

Rodrigo Turcati

Curriculum Vitae

Present Position

2022–present **Postdoctoral Researcher**, *Astrophysics, Cosmology and Fundamental Interactions*, CENTRO BRASILEIRO DE PESQUISAS FÍSICAS, Rio de Janeiro, Brazil

Career

2016–2021 **Postdoctoral Researcher**, *Mathematical Physics and Quantum Field Theory Group*, UNIVERSIDADE FEDERAL DE SANTA CATARINA, Florianópolis, Brazil

2014–2016 **Postdoctoral Researcher**, *Astroparticle Group*, SCUOLA INTERNAZIONALE SUPERIORE DI STUDI AVANZATI, Trieste, Italy

2014–2014 **Assistant Professor**, CENTRO FEDERAL DE EDUCAÇÃO TECNOLÓGICA CELSO SUCKOW DA FONSECA, Petrópolis, Brazil

2013–2014 **Postdoctoral Researcher**, UNIVERSIDADE FEDERAL DO ESPÍRITO SANTO, Vitória, Brazil

Education

2009–2013 **PhD in Physics**, CENTRO BRASILEIRO DE PESQUISAS FÍSICAS, Rio de Janeiro, Brazil

2006–2008 **Master in Physics**, CENTRO BRASILEIRO DE PESQUISAS FÍSICAS, Rio de Janeiro, Brazil

2001–2005 **Bachelor of Science in Physics**, UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL, Porto Alegre, Brazil

PhD Thesis

- Title *Two investigations in quantum field theory*
- Supervisor Prof. Dr. Antônio José Accioly
- Description Two studies in the framework of quantum field theory are carried out. The first is devoted to Higher-derivative Theories, which are efficient and well-known tools for dealing with the ultraviolet divergences that usually plague both electromagnetic and gravitational models. In this vein, some aspects concerning the tree-level unitarity of Lee-Wick Electrodynamics as well as Higher-Order Gravity in Arbitrary Dimensions, are discussed. The canonical quantization of Lee-Wick Electrodynamics is contemplated as well. The second study focus on the Photon Mass: semiclassical and quantum bounds on the mass of this particle — based respectively on recent experimental measurements of the gravitational bending of radio waves by the Sun and the anomalous magnetic moment of the electron — are estimated.

Masters Thesis

- Title *Electromagnetic aspects of neutral particles in relativistic quantum mechanics*
- Supervisor Prof. Dr. José Abdalla Helayël-Neto
- Description The goal of this thesis is to discuss viable scenarios in which we can check the possibility that neutral genuinely elementary particles acquire a magnetic dipole moment at quantum-mechanical level and rather than as a loop effect in Quantum Field Theory. We actually have in mind to evaluate the very role of the spin for the magnetic properties of the particles, trying to disconnect spin from electric charge. For that, we adopt the Dirac equation for the description of massive charged, neutral or, eventually, self-conjugated (Majorana-like) fermions. We propose a systematic study of non-minimal electromagnetic couplings and their consequences, in the non-relativistic regime, on the magnetic dipole moment generation for fermionic particles. The discussion sets out also in situations where Lorentz-symmetry breaking takes place. The investigation is also pursued for massive neutral vector bosons and we contemplate situations in which a non-trivial magnetic moment appears already at the tree-approximation, despite the absence of an electric charge for the particles under consideration.

Awards and Honours

- 2013 Honorable mention by the essay entitled **Solving the riddle of the incompatibility between renormalizability and unitarity in N -dimensional Einstein gravity enlarged by curvature-squared terms**, Gravity Research Foundation

Membership

- 2014–2016 INFN — Istituto Nazionale di Fisica Nucleare, home.infn.it
- 2009–present SBF — Sociedade Brasileira de Física, www.sbfisica.org.br

Referee Experience

- 2024–present Journal of Statistical Mechanics - Theory and Experiment
- 2024–present Nuclear Physics B
- 2019–present Physical Review Research
- 2018–present Journal of Physics A: Mathematical and Theoretical
- 2017–present Classical and Quantum Gravity (Print)
- 2016–present New Journal of Physics
- 2016–present Physical Review Letters
- 2015–present Physical Review D, *covering particles, fields, gravitation, and cosmology*

Mentoring

- 2022–2025 Co-advised a Phd student in features related to Magnetars at CBPF
- 2022–2023 Advisored a high-school student in the research project named *Introduction to Stellar Evolution*
- 2022–2023 Advisored two high-school students in the research project named *Astrobiology and Exoplanets*
- 2014–2016 Helped to mentor two PhD students in topics related to thermodynamics of black holes at SISSA
- 2014–2014 Advisored a high-school student in the research project named *Atomic nucleus and nuclear reactions*

Teaching Experience

- 2014–2014 Vibrations and Waves
- 2014–2014 Introduction to Classical Mechanics
- 2018–2018 Wave Phenomena

Scientific Outreach

I have been in scientific outreach during all my career, giving talks in schools, lecturing basic physics to community preparatory schools and participating in events of science and technology camps.

Languages

- Portuguese Mother tongue
- English Fluent
- Italian Basic

Publications

- 2024 **R. Turcati, I. Soares and S. B. Duarte**, *Quantum gravity phenomenology and the blackbody radiation*, Classical and Quantum Gravity, **41**, 235008

- 2024 **I. Soares, R. Turcati and S. B. Duarte**, *Nonlinear wave propagation in large extra spatial dimensions and the blackbody thermal laws*, Journal of Physics A: Mathematical and Theoretical, **57**, 355401
- 2023 **I. Soares, R. Turcati and S. B. Duarte**, *Thermodynamics of blackbody radiation in nonlinear electrodynamics*, Physical Review D, **108**, 043020
- 2022 **A. Mendoza-Coto, R. Turcati, V. Zampronio, R. Díaz-Méndez, T. Macri and F. Cinti**, *Exploring quantum quasicrystal patterns: A variational study*, Physical Review B, **105**, 134521
- 2020 **R. Turcati, C. A. B. Quintero, J. A. Helayël-Neto and E. Arias**, *Spin-Polarized Current, Spin-Transfer Torque, and Spin Hall Effect in Presence of an Electromagnetic NonMinimal Coupling*, Annalen der Physik, **532**, 1900357
- 2018 **R. Turcati and E. Scatena**, *Magnetic monopoles in Lorentz-violating electrodynamics*, Physics Letter B, **786**, 332-336
- 2016 **Ramit Dey, Stefano Liberati and R. Turcati**, *AdS and dS black hole solutions in analogue gravity: The relativistic and nonrelativistic cases*, Phys. Rev. D, **94** 104068
- 2016 **B. Cropp, S. Liberati and R. Turcati**, *Analogue Black Holes in Relativistic BECs: Mimicking Killing and Universal Horizons*, Phys. Rev. D, **94** 063003
- 2016 **R. Turcati and M. J. Neves**, *Complex-mass shell renormalization of the higher-derivative electrodynamics*, European Physical Journal. C, Particles and Fields (Print), v. 76, p. 456
- 2016 **B. Cropp, S. Liberati and R. Turcati**, *Vorticity in analogue gravity*, Class. Quantum Grav., **33** 125009
- 2014 **E. Scatena and R. Turcati**, *Unitarity and nonrelativistic potential energy in a higher-order Lorentz symmetry breaking electromagnetic model*, Phys. Rev. D, **90** 127703
- 2014 **R. Turcati and M. J. Neves**, *Probing features of the Lee-Wick quantum electrodynamics*, Adv. High Energy Phys., **2014** 153953
- 2013 **A. Accioly, J. Helayel-Neto, E. Scatena and R. Turcati**, *Solving the riddle of the incompatibility between renormalizability and unitarity in N -dimensional Einstein gravity enlarged by curvature-squared terms*, Int. J. Mod. Phys. D, **22** 1342015
- 2011 **A. Accioly, P. Gaete, J. Helayel-Neto, E. Scatena and R. Turcati**, *Investigations in the Lee-Wick electrodynamics*, Mod. Phys. Lett. A, **26** 1985
- 2011 **J. R. Ducati, E. M. Penteado and R. Turcati**, *The mass ratio and initial mass functions in spectroscopic binaries*, Astronomy & Astrophysics, **525** A26
- 2011 **A. Accioly, J. Helayël-Neto, J. Morais, E. Scatena, and R. Turcati**, *Investigations in massive 3D gravity*, Phys. Rev. D, **83** 104005
- 2011 **A. Accioly, J. Helayël-Neto, E. Scatena, J. Morais, R. Turcati, and B. Pereira-Dias**, *Some interesting features of new massive gravity*, Class. Quantum Grav., **28** 225008
- 2011 **A. Accioly, P. Gaete, J. Helayël-Neto, E. Scatena, and R. Turcati**, *Investigations in the Lee-Wick electrodynamics*, Mod. Phys. Lett. A, **26** 1985

- 2010 **A. Accioly, J. Helayël-Neto, R. Turcati, J. Morais and E. Scatena**, *Gravitational and quantum bounds on the photon mass*, *Class. Quantum Grav.*, **27** 205010
- 2008 **H. J. Mosquera Cuesta, R. Turcati, C. Furlanetto, H. G. Khachatryan, S. Mirzoyan, G. Yegorian**, *Hubble diagram of gamma-ray bursts calibrated with Gurzadyan-Xue Cosmology*, *Astronomy & Astrophysics*, **487** 47-54
- 2006 **H. J. Mosquera Cuesta, C. A. Bonilla Quintero, M. H. Dumet, C. Furlanetto, J. Morais and R. Turcati**, *Hubble diagram of gamma-ray bursts and prevalence of energy conditions in Friedmann-Lemaître-Robertson-Walker Cosmology*, *astro-ph/0609262*

References

Collaborator *Prof. Dr. Stefano Liberati*

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