Francisco Bento Lustosa da Costa Duarte Pereira

Bachelor's degree in Physics from the Federal University of Ceará, where he began his research in theoretical physics during his scientific initiation. Presented a thesis on the Randall-Sundrum model and the effects of a fifth dimension on gravitation. He obtained his Master's degree in Physics from the Federal Fluminense University and defended a thesis on the thermodynamics of a black hole in a modified gravity theory. He began his PhD at the State University of Rio de Janeiro studying preheating models in the primordial universe, continuing with the theme of investigating extreme situations involving quantum fields in curved spacetime. Before the end of the first year of his PhD, he changed the topic of his research upon being introduced to the de Broglie-Bohm theory and the possibility of quantum bounces that would prevent the singularity in the Big Bang scenario. Since then, his research has focused on the Quantum Equilibrium Hypothesis (QEH) and the possibility of detecting distinctions between the de Broglie-Bohm theory and the usual quantum theory in cosmological and gravitational scenarios. He spent a sandwich PhD period at Clemson University (SC-USA) under the supervision of Antony Valentini, the original proponent of HEQ. In this research, numerical simulations for quantum systems were developed, which have applications not only in the study of HEQ but also in various other applications known from de Broglie-Bohm theory. After completing his doctorate, he spent a period as a postdoctoral researcher at the Brazilian Center for Physics Research (CBPF), working with Nelson Pinto-Neto in the Cosmology, Astrophysics, and Fundamental Interactions group. In addition to the research at HEQ, he developed two lines of work exploring applications of de Broglie-Bohm theory in cosmological and gravitational scenarios. Currently, his research is focused on bounce scenarios and laboratory tests of quantum gravity. In both scenarios, the de Broglie-Bohm theory offers unique opportunities to test the foundations of quantum mechanics and search for signatures of quantum gravity. In the research on quantum gravitation in the laboratory, there was a deep dive into methods of effective quantum field theories, open quantum systems, and the phenomenology of entanglement and decoherence involved in tests of gravitation and the foundations of quantum mechanics. During the postdoctoral period, he participated as a volunteer mentor in the Scientific Vocational Program of CBPF (PROVOC - CBPF) for four years. In the last three years, your students have been awarded as one of the top three works at the Scientific Vocational Seminar. Has experience with Quantum Field Theory in Curved Spacetime, Topological Defects, Black Hole Thermodynamics, Modified Gravity, Cosmology, Foundations of Quantum Mechanics, Foundations of Statistical Mechanics, Quantum Cosmology, Quantum Gravity, Open Quantum Systems, Decoherence, and Entanglement.

(Text informed by the author)

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Personal Information

Name Francisco Bento Lustosa da Costa Duarte Pereira

Bibliographic Citation LUSTOSA, F. B.;LUSTOSA, FRANCISCO BENTO

Formal Education/Degree

2014 - 2019 Ph.D. in Programa de Pós-graduação em Física .
Universidade do Estado do Rio de Janeiro, UERJ, Brasil.
with collaborative period in Clemson University(Advisor:Antony Valentiny). *Year of degree:* 2019.
Advisor: Santiago Esteban Perez Bergliaffa.
Grantee of: Coordenação de Aperfeiçoamento de Pessoal de Nível Superior ,CAPES ,Brasil .
Keywords: Mecânica Quântica; Teoria da Onda Piloto; Teoria de de Broglie-Bohm; Equilíbrio Quântico; Cosmologia.
Major Area: Exact and Earth Sciences.
Major Area: Exact and Earth Sciences / *Área:* Physics / *Subarea:* Gravitação e Cosmologia.
Activities Sectors: Scientific research and development.

2012 - 2014 Master´s in Física .
Universidade Federal Fluminense, UFF, Brasil. *Year of degree:* 2014.
Advisor: Maria Emilia Xavier Guimarães.
Grantee of: Coordenação de Aperfeiçoamento de Pessoal de Nível Superior ,CAPES ,Brasil .
Keywords: Buracos Negros; Gravitação; Termodinâmica; Teorias f(R); Defeitos Topológicos.
Major Area: Exact and Earth Sciences.

2009 - 2011 Graduation in Bacharelado - Física .
Universidade Federal do Ceará, UFC, Brasil.
Advisor: Carlos Alberto Santos Almeida.
Grantee of: Conselho Nacional de Desenvolvimento Científico e Tecnológico ,CNPq ,Brasil .

2007 incomplete Graduation discontinued in 2008 in Bacharelado - Física .
Universidade Federal do Rio de Janeiro, UFRJ, Brasil.
Year of interruption: 2008

2004 - 2006 Secondary Education .
Centro Educacional Anísio Teixeira, CEAT, Brasil.

1996 - 2003 Elementary Education .
Centro Educacional Anísio Teixeira, CEAT, Brasil.

Postdoctorate

2019 - 2024 Postdoctorate.
Centro Brasileiro de Pesquisas Físicas, CBPF, Brasil.
Grantee of: Conselho Nacional de Desenvolvimento Científico e Tecnológico ,CNPq ,Brasil .
Major Area: Exact and Earth Sciences.
Major Area: Exact and Earth Sciences / *Área:* Physics / *Subarea:* Mecânica Quântica.

Complementary Education

Professional Experience

Centro Brasileiro de Pesquisas Físicas, CBPF, Brasil.

Contract

2024 - Present Type of contract: Colaborator, Functional Placement:

Contract

2019 - 2024 Type of contract: Bolsista, Functional Placement:

Other Information Fellow of the Institutional Training Programme of the Ministry of Science and Technology. Also listed as post-doctoral period.

Contract

2007 - 2007 Type of contract: Bolsista Voluntário, Functional Placement: , Credit Hours: 15

Activities

07/2019 - 07/2024 Research and Development , Coordenação de Cosmologia, Astrofísica e Altas Energias (COSMO), .

2019 - 2024 Project participation activities, Coordenação de Cosmologia, Astrofísica e Altas Energias (COSMO), .

Research Projects
Aplicações da Teoria de de Broglie-Bohm: Transferência de não-equilíbrio quântico, perturbações cosmológicas fora do equilíbrio e a hipótese geométrica.

Research Projects

2019 - 2024 Aplicações da Teoria de de Broglie-Bohm: Transferência de não-equilíbrio quântico, perturbações cosmológicas fora do equilíbrio e a hipótese geométrica.

Description: The project consists of three lines of research based on de Broglie-Bohm's Theory, which describes quantum mechanics through continuous trajectories and allows a dynamical emergence to quantum probability through a quantum relaxation process. The first line consists of an extension of the author's doctoral thesis, studying the effects of mass and frequency variation of two quantum oscillators coupled by a time-dependent potential in the quantum relaxation process. We will also study the possibility of transferring non-equilibrium between different coupled oscillators. The second line of research consists of the study of the quantum-classical transition of perturbations that originate from states initially out of vacuum and/or out of equilibrium. Within the context of a theory with a clear classical limit it is interesting to observe the effects of the variation of the initial states considered in comparison with the CMB observations and a precise numerical estimate of the spectrum of perturbations generated by non-equilibrium or out-of-vacuum states to verify whether this can favour or eliminate these models. Finally, we intend to study the possible applications and consequences of considering the geometric hypothesis that de Broglie-Bohm's quantum theory may naturally arise from the consideration that physical laws can be represented by a mapping of a space of configurations into a two-dimensional space that describes the laws of evolution and probability..
Situation: Concluded; *Nature:* Research.
Participants: Francisco Bento Lustosa da Costa Duarte Pereira - Participant / Nelson Pinto-Neto - Co-ordinator.
Sponsor(es): Conselho Nacional de Desenvolvimento Científico e Tecnológico - Scholarship.
S, T & A Production Rate: 5.

Areas of Expertise

1. *Major Area:* Exact and Earth Sciences / *Area:* Physics / *Subarea:* Fundamentos de Mecânica Quântica.

Languages

English Comprehends Well, Speaks Well, Reads Well, Writes Well.

Spanish Comprehends Well, Speaks Reasonably, Reads Reasonably, Writes Little.

Awards and Titles

2024 Orientador de um dos tres melhores trabalhos no XXVI Seminário de Vocação Científica, PROVOC - CBPF.

2023 Orientador de um dos tres melhores trabalhos no XXV Seminário de Vocação Científica, PROVOC - CBPF.

2022 Orientador de um dos tres melhores trabalhos no XXIV Seminário de Vocação Científica, PROVOC - CBPF.

Scientific, Technological, Artistic and Cultural Production

Bibliographical Production

Citations

SCOPUS
Total of articles:2
Total of citations:5
Lustosa, Francisco Bento Date: 01/08/2024

Outras
Total of articles:5
Total of citations:20
Lustosa F B Date: 01/08/2024

Articles in Scientific Journals

1. doi LUSTOSA, F. B. ; N. Pinto-Neto ; Antony Valentini . Evolution of quantum non-equilibrium for coupled harmonic oscillators. PROCEEDINGS OF THE ROYAL SOCIETY A-MATHEMATICAL PHYSICAL AND ENGINEERING SCIENCES JCR, v. 479, p. 20220411, 2023.

2. doi LUSTOSA, FRANCISCO BENTO ; COLIN, SAMUEL ; PEREZ BERGLIAFFA, SANTIAGO E. . Quantum relaxation in a system of harmonic oscillators with time-dependent coupling. PROCEEDINGS OF THE ROYAL SOCIETY A-MATHEMATICAL PHYSICAL AND ENGINEERING SCIENCES JCR, v. 477, p. 0200606, 2021.

3. doi LUSTOSA, FRANCISCO BENTO ; GUIMARÃES, MARIA EMILIA XAVIER ; FERREIRA, CRISTINE NUNES ; LOPES NETO, JOAQUIM ; HELAYËL-NETO, JOSÉ ABDALLA . On the Thermodynamical Black Hole Stability in the Space-Time of a Global Monopole in f</i>(R</i>)-Gravity. Journal of High Energy Physics, Gravitation and Cosmology, v. 05, p. 587-611, 2019.

Presentations of Work

1. CARAMES, T. R. P. ; LUSTOSA, FRANCISCO BENTO ; Guimarães, M. E. X. . Thermodynamical Analysis of the Black Hole with a Global Monopole in a f(R) Theory. 2013. (Presentation/Seminar).

2. LUSTOSA, FRANCISCO BENTO . A Era dos Modelos Padrões: das partículas à cosmologia. 2023. (Presentation/Seminar).

3. LUSTOSA, FRANCISCO BENTO . Wave Function and Probabilities in Quantum Cosmology. 2022. (Presentation/Seminar).

4. LUSTOSA, FRANCISCO BENTO . Aplicações da Teoria de de Broglie-Bohm: Transferência de não-equilíbrio quântico, perturbações cosmológicas fora do equilíbrio e a hipótese geométrica. 2022. (Presentation/Communication).

5. LUSTOSA, FRANCISCO BENTO . Tabletop quantum gravity as a test of modifications of standard quantum theory. 2024. (Presentation/Communication).

Technical Production

Not Patented or Registered Softwares

1. COLIN, SAMUEL ; LUSTOSA, FRANCISCO BENTO . . 2022.

Events

Participation in events

1. .Phase space analysis of possible matter bounce models in the presence of scalar field and a matter fluid. 2024. (Participation In Events/ Congresses).

2. .Pilot-waves for quantum fields of delocalized sources. 2024. (Participation In Events/ Congresses).

3. Minicourse on perturbative and nonperturbative treatment of quantum gravity problems. Tabletop quantum gravity as a test of modifications of standard quantum theory. 2024. (Participation In Events/ Seminary).

4. Evolution of quantum non-equilibrium for coupled harmonic oscillators. 2023. (Participation In Events/ Congresses).

5. Escola de Cosmologia e Gravitação. Evolution of quantum non-equilibrium for coupled harmonic oscillators. 2023. (Participation In Events/ Seminary).

6. .Evolution of quantum non-equilibrium for coupled harmonic oscillators. 2023. (Participation In Events/ Workshops).

7. .Evolution of quantum non-equilibrium for coupled harmonic oscillators. 2022. (Participation In Events/ Congresses).

8. .Wave Function and Probabilities in Quantum Cosmology. 2022. (Participation In Events/ Congresses).

9. .Evolution of quantum non-equilibrium for coupled harmonic oscillators. 2022. (Participation In Events/ Congresses).

10. JORNADA PCI CBPF 2022.Applications of de Broglie-Bohm's Theory: Transfer of quantum non-equilibrium, cosmological perturbations out of equilibrium and the geometric hypothesis.. 2022. (Participation In Events/Other).

11. Third Argentinian-Brazilian Meeting on Gravitation, Astrophysics, and Cosmology. 2016. (Participation In Events/ Meetings).

12. . 2015. (Participation In Events/ Congresses).

13. Challenges in Modern Cosmology: Dark Matter and Dark Energy. Thermodynamical Analysis of the Black Hole with a Global Monopole in a f(R) Theory. 2014. (Participation In Events/ Seminary).

14. . 2014. (Participation In Events/ Workshops).

15. Escola de Verão UFPE. 2014. (Participation In Events/Other).

16. Thermodynamics of a Black Hole with Global a Monopole in f(R) Theories. 2013. (Participation In Events/ Congresses).

17. .Thermodynamical Analysis of the Black Hole with a Global Monopole in a f(R) Theory. 2013. (Participation In Events/ Workshops).

18. .Domain Walls Constructed with a Scalar Field. 2011. (Participation In Events/ Congresses).

19. .Continuosly Deformable Topological Structure. 2010. (Participation In Events/ Congresses).

Organization of Events

1. N. Pinto-Neto ; LUSTOSA, FRANCISCO BENTO . XIX Brazilian School of Cosmology and Gravitation (BSCG). 2024. (Event Production/Congress).

Academic Advisory

Academic Advisory - concluded

Scientific Initiation

1. Luíza Monteiro Ferreira e Paula Juliana Borges Frickes. Effects of De Broglie-Bohm Quantization on Black Hole Shadows. 2024. Scientific Initiation - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Advisor: Francisco Bento Lustosa da Costa Duarte Pereira.

2. Luiza Monteiro Ferreira e Paula Juliana Borges Frickes Ricar. 2022. Scientific Initiation - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Advisor: Francisco Bento Lustosa da Costa Duarte Pereira.

3. Danillo Valentino e Giovanna Barbosa. Primordial Black Holes: their relation with Dark Matter and the Planet 9. 2021. Scientific Initiation - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Advisor: Francisco Bento Lustosa da Costa Duarte Pereira.

4. Millena Avendano. The Science of Gravitational Waves. 2020. Scientific Initiation - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. Advisor: Francisco Bento Lustosa da Costa Duarte Pereira.