03.02. David P. DiVincenzo: The Physical Implementation of Quantum Computation, Progress of Physics, Vol 48 (9-11), p. 771-783 (2000).

Presenter (10 min):
Sketch the key result.
Bibliometrics: what do you know about the author? Which papers and results does it build on? What are the implications of this study? Is this paper a milestone?

Questions:

1. What does it mean to characterise well the qubits of a system?
2. How can a system of two systems be a one-qubit system? Give an example and a brief explanation of the scenario.
3. What types of systems can implement a qubit? Can you quickly find the state-of-the-art for some of these choices?
4. Why do we need to be able to initialise our systems in a known state? How can we achieve it? What is the state-of-the-art in different platforms?
5. What does decoherence do and what is the connection with observing non-classical behavior? Describe different types of decoherence on different systems.
6. How does error-correction help with decohering states, and what are believed to be the requirements for it to work? Are there systems where error correction might seem easier or more difficult to achieve?
7. Can you briefly describe a very common error-correction technique and how it works?
8. Define what is a universal set of gates and give one such. What is the main difference between the classical and the quantum universal sets of gates?
9. How are gates implemented in different setups? Give a few examples highlighting the differences.
10. What ways do we have to boost the efficiency of a measurement?
11. What are the extra requirements for quantum communication, and what are the typical systems used? How are these connected to quantum computation?
12. Discuss ideas or protocols that you might know that need all requirements to work, in order to be implemented.
13. Discuss what is your opinion on a “winning technology”. Do you think we could have only one?