelling effect in a tangible way.

Key components:

1. Superconductors

- Materials that conduct electricity with zero resistance when cooled to very low temperatures.
- In a superconductor, electrons move together as **Cooper pairs.**

2. Josephson Junction:

- A thin insulating layer placed between two superconductors.
- Though the layer is non-conductive, quantum tunnelling allows current to pass through **without any voltage applied!**
- This phenomenon is called the Josephson Effect.

3. Their contribution:

- Created precise electrical circuits that allowed them to study tunnelling in a controlled way.
- They could make **all the charged particles behave as a single quantum entity** a unified wave-like particle.
- They demonstrated current flow without voltage, showing coherent quantum behavior at a macroscopic (visible) level.

Why is this important?

1. Quantum Mechanics Validation:

It confirms that quantum effects like tunnelling can be engineered and observed at larger scales.

2. Foundation for Quantum Technology:

- Their experiments are crucial for quantum computers and quantum sensors.
- The Josephson junction is already used in SQUIDs (Superconducting Quantum Interference Devices) ultra-sensitive magnetic field detectors.

3. Continuing Legacy:

Like how understanding quantum behavior led to transistors and semiconductors in the 20th century, this research will fuel next-gen computing and digital systems.

Quote Significance

"Century-old quantum mechanics continually offers new surprises." - **Olle Eriksson**

- Meaning: Even after 100 years, quantum theory continues to reveal new applications showing its unending relevance to modern science and technology.

Quick Revision Pointers (Prelims + Mains)

1.Concepts :

- Quantum tunnelling : Particles cross barriers they shouldn't due to wave-like nature.
- Superconductivity : Zero resistance flow of current at low temperatures.
- Josephson junction : Two superconductors separated by an insulator current flows via tunnelling.
- Josephson effect : Current without voltage (supercurrent).

2.Contributions:

- John Clarke, Michel Devoret, John Martinis built device demonstrating controllable quantum tunnelling.
- Enabled study of macroscopic quantum coherence (many particles acting as one).
- Crucial step toward quantum computing hardware.

3.Applications:

- Quantum computers (qubits use Josephson junctions).
- SQUIDs–detect minute magnetic fields (used in brain imaging, geology, etc.).
- Quantum sensors & metrology (precise measurements).

4.Analogy:

"Cricket ball tunnelling through the ground"
= visual way to remember quantum tunnelling.

Summary in One Line

The 2025 Nobel Prize in Physics honors scientists who made the invisible world of quantum tunnelling visible through superconducting circuits - paving the way for the next revolution in quantum technology.

Radical Tunnel: Nobel Prize 2025-Quantum Tunnelling & the Spirit of Pure Inquiry.

1. Core Idea in Simple Terms

The 2025 Nobel Prize in Physics was awarded to John Clarke, Michel Devoret, and John Martinis for their experimental proof that quantum mechanical principles apply not only to subatomic particles but also to large, visible electrical circuits.

They demonstrated "macroscopic quantum tunnelling"-meaning, entire electrical circuits made of trillions of electrons could behave as one single quantum particle, following the strange laws of quantum physics.

2. What Exactly Did They Discover?

The Setup:

- They built a circuit with two superconductors (materials with zero resistance at very low temperatures).
- Between them was a very thin insulating layer- called a Josephson junction.

Classical Physics Prediction:

- Normally, if you have an insulating layer, current cannot pass unless there's enough energy (voltage) to push electrons across.
- So, the system should remain in a zero-voltage, trapped state.

Quantum Physics Reality:

- At temperatures near absolute zero, they found that the electric current did flow - not by going **over** the barrier, but by tunnelling through it!
- This phenomenon is called quantum tunnelling - possible only because, in quantum physics, particles behave like **waves**, and these waves can "leak" through barriers.

Energy Quantisation:

- The entire circuit behaved like a single large particle, with discrete (quantised) energy levels -not a continuous spectrum as classical physics predicts.
- This was the first clear proof that quantum laws apply at a macroscopic scale - to something "big enough to hold in your hand."

3.Why Was This Important?

(a) Scientific Importance

- It confirmed that quantum mechanics is universal it governs everything, not just tiny particles.
- The experiment also established macroscopic quantum coherence (many electrons acting as one quantum system).

(b) Technological Impact

Their work laid the foundation for modern quantum technologies, especially:

1. Superconducting Qubits - the basic units of today's quantum computers.
2. SQUIDs – ultrasensitive magnetometers for measuring faint magnetic fields (used in brain imaging, geology, etc.).
3. Quantum voltage standards – used in metrology (precise electrical measurements).
4. Single-photon detectors – critical in astronomy and biomedical imaging.

4. Relevance for Today & The Future

The Current Challenge:

Now that we know quantum effects can appear at large scales, the challenge is to preserve these effects — because quantum states are fragile and get easily destroyed by:

- Heat,
- Vibrations,
- Stray electromagnetic signals (called **noise**).

So, modern research focuses on:

- Better materials with lower energy loss,
- Cryogenic control (ultra-low temperature systems),
- Hybrid quantum systems (combining superconducting circuits with photonic, spin-based, or mechanical elements).

5.The Philosophical Lesson (UPSC Mains Angle)

The article highlights a deeper message the value of pure scientific inquiry.

"The Physics Nobel exemplifies the value of inquiry not driven by immediate utility."

This means:

- When Clarke, Devoret, and Martinis conducted their experiments in the 1980s, they weren't trying to build quantum computers or devices.
- They were simply exploring a fundamental question -"**Can quantum laws govern large, everyday objects?**"
- Yet, this pure curiosity-driven research eventually led to revolutionary technologies in quantum computing, communications, and sensing.

This reinforces a classic UPSC theme:

"Basic science, though seemingly abstract, is the seed for applied innovations decades later."

6. Indian Relevance

- India is now investing in quantum technology through the National Mission on Quantum Technologies and Applications (NM-QTA) under the Department of Science & Technology (DST).
- Indian researchers are working on superconducting qubits, quantum materials, and photonics all built on the principles demonstrated by the 2025 Nobel laureates.

7. Quick Revision Pointers

Concepts:

- Quantum tunnelling: Particles cross energy barriers they classically shouldn't — due to wave-like behavior.
- Superconductivity: Zero resistance flow of electrons at extremely low temperatures.
- Josephson Junction: Two superconductors separated by a thin insulator → current flows via tunnelling.
- Macroscopic Quantum Coherence: Trillions of electrons behave as a single quantum particle.

Contributions:

- Clarke, Devoret, Martinis (1980s, UC Berkeley):
- Demonstrated macroscopic quantum tunnelling.
- Showed energy quantisation in circuits visible to the eye.
- Confirmed quantum mechanics governs macroscopic systems.

Applications:

- Quantum computers (superconducting qubits).
- SQUIDs (magnetometers).
- Quantum voltage standards.
- Photon detectors in astronomy & medical imaging.

Lessons:

- Pure science → Future technology.
- Proof that fundamental curiosity drives innovation.
- Encourages investment in basic research.

8. UPSC Prelims Practice Question

Q. With reference to the 2025 Nobel Prize in Physics, consider the following statements:

1. The laureates demonstrated macroscopic quantum tunnelling in Josephson junctions.
2. Their experiments showed that quantum laws can apply to large-scale electrical circuits.
3. The Josephson junction consists of two superconductors separated by a conducting metal layer.

Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 only
(d) 1, 2 and 3

Answer: (a) 1 and 2 only

Explanation:

1.Demonstrated macroscopic quantum tunnelling.
2.Showed quantum behavior in macroscopic circuits.
3.The layer between superconductors is an insulator, not a conductor.

Difference Between

Article

1. Provides detailed information on a subject.
2. Mostly neutral, based on facts, data, and research.
3. To inform or explain the reader.
4. Newspapers, magazines, websites, and journals.
5. Reporters, specialists, or professional writers.

Editorial

1. Reflects the opinion of the editor/board.
2. Opinionated and comments on current events/issues.
3. To persuade, criticize, or suggest solutions.
4. Dedicated editorial page in a newspaper.
5. Editor or the editorial board.

Newspaper

1. Delivers timely news and information.
2. Includes news, articles, editorials, and ads.
3. To help people stay updated (local/global).
4. Comprehensive publication with various sections.
5. Large team of reporters, editors, and designers.

Academic Success

Excels in cluster and government competitions. Clear Presentation Mastery for high grades.

Career Launchpad

Confidence in Entrance Exams, Interviews, and Competitive Exam communication sections.

Leadership Growth

Motivating Teams; Negotiation; Creative Thinking & Effective Professional Writing (e.g., contributing to publications).

Expertise & Legacy

Inspiring Vision; Strategic Communication , including thought-leadership articles for major papers (e.g., The Hindu, Times of India).

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