tcg crest

Inventing Harmonious Future

Centres for Quantum Engineering, Research and Education (CQuERE)

Quantum leaps for the benefit of society

Vision of CQuERE

Vision

“If you want to make a simulation of nature, you’d better make it quantum mechanical.”
Richard P. Feynman

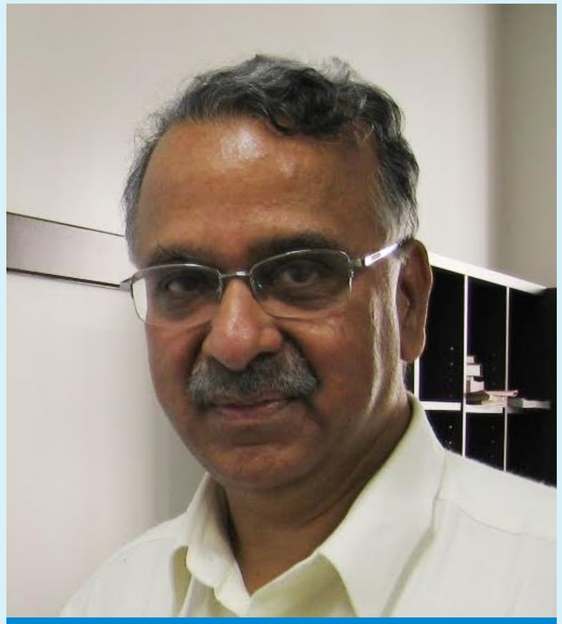
Nobel laureate in physics (1965)

“What is really exciting about quantum computing is that we have good reason to believe that a quantum computer would be able to efficiently simulate any process that occurs in Nature.“
John Preskill

Richard P. Feynman Professor of Theoretical Physics

California Institute of Technology

Our vision is to establish CQuERE as a world class research centre on quantum science and technology by creating a stimulating research environment within the centre and bringing together the best of academia and industry.

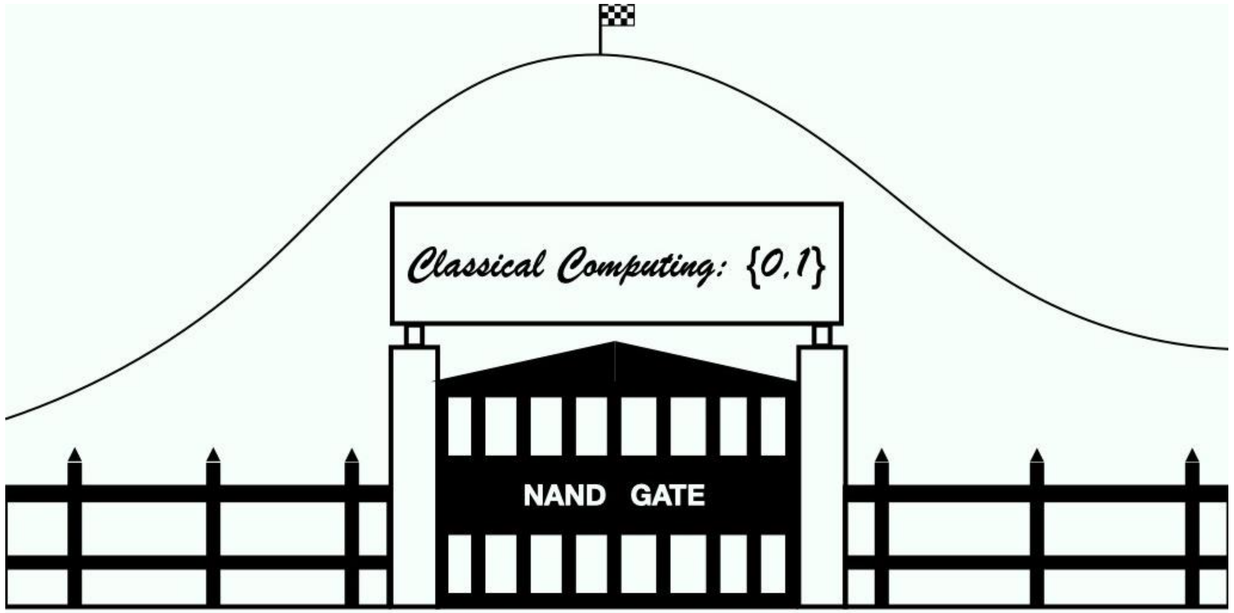


Prof. Bhanu Pratap Das
Director – CQuERE

A B.Sc (Hons.) from IIT Kharagpur, Prof. Das received an MS (1976) and a PhD (1981) from the State University of New York at Albany. After Postdoctoral fellowships at UC, Riverside and Max Planck Institute for Quantum Optics, Munich he held faculty positions at Colorado State University, Utah State University, Oxford University and IIT Bombay before joining the Indian Institute of Astrophysics (IIA), Bangalore in 1993 where he spent 22 years. He left IIA as Distinguished Professor in 2015 to join as Professor of Physics at the Tokyo Institute of Technology, Japan. Prof Das' research field is quantum many-body theory of atoms and molecules and its applications to fundamental physics and quantum computing. He is a Fellow of the American Physical Society for his seminal contributions to the theory of parity and time-reversal violations in atoms in the context of probing the Standard Model of particle physics.

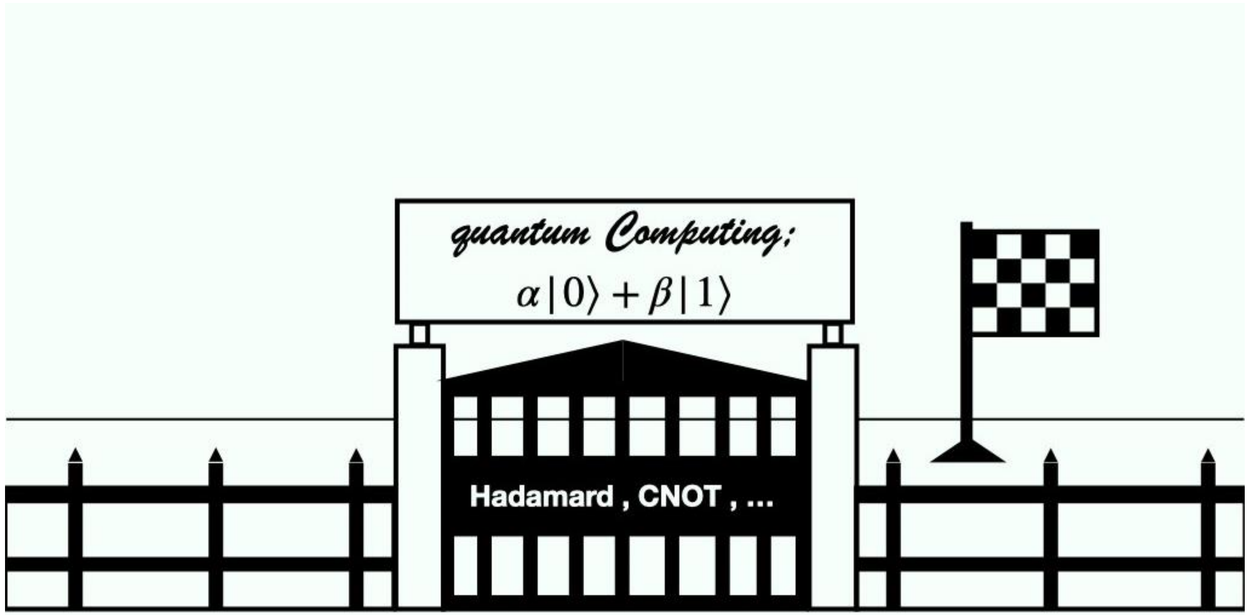
Classical vs Quantum Computation

SPEED-UP IN MOLECULAR CALCULATIONS COULD FIND APPLICATIONS FROM PROBING FUNDAMENTAL PHYSICS TO DRUG DESIGN



Classical Computing

Information is represented by bits.
A bit could be 0 or 1.
Computations use classical gates.

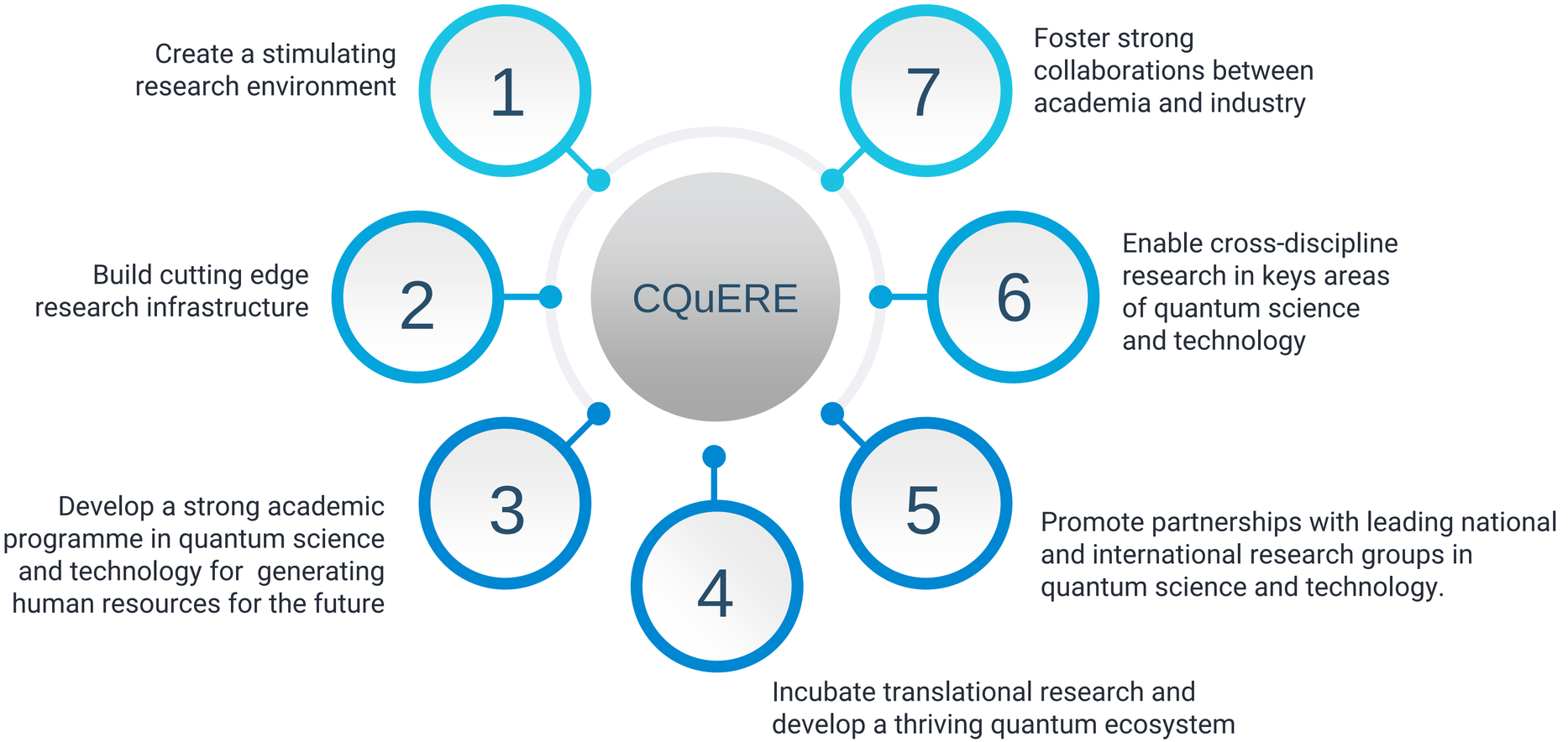


Quantum Computing

Information is represented by qubits.
It is a linear combination of 0 and 1.
Computations could employ quantum gates.

Goals & Objectives of CQuERE

AS THE FIRST CENTRE IN INDIA DEDICATED TO QUANTUM SCIENCE AND TECHNOLOGY, CQUERE WILL AIM TO

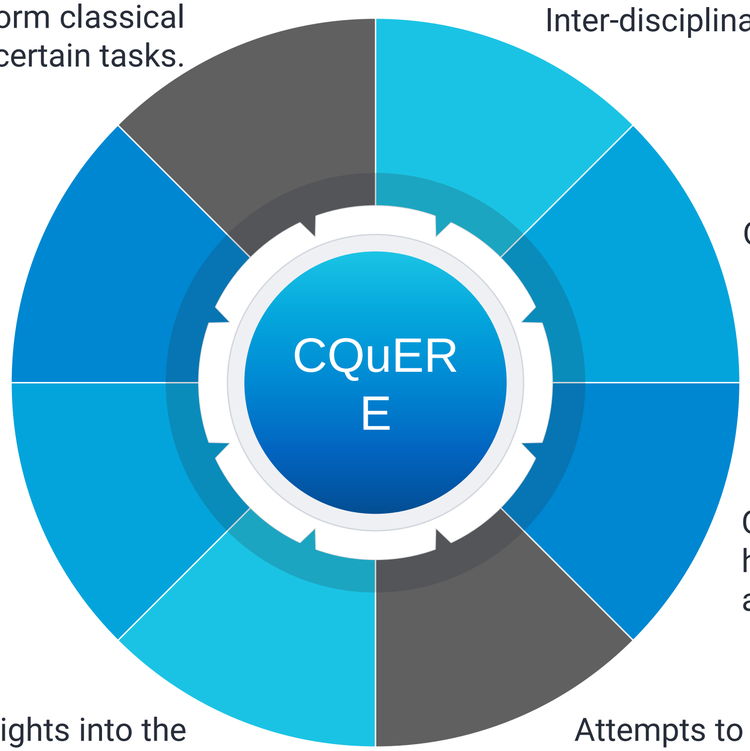


Research Areas

Exploring the potential of trapped ions as Noisy Intermediate Scale Quantum (NISQ) devices with 20-30 qubits in the near future. NISQ computers can, in principle, outperform classical computers for certain tasks.

Inter-disciplinary research.

Using trapped ions, ultra cold atoms and molecules for quantum sensors and clocks. Both sensors and clocks have applications in fundamental and practical problems.



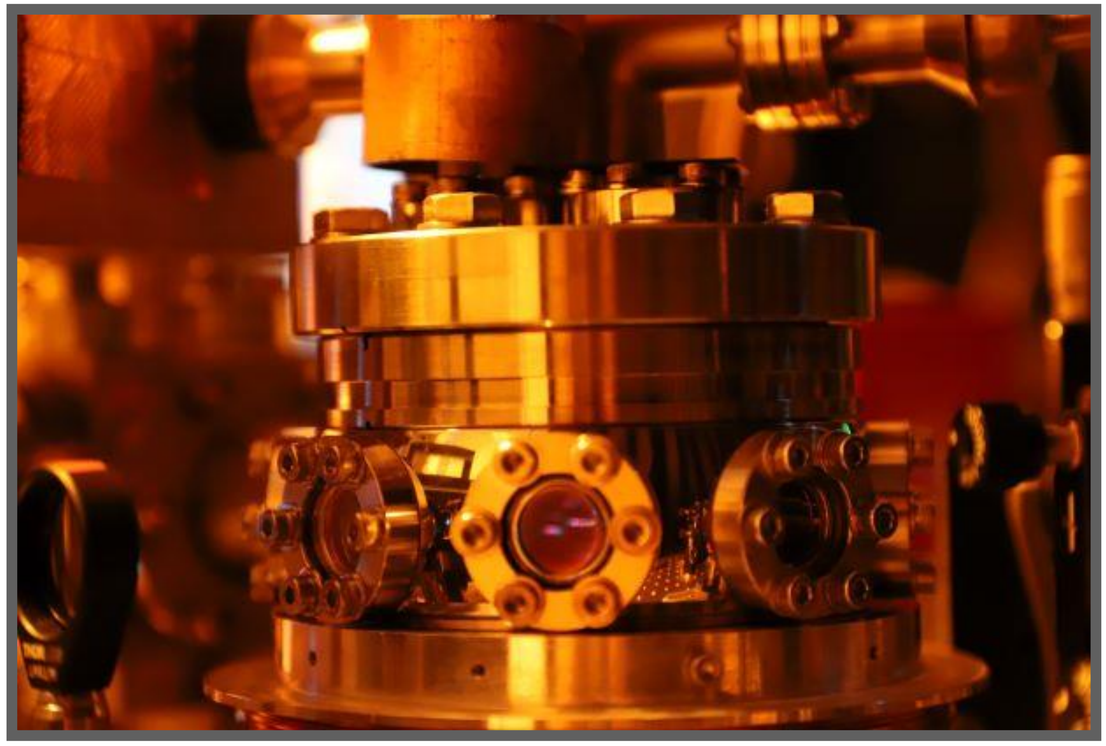
Quantum matter.

Exploring the possibility of superconducting qubits and other platforms for quantum computers.

Quantum simulation: classical-quantum hybrid algorithms, many-body theory and quantum annealing.

Engineered systems to gain insights into the possibility of large scale quantum communication and/or quantum computation.

Attempts to create novel NISQ devices by combining different physical systems including superconducting qubits.



Ion Trap Technology

A combination of ultra-high vacuum, radio-frequency electronics and precision laser optics.
Ion Trap: A leading hardware for quantum computing, simulation and sensing.

Opportunities

CQuERE offers PhD and postdoctoral/visiting programmes in quantum science and technologies.

Prepares doctoral students and postdoctoral researchers for a career in research, both in academia and industry.

A unique research experience

Meeting of experiment and theory, Academia and industry.

Blend of young and an experienced faculty

Student internships from universities IITs, IISERs and participation in projects carried out at the centre.

Contributing to the creation of a pool of young scientists in quantum science and technology.

Collaborations

ACTIVE COLLABORATIONS GLOBALLY AS SCIENCE AND ADVANCED TECHNOLOGY HAS NO BOUNDARIES
BRINGING TOGETHER EXPERTS FROM INSTITUTES IN AND OUTSIDE INDIA

- CENTRE FOR QUANTUM TECHNOLOGIES, SINGAPORE
- INDIAN INSTITUTE OF TECHNOLOGY, DELHI
- PHYSICAL RESEARCH LABORATORY, AHMEDABAD
- INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY
- OSAKA CITY UNIVERSITY, OSAKA, JAPAN
- INDIAN INSTITUTE OF TECHNOLOGY, GUWAHATI

OPEN TO FUTURE COLLABORATIONS ON RESEARCH AREAS PURSUED AT CQuERE

www.tcgcrest.org

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