Unusual talks - QUANTUM COMPUTER FROM INDIA: DR R VIJAYARAGHAVAN - PROF & PRINCIPAL INVESTIGATOR AT TIFR, MUMBAI

✚ Key Takeouts :-

1. assumptions of error correction for Post error correction applications for QIC.
2. DR. Vijay Raghavan, TIFR
3. classical computing ⟷ Quantum Computing
4. why classical system is not able to work efficient way? The key which makes difference b/w classical computer and quantum computer is

   SUPER POSITION

5. number of efficiency exponentially grows with adding more and more qubits.
   with one qubit you have (0 ~ 1)
   two qubit you have (00, 01, 10, 11)
   & with n qubit system you have 2^n states which works all together as superpositioned
6. Hilbert Space ⟶ Quantum Computer
7. single photon Experiment : (delayed choice Experiment)
8. we dont know why quantum Nature works that way, but we know it and we build applications on the basis of that.
9. Qubits are oscillators
   3qubit processor system at TIFR.
10. once a while all quantum computers make errors, they are prone to errors.
11. Quantum computers are only powerful only when number of qubits are sufficiently large. (2^N)
12. Google / IBM both, infact most of the labs uses same super conducting technology, operating at very low temperature, absolute zero, using aluminium thin film devices, on the chip,
13. most recent google announced a system with 53 qubits,
14. classical program ⟶ large Quantum computer ⟶ classical output
15. Upto 20 qubits operations you can do on classical computer, beyond that you require supercomputer to simulate the behaviour. And upto 100 qubits we can simulate on most powerful classical computer, beyond 100 qubits, its not possible.
16. TIFR contact TIFR.
17. The fundamental research was not on quantum level, the curiosity lied underneath the basic nature of atom, 40 years ago in US.
18. current generation of quantum computers are prone to errors, quantum systems are very fragile, they dont use technology called Quantum Error Correction, (QEC), This makes sure even if your qubits are random and unstable, in other words,

    EVEN if your quantum bits are unstable and random, and are sort of doing random things once in a while, your information is not lost, your calculation wont go wrong if you incur QEC.

19. Chemistry applications are good arena where early QC are helping. Modelling nature is interesting way to model nature using quantum system not classical system
20. Negative application = cryptographical code breaking. Breaking codes are one of the early thoughts of past Quantum systems.
21. At this stage
    we know the applications, and far sighted breakthroughs but we are yet to discover Algorithms which could help us clear understanding of the mechanism

22. Quantum AI : [quantum computing shows record breaking applications in AI]
    dependency ⟷ [classical AI can help building Quantum computers]

23. WE ALSO DONT KNOW :-
    we are also unsure about, how our mind works, the cognitive structure we have i.e., how our mind works whether its classical in nature or it behaves quantum mechanical way. This is what we dont know.
    ⇒ This questions, Does the neuron have to be quantum mechanical object?
    Because we already talk a lot about simulating the behaviour of Neurons as ANN / DNN. But, [Neuron need to be a quantum mechanical object?]

24. quantum Extension of current ML, ANN model could be imagined as superposition of neuron!
25. Qust Program, (NM – Quantum Computing)
26. There is a large scope in Algorithm development where people could enforce themselves to study more and convert classical problems in Design Analysis & Algorithms with quantum substitute.
27. EdX Lectures are important
28. Error Correction, Algorithms | next breakthrough in QC could be (QEC, quantum error correction)
29. Superconducting Technology is used to build QC.