



Vítor Sudbrack | Curriculum Vitae

Master student at [Institute of Theoretical Physics \(IFT\)](#)
State University of São Paulo (UNESP) – São Paulo - SP, Brazil

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Vítor de Oliveira Sudbrack, born on Feb 25th 1996.
Brazilian citizen and resident, male.
Physicist - Bachelor of Physics.

Research and projects

- **Analysis of data of COVID-19 in Brazil** covid19br.github.io/
Observatório COVID-19 BR March 2020 – On going

I was one out of 40+ transdisciplinary members of the Observatório COVID-19 BR (Observatory COVID-19 BR), a project meant to make real-time analysis of COVID-19 data and micro-data to inform population and guide authorities in Brazil. We established partnerships with the Secretaries of Health of São Paulo State, 9 northeast Brazilian states (*Consórcio Nordeste*) and a few municipalities. We applied statistical techniques, such as *nowcasting*, to data; we simulated scenarios with mathematical modellings; we calculated epidemic indices, such as Effective Reproductive number (R_{eff}); we projected number of cases, deaths and hospital beds needed in the short-term, among many other analysis. We realised few technical notes about state's reestablishment plannings and took part in several interviews and media agenda. This project is fully volunteering and there is no financial interest.

Media: [Exponential growth and epidemic curve: understand the main concepts to explain the pandemic outbreak of coronavirus](#). 31/03/2020 - Portal G1; [Tool allows real-time monitoring of the progress of COVID-19 in São Paulo city](#). 20/04/2020 - FAPESP.
- **Spatial patterns of population distribution in highly fragmented landscapes** **Palma de Mallorca, Spain**
Institute for Cross-Disciplinary Physics and Complex Systems (IFISC) at UiB University August 2020 – January 2021

During this 6-month Sandwich Research Program, we explore the scales of movements of a model using functional landscapes, i.e., landscapes defined on population distribution at the stationary regime through a discretizing method. We can measure and correlate fragmentation metrics in different refinement scales in order to obtain which scales of habitat landscape best reflect the functional landscape. Also, it makes possible to define networks of patches, weighing correctly the connections between patches based on the physical landscape. Then, we can use clustering algorithms to reduce a network of habitat patches to a network of functional patches. The usage of network theory applied to landscape ecology opens interesting questions and possibilities, e.g., new functional fragmentation metrics and applications such as plague control. These results will be incorporated in the Master thesis, further expanding and improving ours results and conclusions. This work is done under [Cristóbal Lopez](#) supervision.

This project is fully financially supported by São Paulo State Research Funding Agency (Fundação de Amparo à Pesquisa do Estado de São Paulo) - FAPESP, under grant number 2019/25260-1 (as an extension of grant 2018/23984-0).

- Population dynamics in highly fragmented landscapes** **São Paulo, SP**
Institute of Theoretical Physics (IFT) at UNESP University *March 2019 – March 2021*
 Human action fragments the natural habitat of several species everywhere. Therefore, it is important to study how the populations and ecosystems respond to these kinds of changes in landscapes, so-called landscape ecology. We study, mostly with numerical techniques, reaction and diffusion equations in highly fragmented domains, both single population as well as competing symbiosis regimes, looking for patterns in the responses of ecological variables to the geometry of landscape. We aim to discuss two aspects: a) How fragmentation can interfere in the steady total population and in the characteristics of its spacial distribution; b) In what regimes of fragmentation non-interactive (or weakly interacting) metapopulations form. This is being done under professor [Roberto A. Kraenkel](#) supervision (robertokraenkel@gmail.com) and in partnership with professor [Renato Mendes Coutinho](#) (renato.coutinho@ufabc.edu.br).
 This project is fully financially supported by São Paulo State Research Funding Agency (Fundação de Amparo à Pesquisa do Estado de São Paulo) - FAPESP, under grant number 2018/23984-0.

Previous projects.....

- Kelvin-Helmholtz Instability numerical simulation** **Rio de Janeiro, RJ**
Fluid Laboratory at National Institute for Pure and Applied Mathematics (IMPA) *August 2017 – July 2018*
 Through spectral methods in MATLAB with state-of-the-art numerical resolution, I simulated turbulent scenarios in incompressible 2D fluids, solving numerically Navier-Stokes equation in a hyperviscous vanishing limit and comparing energy/enstrophy spectra and fluxes with data from direct numerical simulations (DNS) with Point Vortex method and Vortex-in-Cell method for inviscous (ideal) fluids. This work supported theoretical studies in Kelvin-Helmholtz Instability in viscous vanishing limit through shell models at FluidLab, IMPA.
 It was done under professor [Alexei Mailybaev](#) supervision (alexei@impa.br) and in collaboration with postdoc Simon Thalabard (simon.thalabard@impa.br).
Published results: Results are written in my Final Report at UFRGS, Porto Alegre - RS, accessible [here](#) in Portuguese.
- Protein-protein interaction network model analysis** **Porto Alegre, RS**
Laboratory for Cellular and Biological Physics at UFRGS *August 2016 – July 2017*
 I simulated numerically the growth of networks based on the duplication and divergence model which reproduces key features observed in some biological networks, as protein interactions. Averages of random initializations were compared to new analytic master-equation derived by us that accounts for all possible scenarios that may probabilistically happen within the model. The importance of this work is predicting the future behaviour of real systems described by the studied networks and understanding and quantifying the parameters related to this modeling of biological mutation.
 This work is a collaboration with professors [Leonardo G. Brunnet](#) (leon@if.ufrgs.br) and Rita M.C. de Almeida (rita@if.ufrgs.br) at LabCel group, Physics Institute, UFRGS.
Published results: Vítor Sudbrack, Leonardo G. Brunnet, Rita M.C.de Almeida, Ricardo M. Ferreira & Daniel Gamermann. [Master equation for the degree distribution of a Duplication and Divergence network](#). Physica A: Statistical Mechanics and its Applications, v. 509, 2018.

Teaching and academic activities

- Tutor for 'Computational methods in Physics' disciplines** **Porto Alegre, RS**
Institute of Physics at UFRGS *2016, 2018*
- Volunteer Physics Teacher** **Porto Alegre, RS**
PEAC: Popular University Exam Preparatory course, UFRGS *2016 – 2017*

Education

- Master degree in Physics** **São Paulo, SP**
Institute of Theoretical Physics (IFT) at UNESP University *2019 – 2021*
 Institute of Theoretical Physics (IFT) is a very traditional research institution in Brazil with top-graded Master and Doctorate courses, focused on theoretical physics research. It also hosts the ICTP South American Institute for Fundamental Research (ICTP-SAIFR), that promotes many scientific events and research visiting positions every year. Here, I take Master course in Theoretical Physics, studying Population dynamics in highly fragmented landscapes under the supervision of professor [Roberto A. Kraenkel](#) (robertokraenkel@gmail.com). This project is funded by FAPESP, under grant number 2018/23984-0.

- **Bachelor degree in Physics (Computational Physics)** **Porto Alegre, RS**
2014 – 2018
Institute of Physics at Federal University of Rio Grande do Sul (UFRGS)
 Bachelor degree in Physics (*emphasis on Computational Physics*). Along 10 semesters, I took advanced courses addressed to Mathematical-Physics (such as Dynamical Systems, Stochastic Calculus, PDEs) and Computer Simulation (Numerical methods, Molecular Dynamics and Monte Carlo) as well as the regular courses in Physics (Classical Mechanics, Quantum Mechanics, Thermodynamics, Electromagnetic theory,...).

Events, schools and congresses.....

- **Introduction to Vibration and Wave Theory** **Rio de Janeiro, RJ**
Jan, Feb – 2017
National Institute for Pure and Applied Mathematics (IMPA)
 Summer Mathematical School at IMPA with Professor Alexei Mailybaev.
- **Introduction to Linear Algebra** **Rio de Janeiro, RS**
Jan, Feb – 2018
National Institute for Pure and Applied Mathematics (IMPA)
 Summer Mathematical School at IMPA with Professor Jorge Zubelli.
- **II and III Journeys into Theoretical Physics** **São Paulo, SP**
Jul - 2017, 2018
Institute of Theoretical Physics (IFT) - UNESP
- **Workshop on Mathem. and Comput. Problems of Incompressible Fluid Dynamics** **Rio de Janeiro, RJ**
Aug - 2018
National Institute for Pure and Applied Mathematics (IMPA)
- **XXXI Brazilian Mathematicians Congress** **Rio de Janeiro, RJ**
Aug - 2017
National Institute for Pure and Applied Mathematics (IMPA)
- **XLI Paulo Leal Ferreira Congress** **São Paulo, SP**
Oct - 2018
Theoretical Physics Institute (IFT) - UNESP
- **VIII Southern-Summer School on Mathematical Biology** **São Paulo, SP**
Jan - 2019
Theoretical Physics Institute (IFT) - UNESP
- **Joint ICTP-SAIFR/ICTP-Trieste School on Mathematical Models of Evolution** **São Paulo, SP**
Jan - 2019
Theoretical Physics Institute (IFT) - UNESP
- **Advanced School on Experimental Physics** **Rio de Janeiro, RJ**
Fev - 2019
Brazilian Center for Research in Physics, CBPF
- **Preparatory School for StatPhys 2019** **São Paulo, SP**
Jul - 2019
Theoretical Physics Institute (IFT) - UNESP
- **Conference on Perspectives in Nonlinear Dynamics** **São Paulo, SP**
Jul - 2019
Theoretical Physics Institute (IFT) - UNESP
- **São Paulo School in Advanced sciences on Nonlinear Dynamics** **São Paulo, SP**
Ago - 2019
Escola Politecnica - USP
- **XLII Paulo Leal Ferreira Congress** **São Paulo, SP**
Out - 2019
Theoretical Physics Institute (IFT) - UNESP
 Member of the organizing committee of the biggest Congress of Students of Physics in Brazil.
- **2nd Latin American School on Parallel Programming for High Performance Computing** **São Paulo, SP**
Dez - 2019
Theoretical Physics Institute (IFT) - UNESP
- **IX Southern-Summer School on Mathematical Biology** **São Paulo, SP**
Jan - 2020
Theoretical Physics Institute (IFT) - UNESP
 Participation as Tutor.
- **School on Community Ecology: from patterns to principle** **São Paulo, SP**
Jan - 2020
Theoretical Physics Institute (IFT) - UNESP
 Presented the talk "Population dynamics in highly fragmented landscapes".
- **Workshop on Modelling of Infectious Diseases Dynamics** **São Paulo, SP**
Mar - 2020
Theoretical Physics Institute (IFT) - UNESP
- **eSMB 2020** **Online**
Ago - 2020
Society for Mathematical Biology
 Presented the poster "Population dynamics in highly fragmented landscapes".

Lectures and presentations.....

- **Coloquinhos seminar program** **São Paulo, SP**
Theoretical Physics Institute (IFT) - UNESP *March 5th - 2020*
Presented the 1h00 seminar “*Modeling Populations: A tour on examples*”.
- **EcoEncontros seminar program** **Online**
Department of Ecology - University of São Paulo, USP *April 15th - 2020*
Presented the 1h30 seminar “*FragWars: insights from numerical simulations on the effects of fragmentation per se*”.

Rewards and prizes.....

- **SMB Poster Prize at eSMB 2020** **Online**
Society for Mathematical Biology *Ago - 2020*
SMB Poster Prize for “*Population dynamics in highly fragmented landscapes*”, category Graduate Student in the subgroup of Population dynamics, Ecology and Evolution.
- **Academic honors in Bachelor degree in Physics (Computational Physics)** **Porto Alegre, RS**
Institute of Physics at Federal University of Rio Grande do Sul (UFRGS) *Jan, 2019*
I was honored with *Best student in 2018/2 Class award* and laureated *Academics Honors*, concluding my Bachelor Degree with a final average grade of 9.63/10.

Technical and Personal skills

Languages.....

- **Portuguese** Mother language.
- **English** Fluent in writing, conversation and reading skills. 2018 TOEFL ITP: 657 Final score - CEFR: C1.
- **French** Intermediate (B1) in writing, conversation and reading skills.
- **Spanish** Beginner (A2) in writing, conversation and reading skills.

Programming Languages.....

- **Python** Advanced. Most experienced language. Experience in developing packages (TBP).
- **Linux and Bash** Intermediate.
- **C** Intermediate.
- **HTML** Beginner. Specially using *Jekyll* to *Github* pages.
- **R** Beginner.

Scientific Softwares and Platforms.....

- **Latex** Advanced. Experience in writing everyday documents as well as thesis and posters.
- **Matlab** Intermediate. Specially for spectral and pseudospectral methods.
- **Gnuplot** Intermediate.
- **Github** Intermediate.

Contacts for References

Roberto Andre Kraenkel roberto.kraenkel@unesp.br
Full professor at the Institute for Theoretical Physics at Unesp
My formal adviser during my Master degree.

Renato Mendes Coutinho renato.coutinho@ufabc.edu.br
Adjoint professor at the Center for Math, Computer sci. and Cognition at UFABC
My formal co-adviser during my Master degree.

Paulo Inácio de Knegt López de Prado prado@ib.usp.br
Full professor at the Institute of Biology at USP
My informal adviser for matters of ecology during my Master degree, coworker in the Observatório COVID-19 BR.

Rita Maria Cunha de Almeida rita@if.ufrgs.br
Full professor at the Institute of Physics at UFRGS
Head of Laboratory for Cellular and Biological Physics at UFRGS where I worked during my undergraduate years.