



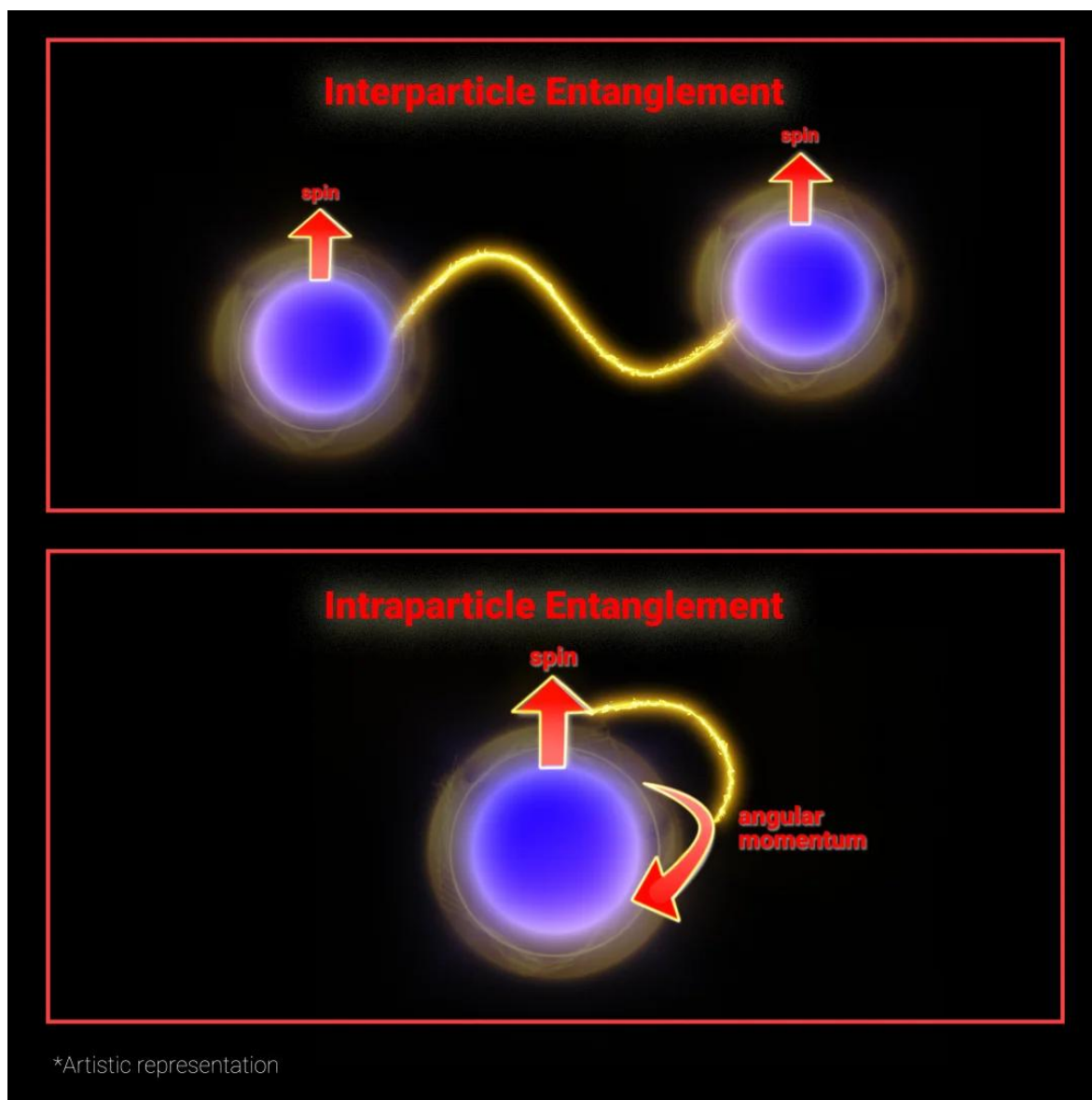
Noise Effect on Quantum Entanglement

[Source: PIB](#)

Scientists from **Raman Research Institute (RRI), IISc Bangalore, IISER Kolkata** have found that **quantum noise** can sometimes **enhance, revive, or even create entanglement**, challenging earlier beliefs that it only **disrupts quantum systems**.

Quantum Entanglement

- **Quantum entanglement** refers to a phenomenon in **quantum mechanics** where **two or more particles** become **interlinked**, such that the **state of one particle instantly determines the state of the other**, regardless of the distance.
- It forms the basis of advanced technologies like **quantum computing, quantum cryptography, and quantum communication**,
- **Types of Quantum Entanglement:**
 - **Intraparticle entanglement**, where different properties (e.g., **spin** and **path**) of a **single particle** are entangled.
 - **Interparticle entanglement**, the more common form, involving entanglement between **separate particles**.



Quantum Noise

- **About:** Quantum noise refers to **random disturbances** arising from a **system's interaction with its environment**, often leading to **loss of coherence (decoherence)** and **degradation of quantum properties** like entanglement.
- **Types:** **Amplitude damping** (energy loss), **Phase damping** (loss of phase coherence), and **Depolarizing noise** (randomization of the quantum state).

Noise Effects on Entanglement

- The study found that **amplitude damping** can **create, preserve, or revive entanglement** in **intraparticle systems**, while **phase damping** and **depolarizing noise** are less effective.
 - Also, **intraparticle entanglement** was found to be **more resilient to noise** compared to **interparticle entanglement**, which showed only **steady decay** with **no revival or generation under noise**.
- The study introduced a realistic **Global Noise Model** and developed a **precise analytical formula** to predict **entanglement behavior** under various noise types, providing a valuable tool for designing **resilient quantum systems** suited for real-world, noisy environments.

NATIONAL QUANTUM MISSION

Aims to put India among the top six leading nations involved in the R&D in quantum technologies

Presently, R&D works in quantum technologies are underway in the US, Canada, France, Finland, China and Austria

Duration: 2023-24 to 2030-31

Nodal Ministry: Ministry of Science & Technology

Highlights of the Mission:

- Four Thematic Hubs (T-Hubs) in different domains across the country
- Wide-scale applications ranging from healthcare and diagnostics, defence, energy and data security

- Strengthening of indigenously building quantum-based computer
- Help develop magnetometers with high sensitivity in atomic systems and atomic clocks
- Support design and synthesis of quantum materials

A huge boost to National priorities like digital India, Make in India, Skill India, Stand-up India, Start-up India, Self-reliant India and SDGs

Quantum Technology

Works by using the principles of quantum mechanics (the physics of sub-atomic particles), including quantum entanglement and quantum superposition

Quantum Superposition

The ability of a quantum system to be in multiple states simultaneously

While digital computers store data as bits (the ones and zeros of binary), quantum computers use qubits that exist as one, zero or both at the same time

This superposition state creates a practically infinite range of possibilities, allowing for fast simultaneous and parallel calculations

Quantum Entanglement

It means the two members of a pair (Qubits) exist in a single quantum state

If you change the properties of one of them, the other changes instantly

This can be used to create a secure encryption key in quantum cryptography

If an eavesdropper tries to intercept the transmission, the entangled state of the particles will be disturbed, making the attempt detectable

QUANTUM TECHNOLOGY

Quantum Key Distribution

Quantum Networks

Quantum Simulators

Post-Quantum Cryptography

Quantum Sensors
Particle Generators
Atomic Clocks

Quantum Cloud Computing

Quantum Memories
Quantum Repeaters
Quantum Chips

Quantum Software

Quantum Computing
Quantum Annealers

Quantum Materials



Read More: [Quantum Entanglement](#), [Ultra-Secure Communication Using Quantum Technology](#)

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