Quantum Computing

Is it possible to maintain the state of a qubit in a physical shell or hardware?

A qubit is a unit of quantum information, analogous to a classical bit but with a critical difference: it can exist in a superposition of two states, measured probabilistically. Unlike classical bits, which are strictly 0 or 1.

However, maintaining a qubit's state is challenging because it requires isolation from environmental noise. Current solutions include:

Superconducting circuits.

Trapped ions or atoms, confined and manipulated with electromagnetic fields.

Topological qubits, which aim for inherent error resistance (given by AI - I (Salim) didn`t have time to read about topological qubits).

The mentioned solutions are not fully implemented and operate under strict conditions.

How to change, measure and control the state of a Qubit?

Once a qubit is confined, isolated, and measurable, **controlling its state** becomes the next critical challenge. Reliable manipulation of qubit states is essential for building a functional quantum computer, enabling advancements such as:

- Secure quantum communication (e.g., quantum cryptography).
- Faster algorithms.
- High data storage.

Manipulate its state include:

Microwave pulses applied via control lines on the chip;
Laser pulses of specific frequencies manipulate ion energy states;
Magnetic fields or electric pulses alter electron spin states.

What unsolvable problems could quantum computing address that classical computing cannot?

Quantum computing can solve problems that classical computers would take far too long to address—data security being one important example. However, the full implementation of quantum computers could also create short-term challenges. These machines would be capable of decrypting conventionally encrypted information in a fraction of the time, potentially disrupting the balance of power among nations.