



TO MAGNIFICO RETTORE OF UNIVERSITA' DEGLI STUDI DI MILANO

ID CODE 6434

I the undersigned asks to participate in the public selection, for qualifications and examinations, for the awarding of a type B fellowship at **Dipartimento di Fisica - Pure and Applied Quantum Mechanics group**

Scientist- in - charge: **Prof. Alessandro Ferraro**

[Name and surname]

## CURRICULUM VITAE

### PERSONAL INFORMATION

Surname	Gupta
Name	Rivu

### PRESENT OCCUPATION

Appointment	Structure
PhD scholar in Physics	Harish Chandra Research Institute

### EDUCATION AND TRAINING

Degree	Course of studies	University	year of achievement of the degree
Master	Physics	University of Calcutta	2019
Bachelors	Physics	St. Xavier's College (Autonomous), Kolkata under University of Calcutta	2017

### FOREIGN LANGUAGES

Languages	level of knowledge
English	Fluent



## AWARDS, ACKNOWLEDGEMENTS, SCHOLARSHIPS

Year	Description of award
2023	INFOSYS Scholarship for senior students - Harish Chandra Research Institute, India
2018	National Eligibility Test (December NET) - Council of Scientific & Industrial Research, India - All India Rank-67
2015	Scholarship for Higher Education (INSPIRE-SHE) - Department of Science and Technology (DST), under the Ministry of Science and Technology, Government of India

## TRAINING OR RESEARCH ACTIVITY

### PhD in Physics (ongoing)

PhD in the Quantum Information and Computation Group at Harish Chandra Research Institute, India started in 2019, under the supervision of Prof. Aditi Sen (De).

I have largely worked in the field of continuous variable (CV) quantum information theory specifically in dense coding, teleportation, telecloning, generation of genuine multimode entanglement, quantum state transfer, and quantum illumination. I have further investigated the properties of quantum correlation measures (resource theory), and quantum channels capable of eliminating quantum advantage in information theoretic tasks.

In the CV regime, the dense coding protocol was limited to the single sender-single receiver scenario. My collaborators and I have provided a protocol for distributed dense coding between multiple senders and a single receiver. On the other hand, we have also studied the teleportation protocol with respect to the fidelity deviation, to analyze whether the average fidelity is sufficient in identifying the best possible resource state.

One of my latest works was focussed on the study of the continuous variable telecloning protocol using non-Gaussian entangled states. We proposed an operational measure of non-classicality, which is capable of determining whether the photonic network is able to support telecloning with quantum advantage. We also showed how the photon-subtracted non-Gaussian state is beneficial over its Gaussian counterpart in the telecloning protocol.

My research also includes the generation of genuine multimode entanglement using waveguide systems. I have also studied the perfect transfer of arbitrary continuous variable quantum states in waveguide lattices. In the field of quantum illumination, I analyzed the benefits of using non-Gaussian photon-added and photon-subtracted states. We defined a measure of quantum advantage, based on the difference between the Chernoff bounds obtained with the coherent state and the non-Gaussian state having equal signal strengths. In a related work, we also exhibited that a light-absorbing target would be easier to detect using Gaussian states, and also proved that in such a scenario, the TMSV state would act as the optimal probe.

Recently, we have provided an operational characterization of quantum channels with respect to their ability to successfully promote information theoretic tasks. We have analyzed non-entanglement-breaking quantum channels which can break the communication capabilities of states employed in dense coding and teleportation.

On a different front, I have studied the effect of non-Markovian noise on quantum correlations and have shown how the backflow of information can aid in preserving entanglement and discord in noisy quantum states. I have also analyzed the interplay of monogamy relations and localisable correlations in random quantum states. In the field of quantum communication, I have shown that the dense coding and teleportation protocols can be accentuated by local operations, thereby establishing that entanglement, although necessary, is not the sufficient resource driving the quantum advantage. Furthermore, to address



the destructive effect of inevitable noise, I have examined how random noise models, in the non-Markovian regime, can counteract the detrimental impact of the paradigmatic dephasing and depolarising noises, thereby leading to a higher dense coding capacity. Recently, I have also investigated the advantage furnished by higher dimensional quantum states in the secure dense coding protocol used for quantum key distribution under the influence of environmental noise.

## CONGRESSES AND SEMINARS

Date	Title	Place
December 04-10, 2023	(Poster) Generation and destruction of information-theoretic resources	Meeting on Quantum Information Processing and Applications, 2023 Harish Chandra Research Institute, India
October 12, 2023	(Talk) Communication protocols in the quantum paradigm	Condensed Matter Physics Research Centre Jadavpur University, India
May 8-June 15, 2023	(Talk) Distributed dense coding network for continuous variable systems	4th International Conference on Quantum Information and Quantum Technology Indian Institute of Science Education and Research, Kolkata, India
February 15-18, 2023	(Poster) Noise-augmented Dense-coding network and its optical implementation	Young Quantum, 2023 Harish Chandra Research Institute, India
December 31, 2022 - January 4, 2023	(Talk) Distributed dense coding network for continuous variable systems	Center for Quantum Science and Technology, Center for Security Theory Algorithmic Research The International Institute of Information Technology, Hyderabad, India
October 12-15, 2022	(Poster) Constructive Feedback of Non-Markovianity on Resources in Random Quantum States	Young Quantum, 2022 Harish Chandra Research Institute, India
March 7-11, 2022	(Poster) Quantum Illumination with imperfections	Quantum Information Processing California, USA

## PUBLICATIONS

Articles in journals
“Emergence of monogamy under static and dynamic scenarios” - <i>Rivu Gupta, Saptarshi Roy, Shiladitya Mal, Aditi Sen De</i> - Phys. Rev. A <b>108</b> , 012420 (2023)
“Quantum dense coding network using multimode squeezed states of light” - <i>Ayan Patra, Rivu Gupta, Saptarshi Roy, Tamoghna Das, Aditi Sen De</i> - Phys. Rev. A <b>106</b> , 052607 (2022)
“Significance of Fidelity Deviation in Continuous Variable Teleportation” - <i>Ayan Patra, Rivu Gupta, Saptarshi Roy, Aditi Sen De</i> - Phys. Rev. A <b>106</b> , 022433 (2022)
“Statistics of entanglement transformation with hierarchies among catalysts” - <i>Rivu Gupta, Arghya Maity, Shiladitya Mal, Aditi Sen De</i> - Phys. Rev. A <b>106</b> , 052402 (2022)
“Constructive feedback of non-Markovianity on resources in random quantum states” - <i>Rivu Gupta,</i>



*Shashank Gupta, Shiladitya Mal, Aditi Sen De* - Phys. Rev. A **105**, 012424 (2022)

“Performance of dense coding and teleportation for random states: Augmentation via preprocessing” - *Rivu Gupta, Shashank Gupta, Shiladitya Mal, Aditi Sen De* - Phys. Rev. A **103**, 032608 (2021)

“An insight into Newton’s cooling law using fractional calculus” - *Adreja Mondol, Rivu Gupta, Shantanu Das, Tapati Dutta* - J. Appl. Phys. **123**, 064901 (2018)

## Preprints

“Nonclassical resource for continuous variable telecloning with non-Gaussian advantage” - *Sudipta Das, Rivu Gupta, Himadri Shekhar Dhar, Aditi Sen De* - arXiv:2312.13586

“Dimensional advantage in secure information trading via the noisy dense coding protocol” - *Ayan Patra, Rivu Gupta, Tamoghna Das, Aditi Sen De* - arXiv:2310.20688

“Information theoretic resource-breaking channels” - *Abhishek Muhuri, Ayan Patra, Rivu Gupta, Aditi Sen De* - arXiv:2309.03108

“Perfect transfer of arbitrary continuous variable states across optical waveguide lattices - *Tonipe Anuradha, Ayan Patra, Rivu Gupta, Aditi Sen De* - arXiv:2306.13068

“Production of genuine multimode entanglement in circular waveguides with long-range interactions” - *T Anuradha, Ayan Patra, Rivu Gupta, Amit Rai, Aditi Sen De* - arXiv:2303.15137

“Superiority in dense coding through non-Markovian stochasticity” - *Abhishek Muhuri, Rivu Gupta, Srijon Ghosh, Aditi Sen De* - arXiv:2211.13057

“Multimode advantage in continuous variable quantum battery” - *Tanoy Kanti Konar, Ayan Patra, Rivu Gupta, Srijon Ghosh, Aditi Sen De* - arXiv:2210.16528

“Quantum illumination with a light absorbing target” - *Rivu Gupta, Saptarshi Roy, Tamoghna Das, Aditi Sen De* - arXiv:2111.01069

Quantum illumination with noisy probes: Conditional advantages of non-Gaussianity - *Rivu Gupta, Saptarshi Roy, Tamoghna Das, Aditi Sen De* - arXiv:2107.02774

## OTHER INFORMATION

### Tutoring Activities

August - December 2023: Teaching assistant for course on Electrodynamics - Instructor: Prof. Tathagata Ghosh, Harish Chandra Research Institute, India

August - December 2022: Teaching assistant for course on Classical Mechanics - Instructor: Prof. Aditi Sen De, Harish Chandra Research Institute, India

### Organizing activities

December 04 - 10, 2023: Member of the organizing committee - QIPA 2023 - Harish Chandra Research Institute, India

February 15 - 18, 2023: Member of the organizing committee - YouQu 2023 - Harish Chandra Research Institute, India

October 12 - 15, 2022: Member of the organizing committee - YouQu 2022 - Harish Chandra Research Institute, India

### Referee for Scientific Journals

Referee for Phys. Rev. Lett, Phys. Rev. A., Phys. Rev. Appl., J. Phys. A., Phys. Scr., Quantum Sci. Technol.

Declarations given in the present curriculum must be considered released according to art. 46 and 47 of DPR



n. 445/2000.

The present curriculum does not contain confidential and legal information according to art. 4, paragraph 1, points d) and e) of D.Lgs. 30.06.2003 n. 196.

Please note that CV WILL BE PUBLISHED on the University website and It is recommended that personal and sensitive data should not be included. This template is realized to satisfy the need of publication without personal and sensitive data.

Please DO NOT SIGN this form.

Place and date: Harish Chandra Research Institute, India - 15/02/2024