Pratapaditya Bej

Location: Bangalore, India | **Contact:** +91 9681701645 | [pratap6906@gmail.com|](pratap6906@gmail.com)
Whats app: +91 9038238265
LinkedIn: Pratapaditya Bej | **Arxiv:** arXiv link
ORCID: ORCID ID | **Google Scholar:** Google Scholar Profile

Professional Summary:

Dedicated Senior Scientist at Happiest Minds Technologies with over nine plus years of experience in quantum computation, quantum cryptography, and information. I specialize in developing quantum computing algorithms using Qiskit, focusing on healthcare applications. Formerly a Mathematical Engineer at ExamRoom.AI, where I advanced post-quantum cryptographic protocols and QKD systems, earning two related patents and papers. My expertise bridges the gap between theoretical quantum physics and practical IT solutions, contributing to both academic research and industry applications. Proficient in Python, FORTRAN, Mathematica, and Qiskit, with 12 publications, including five in *Physical Review Journals*.

Core Competencies:

- **Quantum Computation:** Quantum algorithms, quantum optimization and simulation, Qiskit.

- **Quantum Cryptography**: Quantum Key Distribution (QKD), Quantum Information.

- **Network Security**: Quantum Communication Networks, Secure Transmission Protocols

- **Software Competency**: Python, Fortran, LATEX, Mathematica

- **Research & Development**: Patent Filing, Academic Publishing, Quantum Algorithm Design

- **Problem-Solving**: Complex Systems Analysis, Optimization Strategies

Professional Experience:

Senior Scientist
Happiest Minds Technologies, Bangalore, India
5th September 2024 – Present

- Leading the development of quantum computing algorithms tailored for healthcare applications, focusing on predictive analysis and optimization using Qiskit.
- Designing innovative quantum models to analyze ECG data, enhancing early detection of cardiac anomalies through advanced quantum-based pattern recognition.
- Collaborating closely with interdisciplinary teams to integrate quantum technologies with healthcare systems, bridging research with real-world medical applications.

- Conducting feasibility studies and test implementations to evaluate the impact of quantum solutions on healthcare data analysis.

Mathematical Engineer
ExamRoom.AI, Bangalore, India
10th July 2023 – 2nd September 2024

- Spearheaded the development of advanced post-quantum cryptographic protocols, ensuring secure data transmission in next-generation communication systems.

- Designed and implemented innovative quantum key distribution protocols, enhancing the security and efficiency of quantum communication networks.

- Collaborated with cross-functional teams to integrate quantum computational technologies into existing IT infrastructures, bridging the gap between research and practical application.

- Filed two patents and published two journal papers.

PhD Scholar in Quantum Information and computation
Bose Institute, Kolkata, India
2014 – 2023

- Conducted in-depth research on quantum correlations in entanglement swapping and other quantum information theories.

- Published numerous peer-reviewed papers in leading international journals, contributing to the advancement of quantum cryptography and quantum networks.

- Completed a thesis on the dynamics of quantum information, focusing on theoretical and practical implications in secure communications.

Education:

PhD in Physics
Bose Institute, Kolkata
Thesis Submitted: 2023

Master's in Physics
IIT Delhi, Delhi, CGPA: 7.52
2011

Bachelor of Science in Physics
R. K. Mission Narendrapur, Kolkata, Percentage: 63% 1st class
2009

Technical Skills:

- **Programming Languages**: Python, Fortran, LATEX, Mathematica

- **Quantum Tools**: Quantum Computing, Qiskit, Quantum Key Distribution (QKD).

- **Software & Tools**: MATLAB, Mathematica, Quantum Simulators.

- **Research & Documentation**: Patent Filing, Academic Journal paper writing.

National Level Exams:

CSIR-NET qualified- 2011 in Physics.

GATE qualified- 2011 in Physics.

JAM qualified-2009 in Physics.

Reviewer for International Journals:

Physical Review Journal (American Physical Society): Reviewed several manuscripts for Physical Review A and Physical Review Letter, leading journals in the field of physics. Contributed to the journals` peer-review process, maintaining high standards of scientific integrity.

Quantum Information Processing (Springer Journal): Served as a reviewer for Quantum Information Processing, a reputable journal publishing cutting-edge research in the field. Conducted thorough evaluations of manuscripts, offering valuable insights and suggestions to authors.

Publications & Patents:

Publications:

1. *P. Bej, and V. Jayakeerthi, A secure quantum key distribution protocol using two-particle transmission, arXiv:2403.13634 (2024).*
2. *P. Bej, and A. Banerjee, Activation of entanglement in generalized entanglement swapping, Phys. Rev. A **109**, 052437 (2024).*
3. *A. Banerjee, P. Bej, and S. Bandyopadhyay, Quantum change point and entanglement distillation, Physical Review A, 109, 042407 (2024).*
4. *A. Banerjee, P. Bej, A. Mukherjee, S.G. Naik, M. Alimuddin, M. Banik, When Mei Gu Guan's 1960 Postmen Get Empowered with Bell's 1964 Nonlocal Correlations or Nonlocal Advantage in Vehicle Routing Problem, APL Quantum 1, 036105 (2024)*
5. *P. Bej, A. Ghosal, A. Roy, S. Mal, and D. Das, Creating quantum correlations in generalized entanglement swapping, Physical Review A, 106, 022428 (2022).*
6. *A. Banerjee and P. Bej, Braess paradox in a quantum network, Physical Review A, 104, 052622 (2021).*

7. **P. Bej,** A. Ghosal, D. Das, A. Roy and S. Bandyopadhyay, *Information-disturbance trade-off in generalized entanglement swapping, Physical Review A, 102, 052416 (2020).*
8. **P. Bej,** S. Halder and R. Sengupta, *Optimal teleportation fidelity and its deviation in noisy scenarios, Modern Physics Letters A, 38, (38n39), 2350169 (2023).*
9. **P. Bej,** and S. Halder, *Unextendible product bases, bound entangled state, and range criteria, Physics Letters A, 386, 126992 (2021).*
10. T. Saha, P. Ghosal, **P. Bej,** A. Banerjee, and P. Deb, *Thermalization of isolated quantum many-body system and the role of entanglement, Physics Letters A, 509, 129501 (2024).*
11. P .Deb and **P. Bej,** *Geometry of quantum state space and entanglement, Quantum Information Processing (2019) 18:72.*
12. P .Kumari, V. Jayakeerthi, and **P. Bej,** *Securing long-range QKD with or without trusted nodes, Submitted to Journal of Cryptographic Engineering (Springer Journal) August 2024.*

Patents:

1. Title: ENCRYPTING CONTENT USING QUANTUM KEY CRYPTOGRAPH, Application No: 63/662,433, Inventors: **Pratapadita Bej** and Vinod Jayakeerthi, Status: Under review.

Abstract: Method and system for transmitting content securely between a transmitter and a receiver by generating a symmetric key by quantum key distribution (QKD) with unextendible product bases (UPB), wherein the symmetric key is represented as bits, wherein the number of bit is pre-defined. Encrypting content with the generated symmetric key and transmitting the encrypted content securely to a receiver. Receiving the encrypted content from the transmitter at the receiver, and decrypting the content at the receiver, using the generated symmetric key, wherein the generated symmetric key is available at the transmitter and the receiver.

2. Title: SECURELY TRANSMITTING AND RECEIVING CONTENT, Application No: 63/668,378, Inventors: Priti Kumari, **Pratapadita Bej,** and Vinod Jayakeerthi, Status: Under review.

Abstract: Method and system for securely transmitting content between a transmitter and a receiver by generating a symmetric key via relay, using Post-Quantum Cryptography (PQC), Quantum Key Distribution (QKD), and a Quantum Random Number Generator (QRNG), wherein the relay includes both trusted and untrusted nodes.

Languages:

- **Bengali**: Native

- **English**: Fluent

- **Hindi**: Fluent