Alfredo González-Espinoza

PhD in Science

Personal information

Date of birth	February 10th 1987
Age	36
Nationality	Mexican
Contact	spiralizing@gmail.com

Professional experience

2019–2022 Postdoctoral Researcher at the department of Biology, University of Pennsylvania, USA.

2018–2019 Research Stay at the computational genomics group in the National Institute of Genomic Medicine, CDMX, México

Education

2014–2018 **PhD in Science (Physics)**, *Universidad Autónoma del Estado de Morelos*, Cuernavaca, Morelos, México, Thesis: "Music scores characterization from a complex systems perspective" *Graduated with Honors*
Supervisor: Dr. Gustavo Martínez Mekler, Instituto de Ciencias Físicas, Universidad Nacional Autónoma de México (UNAM)

2011–2014 **Master of Science (Physics)**, *Universidad Autónoma del Estado de Morelos*, Cuernavaca, Morelos, México, Thesis: "A discrete model for the Liesegang-type pattern formation in the reaction NH_3+*HCl*"
Supervisor: Dr. Gustavo Mártinez Mekler, Instituto de Ciencias Físicas, UNAM

2005–2011 **Bachelor of Science (Chemistry)**, *Universidad Autónoma del Estado de Morelos*, Cuernavaca, Morelos, México, Thesis: "An *ab-initio* molecular potential for hydroxylamine"
Supervisor: Dr. Jorge Hernández Cobos, Instituto de Ciencias Físicas, UNAM

Research interests and experience

Music	My research is mainly focused (but not limited to) in understanding different aspects related to music from a complex systems perspective.
Data Science	Most of my research is data-oriented, I'm interested in inference and hypothesis testing, implementing Machine Learning and Statistical methods.
Statistical Physics	Data and time series analysis (texts, NLP, music, biological data), stochastic modeling (markov processes, random walks, complex networks).

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Complex Systems	Self-organization and criticality, the emergence of global properties from collective behavior (human behavior, flocks, neuroscience).
Neuroscience	I'm interested in music perception, language processing, creativity and cognition.

Computer skills

Programming	Linux, Bash, C, Python, Julia, Git, MLOps
Software	Matlab, Mathematica, Gephi
Text	LaTeX, LibreOffice
DataBases	SQL, NoSQL

Awards and scholarships

2003	**Second place**, *XII Chemistry Olympiad of the State of Morelos, México*
2004	**First place**, *XVIII Mathematics Olympiad of the State of Morelos, México*
2005	**First place**, *XIII Chemistry Olympiad of the State of Morelos, México*
2011-2013	**Scholarship**, *National scholarship for graduate studies (Master degree) by CoNaCyT*
2014-2018	**Scholarship**, *National scholarship for graduate studies (PhD) by CoNaCyT*

Research stays

2012	Research stay with Dr. Franco Bagnoli, Department of Physics, University of Florence, Italy.
2017	Research stay with Dr. Edgardo Ugalde, Instituto de Física, Universidad Autónoma de San Luis Potosí, México.

Organizational experience

2015	Co-organizer in the workshop "Joint Action and Perception in Emergence Phenomena", Centro Internacional de Ciencias, Cuernavaca, México.
2017	Co-organizer in the workshop "Science, Art and Cognition", Centro Internacional de Ciencias, Cuernavaca, México.

Languages

Spanish	Native
English	Fluent

Media

2020	Time's Arrow Flies through 500 Years of Classical Music, Physicists Say. *Scientific American*, url=https://www.scientificamerican.com/article/times-arrow-flies-through-500-years-of-classical-music-physicists-say/

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Publications

[1] Alfredo González-Espinoza, Jorge Hernández-Cobos, and Iván Ortega-Blake. A refined potential for hydroxylamine clusters and the liquid phase. *The Journal of Chemical Physics*, 135(5):054502, 2011.

[2] José C. Torres-Guzmán, Thomas Buhse, Elsa María de la Calleja, Alfredo González-Espinoza, Gustavo Martínez-Mekler, Fernando Montoya-Nava, Elizeth Ramírez-Álvarez, Marco Rivera-Islas, Aurora Rodríguez-Álvarez, and Markus F. Müller. Irregular liesegang-type patterns in gas phase revisited. i. experimental setup, data processing, and test of the spacing law. *The Journal of Chemical Physics*, 144(17):174701, 2016.

[3] Alfredo González-Espinoza, Hernán Larralde, Gustavo Martínez-Mekler, and Markus Müller. Multiple scaling behaviour and nonlinear traits in music scores. *Royal Society Open Science*, 4(12), 2017.

[4] Alfredo González-Espinoza, Gustavo Martínez-Mekler, and Lucas Lacasa. Arrow of time across five centuries of classical music. *Phys. Rev. Research*, 2:033166, Jul 2020.

[5] Alfredo González-Espinoza, Jose Zamora-Fuentes, Enrique Hernández-Lemus, and Jesús Espinal-Enríquez. Gene co-expression in breast cancer: a matter of distance. *Frontiers in Oncology*, 2021.

Papers in preparation

[1] Alfredo González-Espinoza and Joshua Plotkin. Quantifying the evolution of harmony and innovation in western classical music. *Arxiv:2308.03224*

[2] Alfredo González-Espinoza, Mitchel Newberry and Joshua Plotkin. Measuring Frequency-dependent selection in music listening.

Attendance to conferences and schools

Talk "Processing and analysis of music scores". *1st Conference of computational modeling and scientific computing 2014*, Universidad Autónoma del Estado de Morelos, México

Poster "Long-range and nonlinear correlations in music scores". *Dynamics Days Latin America and the Caribbean 2016*, Puebla, México

Poster "Long-range and nonlinear correlations in music scores", *Workshop of mathematical and computational applications in music 2016*, Universidad de Buenos Aires, Argentina

School *Workshop of mathematical and computational applications in music 2016*, Universidad de Buenos Aires, Argentina

Poster "Growth and use of bicycle sharing systems from a networks perspective" *1st Latin American Conference on Complex Networks 2017*, Puebla, México

Talk "Scaling and nonlinearity in music scores". *2nd International week of complexity 2018*, Centro de Ciencias de la Complejidad, UNAM

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School *Workshop in developing models for algorithmic composition and improvisation*, Centro Nacional de las Artes, México

Poster "Scaling and nonlinearity in music scores". *7th International Conference on Nonlinear Science and Complexity* Instituto de Física UASLP, San Luis Potosí, México.

Poster "Local structure characterization of gene regulatory networks in breast cancer." *NetSci (Network Science Society) Conference 2019*, University of Vermont, USA.

Talk "Nonlinearity, time directionality and evolution in Western classical music.". *ICCS (International Conference in Complex Systems) 2020*, NECSI, Cambridge MA, USA.

References

Prof. Joshua Plotkin
Department of Biology, University of Pennsylvania.
jplotkin@sas.upenn.edu

Dr. Gustavo Martínez-Mekler
Instituto de Ciencias Físicas, UNAM.
mekler@icf.unam.mx

Dr. Markus Müller Bender
Centro de Investigación en Ciencias, Universidad Autónoma del Estado de Morelos (UAEM).
muellerm@uaem.mx

Dr. Hernán Larralde Ridaura
Instituto de Ciencias Físicas, UNAM.
hernan@icf.unam.mx

Dr. Edgardo Ugalde
Instituto de Física, Universidad Autónoma de San Luis Potosí (UASLP).
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