FELIPE TAHA SANT'ANA, Ph.D.

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Introduction

I am a scientist with an interdisciplinary background on theoretical physics, electrical engineering, and computer science. During my undergraduate studies, I worked on numerical techniques for astroparticle physics problems. Then, I started working on AI applied to autonomous robots until I finished my M.Sc. diploma on the field, acquiring extensive experience on machine learning techniques. Since then, during my Ph.D. in theoretical physics and in my postdoc positions, I acquired an extensive expertise on interacting quantum systems, integrable models, quantum field theories, mathematical physics, and complex systems in general. In addition, I have experience in the private sector, where I have worked on financial models and data science.

Education

- **University of São Paulo** *04/2020*
  Ph.D. in Physics São Carlos, Brazil
  - Keywords: Bose gases, optical lattice, quantum phase transition, 1d interacting systems.
  - Thesis: A study on quantum gases: bosons in optical lattices and the one-dimensional interacting Bose gas. arXiv:2006.13100; teses.usp
- **University of São Paulo** *07/2015*
  M.Sc. in Electrical Engineering São Carlos, Brazil
  - Keywords: Autonomous robots, dynamical environments, collision probability estimation.
  - Dissertation: Estimação de probabilidade de colisão com obstáculos móveis para navegação autônoma. teses.usp
- **University of São Paulo** *07/2012*
  B.Sc. in Physics São Carlos, Brazil

Experience

- **Institute of Physics, Polish Academy of Sciences [🌐]** *11/2022 - 10/2024*
  Assistant Professor Warsaw, Poland
  - NCN Polonez Bis 1 Fellow
  - Principal Investigator of the project CIQS: Correlation aspects of Interacting Quantum Systems in reduced dimensionality
- **Faculty of Physics, University of Warsaw [🌐]** *10/2020 - 09/2022*
  Assistant Professor Warsaw, Poland
  - Postdoctoral researcher within the NCN Sonata project "Dynamic correlation functions of quantum integrable models: in and beyond the equilibrium" headed by Miłosz Panfil.
- **Institut de Physique de Nice, Universitè Côte D'Azur [🌐]** *06/2018 - 05/2019*
  Ph.D. Researcher Nice, France
  - Doctoral researcher under CAPES/COFECUB bilateral collaboration.
- **São Carlos Institute of Physics, University of São Paulo [🌐]** *04/2016 - 04/2020*
  Ph.D. Researcher São Carlos, Brazil
  - Doctoral researcher within project "Bose gases in optical lattices" headed by F.E.A. dos Santos.
- **Luz Financial Solutions [🌐]** *08/2015-03/2016*
  Financial Analyst São Carlos, Brazil
  - Applied data science and financial modeling techniques to market analysis.
- **São Carlos School of Engineering [🌐]** *03/2013-07/2015*
  M.Sc. Researcher São Carlos, Brazil
  - Master student within the project "Dynamic environments in autonomous robotics" headed by Valdir Grassi Jr.
- **Warthog Robotics [🌐]** *02/2012-07/2015*
  AI Developer São Carlos, Brazil
  - Developed machine learning algorithms for autonomous robotics.

Teaching

- **Quantum Field Theory** *2023-2024*
  Institute of Physics, Polish Academy of Sciences Warsaw, Poland
  ◦ Lecture notes
- **Statistical Physics** *2021-2022*
  Faculty of Physics, University of Warsaw Warsaw, Poland
- **Quantum Mechanics** *2021-2022*
  Faculty of Physics, University of Warsaw Warsaw, Poland
- **Computational Physics** *2017*
  São Carlos Institute of Physics, University of São Paylo São Carlos, Brazil
  ◦ Repository with projects and codes

Projects

- **CIQS: Correlation aspects of Interacting Quantum Systems in reduced dimensionality** *November 2022 - October 2024*
  Keywords: Quantum Field Theories, Integrable models, 1d interacting systems [GitHub]
  ◦ Project No. 2021/43/P/ST2/02904 co-funded by the National Science Centre and the European Union Framework Programme for Research and Innovation Horizon 2020 under the Marie Skłodowska-Curie grant agreement no. 945339.

Publications

C=Conference, J=Journal, P=Preprint, S=In Submission, T=Thesis

[P.1] Felipe Taha Sant'Ana, Hui Liu, Two-spinon effects on the thermal Tonks-Girardeau gas, arXiv:2410.20929.

[J.1] Oleksandr Gamayun, Miłosz Panfil, Felipe Taha Sant'Ana, Kubo-Martin-Schwinger relation for an interacting mobile impurity, Phys. Rev. Research 5, 043265, 2023. arXiv:2308.06482

[J.2] Oleksandr Gamayun, Miłosz Panfil, Felipe Taha Sant'Ana, Mobile impurity in a one-dimensional gas at finite temperatures, Phys. Rev. A 106, 023305, 2022. arXiv:2202.07657

[J.3] Miłosz Panfil, Felipe Taha Sant'Ana, The relevant excitations for the one-body function in the Lieb-Liniger model, J. Stat. Mech. (2021) 073103. arXiv:2104.10491

[T.1] Felipe Taha Sant'Ana, A study on quantum gases: bosons in optical lattices and the one-dimensional interacting Bose gas, University of São Paulo thesis repository arXiv:2006.13100

[J.4] F. T. Sant'Ana, F. Hébert, V. Rousseau, M. Albert, P. Vignolo, Scaling properties of Tan's contact: Embedding pairs and correlation effect in the Tonks-Girardeau limit, *Phys. Rev. A* **100**, 063608 (2019). arXiv:1908.08714

[J.5] Felipe Taha Sant'Ana, Axel Pelster, and Francisco Ednilson Alves dos Santos, Finite-temperature degenerate pergutbation theory for bosons in optical lattices, *Phys. Rev. A* **100**, 043609 (2019). arXiv:1906.09661

[J.6] M. Kübler, F. T. Sant'Ana, F. E. A. dos Santos, and A. Pelster, Improving mean-field theory for bosons in optical lattices via degenerate perturbation theory, *Phys. Rev. A* **99**, 063603 (2019).arXiv:1804.08689

[C.1] Felipe Taha Sant'Ana *et al.*, Warthog Robotics Team Description Paper 2012, *Latin American Robotics Competition Symposium* (2012).

Talks and Posters

- **Correlation aspects of interacting quantum systems in one dimension** *10-14 July 2023*
  International Conference on Statistical Physics - SIGMAPHI 2023, Chania, Greece
- **Correlation aspects of interacting quantum systems in reduced dimensionality** *December 2022*
  BEC seminar, CFT PAN, Warsaw, Poland
- **The relevant excitations for the one-body function in the Lieb-Liniger model** *20/02 - 04/03, 2022*
  São Paulo School of Advanced Science on Quantum Fluids and Applications, São Carlos, Brazil
- **Understanding the important excitations in the Lieb-Liniger model** *March 2022*
  Student workshop on integrability, 2022, Hannover, Germany
- **Correlation features of interacting bosons** *October 2021*
  Condensed matter physics seminar, FUW, Warsaw, Poland
- **A study on quantum gases: bosons in optical lattices and the interacting Bose gas** *December 2020*
  Condensed matter physics seminar, FUW, Warsaw, Poland
- **Bosons in optical lattices** *30/01 - 10/02, 2017*
  School on Interaction of Light with Cold Atoms, São Paulo, Brazil

Skills

- **Programming Languages:** Fortran, C, C++, Python, HTML, Julia, R
- **Systems and softwares:** Linux, LaTeX, Mathematica, MatLab, JupyterLab, ROS
- **Specialized Areas:** Data Science, Machine Learning
- **Research Skills:** Quantum Systems, Quantum Field Theory, AMO Physics, Integrability, AI, Autonomous Robots
- **Languages:** Portuguese (Native), English (Professional Proficiency), Spanish (Intermediate), Polish (Basic)