

Full CV
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M. Ángeles Serrano

ICREA Research Professor

Head of the Mapping Complexity Lab

<https://mappingcomplexity.net>

Martí I Franquès 1
08028 Barcelona
Spain

Dept. of Condensed Matter Physics, Statistical Physics Section

UB, Universitat de Barcelona

UBICS, Universitat de Barcelona Institute of Complex Systems

ICREA, Catalan Institution for Research and Advanced Studies

Short Bio

A native of Barcelona, M.Á.S. received a **Ph.D. in theoretical physics from UB** in 1999 and, a year later, a **master's degree in mathematics for finance** from the Centre de Recerca Matemàtica **CRM**. She spent several years in the **private sector** and **returned to academia in 2004** to work in **network science**. She conducted **postdoctoral research** at Indiana University (USA), the École Polytechnique Fédérale de Lausanne (Switzerland), and IFISC Institute (Spain) until 2009 when she was awarded a **Ramón y Cajal Fellowship**. M.Á.S. has published in **major peer reviewed international scientific journals**, including Nature Reviews Physics, Nature Physics, Nature Communications, PNAS, Phys Rev Letters. She obtained the **Outstanding Referee Award of the American Physical Society (APS)** and a **James McDonnell Foundation Scholar Award** for the Study of Complex Systems. She serves as a **Board member** of the Statistical and Nonlinear Physics Division **SNPD of the European Physical Society** and belongs to the **Editorial Board** of the APS journal **Physical Review Research**. She is a **founding member of Complexitat**, the Catalan network for the study of complex systems, and a **promoter and Internal Scientific Board member of UBICS**, the Universitat de Barcelona Institute of Complex Systems. She holds an appointment as an **External Faculty at the Complexity Science Hub CSH** in Vienna.

Research interests

Complex systems -e.g., the **human brain**, the **Internet**, **molecular networks in the cell**, **international trade**, and many more- are ubiquitous and around us. All of them, regardless of their origin, talk a **common language** that we are starting to understand. A major challenge for a better comprehension of the relation between their **structure and function** is the characterization of their **multiscale** nature in space and time. At the **Mapping Complexity Lab**, we are using **networks** to **model and predict** the **evolution and adaptation** capabilities of complex systems. We produce models and maps in a **latent hyperbolic geometry** where distances measure the likelihood of interactions and reveal their multiscale nature, nested architecture, dimensionality, and hidden symmetries. Our applications cover a wide variety of **real systems**, from biological to economic, socio-technological, and AI systems, that we characterize using **massive data**.

marian.serrano@ub.edu
+34 934021153

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Education

- Jul 2000** **M. D. in Mathematical Finance**, Centre de Recerca Matemàtica CRM, Barcelona, Spain
- Jun 1999** **Ph. D. in Theoretical Physics**, University of Barcelona, Spain
Ph. D. thesis: *The motion sensing problem in spherical gravitational wave detectors*, ISBN: 84-475-2246-6.
- Sep 1994** **BSc. D. in Physics**, University of Barcelona, Spain

Academic positions

- Oct 2015 - Present** **ICREA Research Professor**, Dept. Física de la Matèria Condensada and UB Institute of Complex Systems, Universitat de Barcelona, Spain.
Associate Professor, Universitat de Barcelona, Spain.
- Mar 2009 - Oct 2015** **Ramón y Cajal Research Associate**, Dept. Física Fonamental, Universitat de Barcelona, Spain. May 2014-October 2015, Universitat de Barcelona Talent Retention Programme.
- Apr 2008 - Feb 2009** **Postdoctoral Researcher**, CSIC JAE Doc, IFISC (CSIC-UIB), Palma de Mallorca, Spain. Supervisor: Maxi San Miguel.
- Jan 2007 - Mar 2008** **Postdoctoral Researcher**, DELIS project, Institut de Théorie des Phénomènes Physiques, Ecole Polytechnique Fédérale de Lausanne, Switzerland. Supervisor: Paolo De Los Rios.
- Mar 2006 - Aug 2006** **Visiting Guest Scientist**, Complex Network Lagrange Laboratory, Institute for Scientific Interchange (ISI) Foundation, Turin, Italy. Supervisor: Alessandro Vespignani.
- Feb 2005 - Dec 2006** **Postdoctoral Researcher**, School of Informatics, Indiana University, Bloomington, USA. Supervisor: Alessandro Vespignani.
- Jan 2004 - Dec 2004** **Postdoctoral Researcher**, COSIN Project, Fundació Bosch i Gimpera, Universitat de Barcelona, Spain. Supervisor: Albert Díaz-Guilera.

Habilitations

Research and teaching qualifications required in the Spanish and Catalan academic system

Jan 2015	Senior Lecturer , National Agency for Quality Accreditation ANECA
Apr 2013	I3 Programme Certificate , Ministry of Economy and Competitiveness, ANEP (Spanish National Evaluation and Foresight Agency)
Feb 2010	Accreditation of Research , Catalan University Quality Assurance Agency (AQU Catalunya)
Mar 2009	Ramón y Cajal Fellow of the Spanish Ministry of Science
2004	Accreditation for tenure-track lecturer , Catalan University Quality Assurance Agency (AQU Catalunya)

Career breaks

Unconventional career paths and major life events

Oct 2021 - Feb 2022	Medical leave for long term illness	16 months
Sep 2020 - Sep 2021	Medical leave for long term illness	
Feb 2013 - Jun 2013	Maternity leave	6.58 months
Sep 2009 - Dec 2009	Maternity leave	
Jun 2001 - Dec 2003	Non-academic professional experience: Investment Manager , Mutual Funds Specialist and Quantitative Analyst, Catalunya Caixa Inversió S.G.I.I.C. S.A., Madrid-Barcelona, Spain	46 months
Mar 2000 - May 2001	Non-academic professional experience: Information Technologies Consultant , Information Highway Group S.L., Barcelona, Spain	
Sep 1997 - Apr 1998	Non-academic professional experience: Secondary School Teacher , Fundació Lleó XIII, Barcelona, Spain	

Selected publications

R. Jankowski, A. Allard, M. Boguñá, M. Á. Serrano, *The D-Mercator method for the multidimensional hyperbolic embedding of real networks*,

Nature Communications 14, 7585 (2023)

P. Almagro, M. Boguñá, M. Á. Serrano, *Detecting the ultra low dimensionality of real networks*,

Nature Communications 13, 6096 (2022)

M. Boguñá, I. Bonamassa, M. De Domenico, S. Havlin, D. Krioukov, M. Á. Serrano, *Network Geometry*,

Nature Reviews Physics 3, 114-135 (2021)

M. Zheng, G. García-Pérez, M. Boguñá, M. Á. Serrano, *Scaling up real networks by geometric branching growth*,

Proc. of the National Academy of Sciences USA 118, e2018994118 (2021)

M. Zheng, A. Allard, P. Hagmann, Y. Alemán, M. Á. Serrano, *Geometric renormalization unravels self-similarity of the multiscale human connectome*,

Proc. of the National Academy of Sciences USA 117, 20244-20253 (2020)

G. García-Pérez, Marián Boguñá, M. Á. Serrano, *Multiscale unfolding of real networks by geometric renormalization*,

Nature Physics 14, 583-589 (2018)

K.-K. Kleineberg, L. Buzna, F. Papadopoulos, M. Boguñá, M. Á. Serrano, *Geometric correlations mitigate the extreme vulnerability of multiplex networks against targeted attacks*,

Physical Review Letters 118, 218301 (2017)

G. García-Pérez, M. Boguñá, A. Allard, M. Á. Serrano, *The hidden hyperbolic geometry of international trade: World Trade Atlas 1870-2013*,

Scientific Reports 6, 33441 (2016)

O. Güell, F. Sagués, and M. A. Serrano, *Essential plasticity and redundancy of metabolism unveiled by synthetic lethality analysis*

PLoS Computational Biology 10, e1003637 (2014)

M. A. Serrano, M. Boguñá, and A. Vespignani, *Extracting the multiscale backbone of complex weighted networks*,

Proc. of the National Academy of Sciences USA 106, 6438 (2009)

M. A. Serrano, D. Krioukov and M. Boguñá, *Self-similarity of complex networks and hidden metric spaces*,

Physical Review Letters 100, 078701 (2008)

M. A. Serrano, M. Boguñá, *Topology of the world trade web*

Physical Review E 68, 015101(R) (2003)

Publications

I develop **fundamental models, analytical methods and computational tools** to understand **real complex networks** based on large samples of **empirical data**. My research is at the interface of Statistical Physics, Mathematics, and Computational Sciences. Applications run from Neuroscience to Economic Systems.

My works have been published in major peer reviewed international scientific journals—including Nature Physics, Physical Review Letters, Proceedings of the National Academy of Sciences USA, Nature Communications, PLOS Computational Biology, Physical Review Research, and more—, book chapters, and conference proceedings covering different fields from Network Theory to Physics, Biology, Economics, and Computer Science.

The computational tools and the network reconstructions that we have produced in our investigations are **open source**. Check our lab website **mappingcomplexity.net** for more information.

In the last years, my research has been mainly focused on constructing a theory for the **geometric description of networks**. In the publications list below, you can find the works that paved the way for the emergence of **Network Geometry** as an entirely new research field within **Network Science**.

The list includes the seminal paper in 2008, where we introduced the **geometric soft configuration model**, or **SP model**, which later proved to explain the emergence of the **hyperbolic geometry of complex networks**. Despite its simplicity, it demonstrates many fundamental features of real networks—the small world property, scale-free degree distributions, clustering, symmetries—and fundamental mechanisms such as preferential attachment in growing networks. The list also includes the articles in which we proposed the **geometric renormalization group for complex networks**, and the articles where we explain how to detect the **ultra low dimensionality of real networks**. We have not yet exhausted the investigation of the model, and we are still studying its **several phase transitions and anomalous properties**.

One of the more relevant results is the introduction of a **geometric renormalization** (GR) technique that reveals the ubiquity of **multiscale self-similarity** in real networks. In collaboration with neuroscientists, we reconstructed **multiscale human brain connectomes** from anatomical data and proved that GR explains their self-similarity over a range of length scales. Additionally, the growth over time of some real networks also exhibits selfsimilarity, and their **evolution** can be modeled using a **reverse renormalization**, or **fine-graining**, process. From an applied perspective, GR can be used to produce scaled replicas that are central to a variety of downstream tasks and in the study of processes where network size is relevant. We also used the GR coarse graining to investigate the influence of clans on opinion formation in real networks.

One of the milestones of the new paradigm was to leverage the models to develop methods and computational tools to obtain geometric maps of real networks using **embedding techniques in hyperbolic space**. These **maps** have been exploited to explain successfully different aspects of the complex architecture, performance, and evolution of real networks.

We also have important findings about **multiplexes and interconnected networks, percolation**, and **dynamical processes** such as **epidemic spreading, Turing patterns, Voter model**, and more.

Our models and methods are general and **have influenced a variety of areas** including neuroscience and the study of social systems, mathematics, machine learning, and many other fields. For instance, in the domain of economic complexity, the hyperbolic geometric approach has shown that globalization, hierarchization, and localization are three simultaneous forces that shape the evolution of the international trade system, observed over more than a hundred years.

Preprints

R. Jankowski, P. Hozhabrierdi, M. Boguñá, M. Á. Serrano,
Feature-aware ultra-low dimensional reduction of real networks
arXiv:2401.09368 (2024)

J. van der Kolk, M. Á. Serrano, M. Boguñá
Random graphs and real networks with weak geometric coupling
arXiv:2312.07416 (2023)

L. Barjuan, J. Soriano, M. Á. Serrano
Optimal navigability of weighted human brain connectomes in physical space
arXiv:2311.10669 (2023)

R. Aliakbarisani, M. Á. Serrano, M. Boguñá
Feature-enriched network geometry explains graph-structured data
arXiv:2307.14198 (2023)

M. Zheng, G. García-Pérez, M. Boguñá, M. Á. Serrano
Geometric renormalization of weighted networks
arXiv:2307.00879 (2023)

Journals

A. Allard, M. Á. Serrano, M. Boguñá
Geometric description of clustering in directed networks
Nature Physics **20**, 150-156 (2024); Published: 02 November 2023

R. Jankowski, A. Allard, M. Boguñá, M. Á. Serrano
D-Mercator: multidimensional hyperbolic embedding of real networks
Nature Communications **14**, 7585 (2023)

Research highlights and media coverage:

Nature Communications, Editor's highlights on Applied physics and mathematics

J. van der Kolk, G. García-Pérez, N. E. Kouvaris, M. Á. Serrano, M. Boguñá
Emergence of geometric Turing patterns in complex networks
Physical Review X **13**, 021038 (2023)

E. Ortiz, M. Á. Serrano
Multiscale opinion dynamics on real networks
Chaos, Solitons & Fractals **165**, 112847 (2022)

P. Almagro, M. Boguñá, M. Á. Serrano
Detecting the ultra low dimensionality of real networks,
Nature Communications **13**, 6096 (2022)

Research highlights and media coverage:

Nature Computational Science, 14 Nov 2022, *Reducing the network dimensionality*
Nature Communications, Focus on Applied physics and mathematics
Mirage News, AlphaGalileo, Tech Explore, MorningNews, Verve Times

J. van der Kolk, M. Á. Serrano, M. Boguñá
A geometry-induced topological phase transition in random graphs,
Communication Physics 5, 245 (2022)

R. Aliakbarisani, A. Ghasemi, M. Á. Serrano,
Perturbation of the normalized Laplacian matrix for the prediction of missing links in real networks,
IEEE Transactions on Network Science and Engineering 9, 863-874 (2022)

M. Boguñá, I. Bonamassa, M. De Domenico, S. Havlin, D. Krioukov, M. Á. Serrano,
Network Geometry,
Nature Reviews Physics 3, 114-135 (2021)

Research highlights and media coverage:

KKNews.cc

<https://kknews.cc/science/jagyyxy.html>

M. Zheng, G. García-Pérez, M. Boguñá, M. Á. Serrano,
Scaling up real networks by geometric branching growth,
Proc. of the National Academy of Sciences USA 118, e2018994118 (2021)

Research highlights and media coverage:

ScienMag, Tech Explore, AlphaGalileo, EurekAlert!, Mirage News

A new model enables the recreating of the family tree of complex networks

M. Zheng, A. Allard, P. Hagmann, Y. Alemán, M. Á. Serrano,
Geometric renormalization unravels self-similarity of the multiscale human connectome,
Proc. of the National Academy of Sciences USA 117, 20244-20253 (2020)

Research highlights and media coverage:

Technology Networks

The Brain's Connectome: Why Many Different Layers Seem Strangely Similar,

The News Medical

Scientists study the multiscale spatial organization of the brain

Newswise, Medical Xpress, ScienMag, bioengineer.org, sciencenewsnet.in, EurekAlert!

A new multiscale view of the human brain

Mirage News

Researchers from UBICS study how multilayers that form human brain interact at different resolutions

E. Ortiz, G. García-Pérez, M. Á. Serrano,
Geometric detection of hierarchical backbones in real networks,
Physical Review Research 2, 033519 (2020)

G. García-Pérez, R. Aliakbarisani, A. Ghasemi, M. Á. Serrano,
Precision as a measure of predictability of missing links in complex networks,
Physical Review E 101, 052318 (2020)

M. Boguñá, D. Krioukov, P. Almagro, M. Á. Serrano
Small worlds and clustering in spatial networks
Physical Review Research 2, 023040 (2020)

A. Allard, M. Á. Serrano,
Navigable maps of structural brain networks across species,
PLOS Computational Biology 16, e1007584 (2020)

E. Ortiz, M. Starnini, M. Á. Serrano,
Geometric randomization of real networks with prescribed degree sequence,
New Journal of Physics 21, 053039 (2019)

G. García-Pérez, A. Allard, M. Á. Serrano, M. Boguñá,
Mercator: uncovering faithful hyperbolic embeddings of complex networks,
New Journal of Physics **21**, 123033 (2019)

M. Starnini, M. Boguñá, M. Á. Serrano,
The interconnected wealth of nations: Shock propagation on global trade-investment multiplex networks,
Scientific Reports **9**, 13079 (2019)

G. García-Pérez, Marián Boguñá, M. Á. Serrano,
Multiscale unfolding of real networks by geometric renormalization,
Nature Physics **14**, 583-589 (2018)

Research highlights and media coverage:

Investigación y Ciencia 508, 16-19 (2019)

Renormalización en redes complejas,

AlphaGalileo, phys.org

A new technique allows researchers to create real system 'cartographic' maps at different scales

SINC - Servicio de Información y Noticias Científicas, Fundación para el conocimiento Madrid

Cómo crear mapas 'cartográficos' de sistemas reales a diferentes escalas

phys.org, madri+d, Nature Research Bioengineering Community

F. A. Massucci, F. Sagués, M. Á. Serrano,
Metabolic plasticity in synthetic lethal mutants: viability at higher cost,
PLOS Computational Biology **14**, e1005949 (2018)

G. García-Pérez, M. Á. Serrano, M. Boguñá,
Soft communities in similarity space,
Journal of Statistical Physics **173**, 775-782 (2018)

E. Ortiz, M. Starnini, M. Á. Serrano,
Navigability of temporal networks in hyperbolic space,
Scientific Reports **7**, 15054 (2017)

K.-K. Kleineberg, L. Buzna, F. Papadopoulos, M. Boguñá, M. Á. Serrano,
Geometric correlations mitigate the extreme vulnerability of multiplex networks against targeted attacks,
Physical Review Letters **118**, 218301 (2017)

O. Güell, F. Sagués, M. Á. Serrano,
Detecting the Escherichia coli metabolic backbone,
FEBS Letters **591**, 1437-1451 (2017)

J. Haerter, A. Díaz-Guilera, M. Á. Serrano,
Noise-Induced Polarization Switch in Single and Multiplex Complex Networks,
Physical Review E **95**, 042305 (2017)

A. Allard, M. Á. Serrano, G. García-Pérez, M. Boguñá,
The geometric nature of weights in real complex networks,
Nature Communications **8**, 14103 (2017)

Research highlights and media coverage:

Research Highlights, Nature Physics 13, 109 (2017)

Hidden influence

G. García-Pérez, M. Boguñá, A. Allard, M. Á. Serrano
The hidden hyperbolic geometry of international trade: World Trade Atlas 1870-2013,
Scientific Reports **6**, 33441 (2016)

Research highlights and media coverage:

El Periódico online 02/18/2017 *La globalización ha reforzado las grandes potencias comerciales*
 El Periódico in press 02/19/2017 *La globalización del ganchillo*
 Revista Española de Física, vol 30 n° 4, 2016,
Geometría oculta en las relaciones comerciales

K.-K. Kleineberg, M. Boguñá, M. Á. Serrano, F. Papadopoulos,
Hidden geometric correlations in real multiplex networks,
Nature Physics **12**, 1076-1082 (2016)

F. Vazquez, M. Á. Serrano, M. San Miguel,
Rescue of endemic states in interconnected networks with adaptive coupling,
Scientific Reports **6**, 29342 (2016)

O. Güell, F. A. Massucci, F. Font-Clos, F. Sagués, M. Á. Serrano,
Mapping High-growth Phenotypes in the Flux Space of Microbial Metabolism,
Journal of the Royal Society Interface **12**, 20150543 (2015)

Research highlights and media coverage:

Atlas of Science, November 26, 2015
What is really driving our need for food, besides the pleasure of taste?

M. Á. Serrano, L. Buzna, M. Boguñá,
Escaping the avalanche collapse in self-similar multiplexes,
New Journal of Physics **17**, 053033 (2015)

G. García-Pérez, M. Boguñá, M. Á. Serrano,
Regulation of burstiness by network-driven activation,
Scientific Reports **5**, 9714 (2015)

Research highlights and media coverage:

Revista Española de Física, vol 29 n° 3, 2015
Explosiones de actividad en redes complejas

M. Boguñá, L. F. Lafuerza, R. Toral, M. Á. Serrano,
Simulating non-Markovian stochastic processes,
Physical Review E **90**, 042108 (2014)

G. García-Pérez, M. Á. Serrano, M. Boguñá,
Complex architecture of primes and natural numbers,
Physical Review E **90**, 022806 (2014)

Research highlights and media coverage:

New Scientist March 2014
Prime number enigma could be solved by simple networks

O. Güell, F. Sagués, and M. A. Serrano,
Essential plasticity and redundancy of metabolism unveiled by synthetic lethality analysis
PLoS Computational Biology **10**, e1003637 (2014)

M. Á. Serrano, M. Jurado, and R. Reigada,
Negative-feedback self-regulation contributes to robust and high-fidelity transmembrane signal transduction,
Journal of the Royal Society Interface **10**, 20130581 (2013)

P. Colomer-de-Simón, M. Á. Serrano, M. G. Beiró, J. I. Alvarez-Hamelin, and M. Boguñá
Deciphering the global organization of clustering in real complex networks
Scientific Reports 3, 2517 (2013)

F. Papadopoulos, M. Kitsak, M. Á. Serrano, M. Boguñá, and D. Krioukov,
Popularity versus similarity in growing networks,
Nature 489 537-540 (2012)

Research highlights and media coverage:
News&Views, Nature 489 (2012)
Research Highlights, Nature Physics 8 (2012)

M. Á. Serrano, M. Boguñá, and F. Sagués,
Uncovering the hidden geometry behind metabolic networks,
Molecular Biosystems 8, 843-850 (2012)

K. Klemm, M. Á. Serrano, V. M. Eguíluz, and M. San Miguel,
A measure of individual role in collective dynamics,
Scientific Reports 2, 292 (2012)

O. Güell, F. Sagués, and M. Á. Serrano,
Predicting effects of structural stress in a genome-reduced model bacterial metabolism,
Scientific Reports 2, 621 (2012)

A. Saumell-Mendiola, M. A. Serrano, and M. Boguñá,
Epidemic spreading on interconnected networks,
Physical Review E 86, 026106 (2012)

O. Güell, F. Sagués, G. Basler, Z. Nikoloski, and M. Á. Serrano,
Assessing the significance of knockout cascades in metabolic networks,
Journal of Computational Interdisciplinary Sciences 3, 1-9 (2012)

M. Á. Serrano, D. Krioukov, and M. Boguñá,
Percolation in self-similar networks,
Physical Review Letters 106, 048701 (2011)

M. Á. Serrano and F. Sagués,
Network-based scoring system for genome-scale metabolic reconstructions,
BMC Systems Biology 5, 76 (2011)

M. A. Serrano, M. Boguñá, and A. Vespignani,
Extracting the multiscale backbone of complex weighted networks,
Proc. of the National Academy of Sciences USA 106, 6438 (2009)

M. Á. Serrano, A. Flammini, and F. Menczer,
Modeling the structure of written text,
PLOS ONE 4, e5372 (2009)

M. Á. Serrano, K. Klemm, F. Vazquez, V. M. Eguiluz, and M. San Miguel
Conservation laws for voter-like models on random directed networks,
Journal of Statistical Mechanics-Theory And Experiment P10024 (2009)

M. Á. Serrano,
Rich-club vs rich-multipolarization phenomena in weighted networks,

Physical Review E 78, 026101 (2008)

M. Á. Serrano and P. De Los Rios,
Structural efficiency of percolated landscapes in flow networks,
PLOS ONE 3, e3654 (2008)

M. A. Serrano, D. Krioukov and M. Boguñá, *Self-similarity of complex networks and hidden metric spaces*,
Physical Review Letters 100, 078701 (2008)

M. Á. Serrano and P. De Los Rios,
Interfaces and the edge percolation map of random directed networks,
Physical Review E 76, 056121 (2007)

M. Á. Serrano, A. Magitman, M. Boguñá, S. Fortunato, and A. Vespignani,
Decoding the structure of the WWW: a comparative analysis of web crawlers,
ACM transactions on the Web 1, 10 (2007)

Research highlights and media coverage:

TRN (Technology Research News) November 2005
 Search engines share the wealth

M. Á. Serrano,
Phase transition in the globalization of trade,
Journal of Statistical Mechanics-Theory And Experiment L01002 (2007)

M. Á. Serrano, M. Boguñá, and A. Vespignani,
Patterns of dominant flows in the world trade web,
Journal of Economic Interaction and Coordination 2, 111 (2007)

M. Á. Serrano and M. Boguñá,
Percolation and Epidemic Thresholds in Clustered Networks,
Physical Review Letters 97, 088701 (2006)

Selected for the *Virtual Journal of Biological Physics Research*
 VJBIO, *Statistical and Nonlinear Physics section*, 12 (5) (2006)

M. Á. Serrano, M. Boguñá, and R. Pastor-Satorras,
Correlations in weighted networks,
Physical Review E 74, 055101(R) (2006)

Selected for the *Virtual Journal of Biological Physics Research*
 VJBIO, *Statistical and Nonlinear Physics section*, 12 (5) (2006)

M. Á. Serrano and M. Boguñá,
Clustering in complex networks. II. Percolation properties,
Physical Review E 74, 056115 (2006)

M. Á. Serrano and M. Boguñá,
Clustering in complex networks. I. General formalism,
Physical Review E 74, 056114 (2006)

Selected for the *Virtual Journal of Biological Physics Research*
 VJBIO, *Statistical and Nonlinear Physics section*, 12 (11) (2006)

V. Colizza, A. Flammini, M. Á. Serrano, and A. Vespignani,
Detecting rich-club ordering in complex networks,
Nature Physics 2, 110-115 (2006)

Research highlights and media coverage:

News&Views, *Nature Physics* 2 (2006)
 Research Highlights, *Nature Physics* 439 (2006)

M. Á. Serrano, M. Boguñá, and A. Díaz-Guilera,
Modeling the Internet,
European Physical Journal B **50**, 249 (2006)

M. Á. Serrano, M. Boguñá, and A. Díaz-Guilera,
Competition and Adaptation in an Internet Evolution Model,
Physical Review Letters **94**, 038701 (2005)

M. Á. Serrano and M. Boguñá,
Tuning clustering in random networks with arbitrary degree distributions,
Physical Review E **72**, 036133 (2005)

Selected for the *Virtual Journal of Biological Physics Research*
 VJBIO, *Statistical and Nonlinear Physics* section, 10 (7) (2005)

M. Boguñá and M. Á. Serrano,
Generalized percolation in random directed networks,
Physical Review E **72**, 016106 (2005)

M. A. Serrano, M. Boguñá,
Topology of the world trade web,
Physical Review E **68**, 015101(R) (2003)

Research highlights and media coverage:

Reprinted in: *The Economics of Networks (The International Library of Critical Writings in Economics 221)*, M.
 Cason and M. Della Giusta (Edward Elgar Publishing, 2008), ISBN 978-1847203656
 APS Physics tip sheets 36, 30 July 2003
 Paper of the month Econophysics Forum, February 2003

S. M. Merkowitz, J. A. Lobo, M. Á. Serrano,
Errors in the inverse problem solution for a noisy spherical GW antenna,
Classical and Quantum Gravity **16**, 3035-3046 (1999)

J. A. Lobo, M. Á. Serrano,
The Resonator Problem in a Spherical GW Detector,
Classical and Quantum Gravity **14**, 1495-1498 (1997)

J. A. Lobo, M. Á. Serrano,
*The Multiple Resonator Problem in a Spherical GW Antenna: its General Solution and
 New Interesting Layouts*,
Europhysics Letters **35**, 253-258 (1996)

J. A. Lobo, M. Á. Serrano,
New Ideas for a Transducer Layout in a Spherical GW Antenna,
Nuclear Physics (Proc. Suppl.) B **48**, 116 (1996)

Books

Serrano, M., & Boguñá, M. (2022), ***The Shortest Path to Network Geometry: A Practical
 Guide to Basic Models and Applications*** (Elements in Structure and Dynamics of
 Complex Networks)
Cambridge: Cambridge University Press. doi:10.1017/9781108865791

Book chapters and conference proceedings

A new approach to international trade from Network Geometry. The World Trade Atlas 1870-2013, Guillermo García-Pérez, Marián Boguñá, Antoine Allard, and M. Ángeles Serrano in *Networks of International Trade and Investment: Understanding globalization through the lens of network analysis*, Sara Gorgoni, Alessia Amighini, and Matthew Smith Eds., Vernon Press, 2018. ISBN:978-1-62273-065-0. Pages: 73-118

Environmental dependence of the activity and essentiality of reactions in the metabolism of *Escherichia coli*

Oriol Güell, M. Ángeles Serrano and Francesc Sagués in *Engineering of Chemical Complexity II*, Alexander S Mikhailov and Gerhard Ertl eds., World Scientific Lecture Notes in Complex Systems 12 (2014). ISBN: 978-981-4616-12-6. Pages 39-56

The World Trade Web: Structure, evolution and modeling

M. Ángeles Serrano, Diego Garlaschelli, Marián Boguñá, and Maria Loffredo in *Complex Networks*. G. Caldarelli Ed, Encyclopedia of Life Support Systems (EOLSS), UNESCO-EOLSS Publishers, 2010. eISBN: 978-1-84826-322-2, ISBN: 978-1-84826-772-5 Pages: E6-200-05-1 - E6-200-05-48

Correlations in complex networks

M. Ángeles Serrano, Marián Boguñá, Romualdo Pastor-Satorras, and Alessandro Vespignani in *Structure and Dynamics of Complex Networks. From Information Technology to Finance and Natural Science*. G. Caldarelli and A. Vespignani Eds. World Scientific, Singapur, 2007. ISBN: 978-981-270-664-5. Pages: 35-66

Weighted configuration model

M. Ángeles Serrano and Marián Boguñá, in *Science of Complex Networks: from Biology to the Internet and WWW*. CNET2004 American Institute of Physics Conference proceedings, (2005). ISBN: 978-0735402621. Pages: 101-107

The Resonator Problem in a Spherical GW Antenna

J. A. Lobo, M. Á. Serrano in *Proceedings of the first international workshop Omnidirectional Gravitational Radiation Observatory*. W. F. Veloso, O. D. Aguiar and N. S. Magalhaes Eds. World Scientific, Singapore, 1997. ISBN: 9810232098. Pages: 201-204

Spherical GW Antenna: the Mathematical Theory for the Resonator Problem

J. A. Lobo, M. Á. Serrano in *Proceedings of the Spanish Relativistic Meeting, Relativistic Astrophysics and Cosmology ERE95*. Buitrago, E. Mediavilla and A. Oscoz Eds., World Scientific, Singapore, 1995. ISBN: 981023189X. Pages: 95-102

Editorial notes

X. Dimitropoulos, M. Á. Serrano, D. Krioukov,
On Cycles in AS Relationships
ACM SIGCOMM Computer Communication Review 38, 103-104 (2008)

Popular science publications

Shake and divide: the cocktail formula for global consensus

Mezclar y dividir: el cóctel para alcanzar consensos globales

The Conversation (ISSN 2201-5639), Feb 16 2023

Renormalización en redes complejas,

M. Á. Serrano,

Investigación y Ciencia 508, 16-19 (2019)

Xarxes complexes en biologia cel·lular,

M. Á. Serrano, M. Sales-Pardo, T. Alarcón, R. Guimerà, F. Sagués,

Revista de Física (Ed. Institut d'Estudis Catalans) 5 (2) 23-28 (2015)

Sistemes socioeconòmics i financers,

J. Duch, M. Gutiérrez-Roig, J. Masoliver, M. Montero, J. Perelló, M. Á. Serrano,

Revista de Física (Ed. Institut d'Estudis Catalans) 5 (2) 38-44 (2015)

Distinctions, awards, and fellowships

2019 - Present	External faculty of the Complexity Science Hub Vienna CSH
May 2023	Remote referee for the ERC Synergy grants
Jan 2021	Jury member of the City of Barcelona Award in Experimental Sciences and Technology
Jun 2021	Selection committee for the Fellows of the Network Science Society
Jun 2020	Selection committee for the Fellows of the Network Science Society
2013	James McDonnell Foundation Scholar Award for the Study of Complex Systems
2009	Outstanding Referee Award of the American Physical Society

Media coverage:

el Periódico, March 16, 2009

La ciencia fortalece el proceso para filtrar la mala investigación

La ciència enforteix el procés per filtrar la mala recerca

2009	Ramón y Cajal fellowship, Spanish Ministry of Science
2004	Lipper-Cinco Días Mutual Fund Award for Caixa Catalunya Dinámico FIMF, three-year performance. Based on an advanced version of the Pulsar tool, see Intellectual Property section
1998-1999	FPI predoctoral fellowship , Ministerio de Educación y Ciencia, Spain

Scientific and editorial boards

Scientific boards

2023 - present	European Physical Society Member of the Board of the Statistical and Nonlinear Physics Division
2022 - present 2016 - present 2016 - 2020 2016	University of Barcelona Institute of Complex Systems UBICS Member of the Internal Scientific Board Member of the Council Member of the Executive Board Promoter member
2015 - 2019 2014 - 2018 2014	Complexitat.cat, Catalan Network for the Study of Complex Systems Member of the Council Treasurer and member of the Executive Board Founder member

Editorial boards

2019 - present	Physical Review Research , journal of the American Physical Society
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Workshops, conferences, and seminars

Invited and keynote talks

- Aug 14-18, 2023** **V1th Interdisciplinary International Conference on Applied Mathematics, Modeling and Computational Science AMMCS-2023**, Plenary talk
Network geometry: from multiscale to ultra low dimensional representations of complex systems
Waterloo, Canada
- Aug 7-11, 2023** **28th International Conference on Statistical Physics Statphys28**
Renormalization of complex networks
Tokyo, Japan
- Jul 10-14, 2023** **International Conference on Statistical Physics SigmaPhi 2023**
Renormalization of complex networks
Chania, Crete, Greece
- Jul 11-12, 2023** **Complex Networks: Hidden Geometry and Dynamics Workshop3@SigmaPhi 2023**
Detecting the ultra low dimensionality of real network
Chania, Crete, Greece
- Jun 21-23, 2023** **III Conference of the Italian Society of Statistical Physics SIFS**
Network geometry: from multiscale to ultra low dimensional representations of complex systems
Parma, Italy
- Jul 10-16, 2022** **Complex networks: from socio-economic systems to biology and the brain**
The hyperbolic geometry of brain connectomes
Lipari, Italy
- Jun 14, 2022** **Algorithmiq Symposium**
Networks, scales, and symmetries
Helsinki, Finland
- Mar 14-18, 2022** **APS March Meeting, Session Network Theory and Applications to Complex Systems**
Towards multiscale network science
Chicago, USA
- Feb 8-11, 2022** **International School and Conference on Network Science NetSciX 22**
Scaling up and down complex networks
Porto, Portugal
- Jun 26, 2020** **Probability Seminars, School of Mathematics Research**
Geometric renormalization unravels the multiscale structure of complex networks
University of Bristol, UK

- May 7-11, 2019** **Statistical Physics of Complex Systems**
Geometric renormalization unravels self-similarity of the multiscale human connectome
 Stockholm, Sweden
- May 5-10, 2019** **Critical and collective effects in graphs and networks CCEGN-IV**
Geometric renormalization unravels self-similarity of the multiscale human connectome
 Les Houches, France
- Mar 4-8, 2019** **APS March Meeting, Session Network Theory I**
Geometric renormalization of complex networks
 Boston, USA
- Jan 29, 2019** **XIV Jornada de Recerca, Dept. Física UPC**
A geometric approach to the renormalization of complex networks
 Barcelona, Spain
- Nov 28, 2018** **Col.loqui FME-UPC**
Network Geometry
 Barcelona, Spain
- Jul 29 - Aug 3, 2018** **XVIII World Economic History Congress, Session Networks, Intensity, Extensive Margins of Trade since the 19th Century: New Approaches to Globalization with Large Databases**
The hidden hyperbolic geometry of international trade: World Trade Atlas 1870-2013
 MIT, Boston, USA
- Jun 19, 2018** **UBICS Day 2018**
Mapping complexity: embedding networks in hidden metric spaces
 Barcelona, Spain
- Jun 25-27, 2018** **Summer Solstice 2018 International Conference on Discrete Models of Complex Systems**
Multiscale unfolding of real networks by geometric renormalization
 Gdansk, Poland
- Jun 19-23, 2017** **International School and Conference on Network Science NetSci 17**
Multiscale unfolding of complex networks by geometric renormalization
 Indianapolis, Indiana, USA
- Jun 7-9, 2017** **Networks Scientific Conference 2017, Keynote talk**
The hidden geometry of complex networks: foundations and applications
 Amsterdam, The Netherlands
- 15-19 May, 2017** **Critical and collective effects in graphs and networks, CCEGN-17, Keynote talk**
Multiscale unfolding of complex networks by geometric renormalization
 Moscow, Russia

- Sep 23 2016** **Symposium Leiden Networks Days**
Network geometry and gravity models in complex networks
Leiden, The Netherlands
- Sept 19-22, 2016** **CCS 2016, Conference on Complex Systems**, Keynote talk
The hidden geometry of complex networks
Amsterdam, The Netherlands
- Aug 29 - Sep 2, 2016** **Complex networks: from socio-economic systems to biology and brain**
Essential Plasticity and Redundancy of Metabolism Unveiled by Synthetic Lethality Analysis
Lipari, Italy
- May 30 - Jun 3, 2016** **Network Geometry and Topology Workshop, Satellite Meeting of NetSci 2016 International Conference on Network Science**
Network geometry: expanding the heritage of Newton's gravity law
Seoul, South Korea
- May 28-29, 2015** **Symposium Honoring John T. Bruer on his leadership**
Mapping complexity: Embedding networks in hidden metric spaces
at James S. McDonnell F, St. Louis, Missouri, USA
- July 7-11, 2014** **10th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Special Session Interacting population on social, economic and ecological networks**
Mapping the World Trade Web
Madrid, Spain
- May 28-30, 2014** **James S. McDonnell Foundation 2014 Studying Complex Systems Scholars and Postdoctoral Fellows Meeting**
The Mapping Complexity Project
Atlanta, USA
- Oct 18-20, 2012** **Fises'12, XVIII Congreso de Física Estadística**
Networks meet Geometry: the S1 model and beyond
Palma de Mallorca, Spain
- Jun 7-8, 2012** **Aalto Complex Networks Factory Workshop**
Networks meet Geometry: the S1 model
Porvoo, Finland
- Jun 4-6, 2012** **NOLINEAL 2012**
Cartography of metabolic networks: the S1 model
Universidad de Zaragoza, Zaragoza, Spain
- Feb 15-17, 2012** **Workshop on Web Epistemics**
Language structure, bursty words, and topicality in large web datasets
Center of Interdisciplinary Research, Bielefeld, Germany
- Oct 31-Nov 4, 2011** **Geometry of large networks, American Institute of Mathematics AIM**
Uncovering the hidden geometry behind complex networks

Palo Alto, California, USA

- Oct 26-28, 2011** **Net-Works 2011 International Conference, Complex Networks: structure, applications and related topics**
Uncovering the hidden geometry behind metabolic networks
Madrid, Spain
- Jun 9-10, 2011** **Summer Solstice 2011 International Conference on Discrete Models of Complex Systems**
Uncovering the hidden geometry behind metabolic networks: from hierarchical random graphs to the S1 model
Turku, Finland
- May 6, 2011** **III Workshop MODELICO-CM, Modelización y Simulación de Sistemas Complejos**
Uncovering the hidden geometry behind complex networks: The S1 model
Madrid, Spain
- Apr 27, 2011** **First joint CRM-VHIR workshop on mathematical modelling and Biomedicine: Enabling collaboration between mathematics and biology**
A complex networks approach to genome-scale metabolic reconstructions
Barcelona, Spain
- Mar 18, 2011** **Encuentro IBERSINC**
Uncovering the hidden geometry behind complex networks: The S1 model
Barcelona, Spain
- Jul 5, 2010** **TERA-NET: Towards Evolutive Routing Algorithms for scale-free internet-like NETWORKS**
Self-similarity of complex networks and hidden metric spaces
Bordeaux, France
- Jun 22-24, 2009** **Summer Solstice 2009 International Conference on Discrete Models of Complex Systems**
Rich clubs in weighted networks
Gdansk, Poland
- Jul 14-18, 2008** **Sigma Phi International Conference in Statistical Physics**
Self-similarity of complex networks and hidden metric spaces
Kolympari-Creta, Greece
- Nov 19-21, 2007** **Workshop on Theoretical Aspects and Models of Large, Complex and Open Information Networks**
Structural efficiency of percolation landscapes in flow networks
ISI Foundation, Torino, Italy
- Mar 5-9, 2007** **APS March Meeting, Focus Session Structure and Dynamics of Complex Networks**
Percolation properties of complex networks with weak and strong clustering
Denver, USA
- Jan 21-Feb 9, 2006** **EXYSTENCE Thematic Institute, Interfacing Networks: from**

behavioral networks to info structures and infrastructures*Tuning Clustering in Random Networks*

ISI Foundation, Torino, Italy

Invited tutorials

- Jul 17-21, 2023** **XI GEFENOL Summer School on Statistical Physics of Complex Systems,**
Introduction to network geometry,
University of Barcelona, Spain
- Mar 17-28, 2023** **Theory Lecture Series ICFO,**
Networks: a change of paradigm,
The Institute of Photonic Sciences, Castelldefels, Spain
- Dec 9-12, 2019** **Complex networks 2019, The 8th International Conference on Complex Networks and their Applications**
Mapping networks in latent geometry: models and applications,
Lisbon, Portugal
- Apr 8-13, 2013** **Joint CRM-Imperial College School in Complex Systems,**
Complex networks and Hidden metric spaces,
Centre Recerca Matemàtica CRM, Bellaterra, Spain
- Fall 2006** **Postgraduate course, School of Informatics IU**
Introduction to complex system,
Indiana University, USA
- 2003-2004** **M. D. in Mathematical Finance,**
Gestió de carteres,
Centre de Recerca Matemàtica CRM, Bellaterra, Spain

Contributed talks

- Sep 16-20, 2016** **International Conference on Systems Biology ICSB 2016,**
Essential Plasticity and Redundancy of Metabolism Unveiled by Synthetic Lethality Analysis,
Barcelona, Spain
- Jun 1-5, 2015** **International School and Conference on Network Science NetSci2015,**
Escaping the avalanche collapse in self-similar multiplexes,
Zaragoza, Spain
- Sep 22-26, 2014** **European Conference on Complex Systems ECCS14,**
Mapping complexity: embedding networks in hidden metric spaces,
Lucca, Italy
- Jul 4-8, 2011** **Engineering of Chemical Complexity International Conference,**
Uncovering the hidden geometry behind metabolic networks,
Berlin, Germany
- May 9-12, 2011** **The XII International Congress on Molecular Systems Biology,**
Uncovering the hidden geometry behind metabolic networks,

Lleida, Spain

- Dec 9-10, 2010** **6th Meeting of the Spanish Systems Biology Network REBS,**
Network-based reaction scores for metabolic reconstructions,
Barcelona, Spain
- Jun 29-Jul 3, 2009** **NetSci International Workshop and Conference on Complex
Networks and their Applications,**
Rich clubs in weighted networks,
Venice, Italy
- Nov 10-14, 2008** **Extreme Events: Theory, Observations, Modeling, and Prediction,
Trends in Complex Systems,**
*A generative model of text documents capturing bursts and
similarity,*
IFISC - MPIPES, Palma de Mallorca, Spain
- Feb 18-20, 2008** **Dynamics and evolution of biological and social networks,**
Structural efficiency of percolation landscapes in flow networks,
IFISC, Palma de Mallorca, Spain
- Jul 2-6, 2007** **StatPhys 23 Satellite, Complex Networks: from Biology to
Information Technology,**
*Dominant interactions and diffusion experiments in weighted
networks. The case of the WTW,*
Pula, Italy
- Sept 3-9, 2006** **New Directions in Complex Systems NDCOS,**
Correlations in Weighted Networks,
Istanbul, Turkey
- Feb 27-Mar 3, 2006** **Dynamics on Complex Networks and Applications,**
Tuning Clustering in Random Networks,
Max Planck Institute for the Physics of Complex Systems,
Dresden, Germany
- Aug 13-18, 2005** **Sigma Phi International Conference in Statistical Physics**
Modeling the Internet
Kolimbari, Creta, Greece
- Sept 4-7, 1995** **Spanish Relativity Meeting ERE95**
The Resonator Problem in a Spherical GW Antenna,
Instituto de Astrofísica de Canarias, Tenerife, Spain

Posters

- Oct 30-31, 2013** **12th CRG Symposium on Biological Control Networks,**
Mapping Metabolic Networks to Hidden Metric Spaces,
Barcelona, Spain
- Jun 2-4, 2011** **XIV Congreso de Física Estadística FisEs'11,**
*Network-based scoring system for genome-scale metabolic
reconstructions*
Barcelona, Spain

- Dec 13-15, 2009** **5th Meeting of the Spanish Network of Systems Biology REBS,**
*The Large Scale Structure of Biological Networks Revisited:
Changing Focus in Bow Ties from Nodes to Edges*
Madrid, Spain
- Sept 14-16, 2006** **XIV Congreso de Física Estadística FisEs'06,**
Generalized Percolation in Random Directed Networks,
Universidad de Granada, Granada, Spain
- Mar 14-18, 2005** **Conference on Complex Networks: Evolution and Statistical
Properties COSIN2005,**
Generalized percolation in random directed networks,
Salou, Spain
-

Outreach activities

- May 12-13, 2023** **UB IX Science Festival - IX Festa de la Ciència UB**
*Workshop: Les xarxes complexes com a eina per resoldre
problemes,*
University of Barcelona.
- Feb 23, 2023** **Conversation**
Reaching the Complexity of the World,
with M. Sales Pardo, Moderator M. Catanzaro,
City and Science Biennial Barcelona - Biennial Ciutat i Ciència
Barcelona, open forum to discuss societal challenges from a
scientific perspective
Institut d'Estudis Catalans, Barcelona.
- Mar 2, 2022** **Course for graduate and undergraduate students**
Complexitat de les xarxes neurones en el cervell
Minicurs "Física de la complexitat en la matèria viva", UBICS,
Physics Faculty, Univeristy of Barcelona.
- Feb 12, 2020** **Course for graduate and undergraduate students**
Introducció a les xarxes complexes,
Minicurs "Xarxes Complexes", UBICS, Physics Faculty, University
of Barcelona.
- June 7-9, 2017** **Public Lecture**
Networks: a change of paradigm
Networks Scientific Conference 2017, Amsterdam, The
Netherlands.

Supervision and advising

Postdoctoral fellows

Jan 2024 - Present	Dr. Lucía Ramírez
Jun 2022 - Present	Dr. Roya Ali Akbari Sani
Apr 2019 - Sep 2020	Dr. Pedro Almagro
Oct 2018 - Feb 2020	Dr. Amani Tahat
Nov 2017 - Nov 2020	Dr. Muhua Zheng
Feb 2015 - Aug 2018	Dr. Michele Starnini
Jan 2018 - Jul 2018 Aug 2014 - Dec 2016	Dr. Antoine Allard
Sep 2015 - Sep 2016	Dr. Jan Haerter
Sep 2015 - May 2016	Dr. Francesco Alessandro Massucci

PhD theses

In progress: expected fall 2025	<i>Communicability and resilience of neural networks at the multiscale.</i> Advisor. Ph. D. candidate: Laija Barjuan. Universitat de Barcelona.
In progress: expected fall 2024	<i>Mapping complex networks in ultra low dimensional hyperbolic spaces.</i> Advisor. Ph. D. candidate: Robert Jankowski. Universitat de Barcelona.
In progress: expected spring 2024	<i>Dynamical processes on complex networks with latent geometric spaces.</i> Co-advisor. Ph. D. candidate: Jasper van der Kolk Universitat de Barcelona.
Feb 23, 2022	<i>Link Prediction in complex networks: A network evolution analysis approach.</i> External advisor. Dr. Roya Aliakbarisani, K. N. Toosi University of Technology, Tehran, Iran.
Jan 13, 2022	<i>Mapping complexity through Network Geometry: Structure and dynamics of real-world networks.</i> Advisor.

Dr. Elisenda Ortiz Castillo,
Universitat de Barcelona. Grade: Excellent Cum Laude.

Nov 16, 2018 **A geometric approach to the structure of complex networks.**
Advisor.
Dr. Guillermo García Pérez, Universitat de Barcelona.
Grade: Excellent Cum Laude. PhD special prize 2018-2019.

Feb 2015 **A network-based approach to cell metabolism: from structure to flux balances.** Advisor.
Dr. Oriol Güell Riera, Universitat de Barcelona.
Grade: Excellent Cum Laude. Published in Springer Theses ISBN 978-3-319-63999-4.

Visiting PhD students

Oct 1, 2021-Jan 31, 2022 **Pegah Hozhabrierdi, Syracuse University,** Syracuse, USA. PhD advisor Dr. Sucheta Soundarajan and Dr. Joshua Introne. Visit in the context of the *AccelNet-MultiNet* program.

Oct 19, 2017-Sep 12, 2018 **Roya Aliakbarisani, K. N. Toosi University of Technology,** Tehran, Iran. PhD advisor Dr. Abdorasoul Ghasemi. Visit in the context of the project *Link Prediction in complex networks: A network evolution analysis approach*.

Mar 13-Apr 30, 2017 **Sergio Alcalá, National Autonomous University of Mexico,** Mexico city, Mexico. PhD advisor Dr. Enrique Hernández Lemus. Visit in the context of the project *Métodos computacionales de búsqueda de comunidades funcionales en redes de regulación genética*.

Master's theses

Sept 2023 **Community structure of the geometric soft configuration model**
Master student: **Viktor González Gea**
Master's Degree in Physics of Complex Systems and Biophysics 2022-2023 Universitat de Barcelona

Sept 2020 **Role of reservoir architecture in the performance of echo state neural networks**
Master student: **Adrià Vicens Salomon**
Master's Degree in Atomistic and Multiscale Computational Modelling in Physics, Chemistry and Biochemistry 2019-2020
Universitat de Barcelona

Jul 2019 **Information transmission in a self-similar multiscale shell model of the brain**

- Master student: **Joan Giralt Ibáñez**
 Master's Degree in Atomistic and Multiscale Computational Modelling
 in Physics, Chemistry and Biochemistry 2018-2019
 Universitat de Barcelona
- Jan 2016** ***Navigability of time-varying networks embedded in hidden metric spaces,***
 Master student: **Elisenda Ortiz Castillo**
 Master's Degree in Advanced Physics 2014-2015
 Universitat de Barcelona
- Jun 2015** ***Bistability and oscillations in repressilator interconnected networks,***
 Master student: **Héctor Albalad Alcalá**
 Master's Degree in Advanced Physics 2014-2015
 Universitat de Barcelona
- Jan 2015** ***The complex architecture of primes and natural numbers***
 Master student: **Guillermo García Pérez**
 Master's Degree in Advanced Physics 2014-2015
 Universitat de Barcelona
- Sept 2011** ***Global epidemic spreading processes in coupled network***
 Master student: **Anna Saumell Mendiola**
 Master's Degree in Computational and Applied Physics 2011-2012
 Universitat de Barcelona

Undergraduate students

- 2023-2024** ***Introduction to weighted networks***
 Undergraduate student: **Carla Caro**
 Universitat de Barcelona
- 2022-2023** ***Persistent homology methods to determine the dimensionality of complex networks***
 Undergraduate student: **Meritxell Vila Miñana**
 Universitat de Barcelona
- 2011-2012** ***Introduction to complex networks***
 Undergraduate student: **Guillermo García Pérez**
 Universitat de Barcelona
- 2008** ***Modelos dinámicos en redes complejas,***
 CSIC JAE-Intro Collaboration Fellowship
 Undergraduate student: **Pablo Gonzalez de Prado Salas**
 IFISC, Instituto de Física Interdisciplinar y Sistemas Complejos

Grants

- 2023-2026** *Higher order features in the structure and function of complex systems in complex environments. From pattern formation to collective intelligence II (COMPLEX²)*, PID2022-137505NB-C22.
MCIN/AEI/10.13039/501100011033,
225000€. **Principal Investigator**
- 2022-2024** *Complexity Lab Barcelona*, 2021SGR00856.
Generalitat de Catalunya,
40000€. **Principal Investigator**
- 2022-2024** *Hyperbolic Dimensional Reduction Techniques for Classification of Complex Data in Digital Environments (HYPERDATA)*, TED2021-129791B-I00. Proyectos de Transición Ecológica y Digital 2021,
MCIN/AEI/10.13039/501100011033 and the “European Union NextGenerationEU/PRTR”,
230000€. **Principal Investigator**
- 2019-2024** *AccelNet: Accelerating Discovery in Multilevel Network Science*, NSF Award Number:1927418, **National Science Foundation USA.**
External collaborator
- 2020-2023** *Effects of similarity, heterogeneity and interdependence in the collective behavior of artificial and natural complex systems II*, PID2019-106290GB-C22. Agencia Estatal de Investigación, Ministerio de Ciencia e Innovación,
156090€. **Senior researcher**
- 2013-2021** *Mapping complexity: Embedding networks in hidden metric spaces*, JSMF GRANT NO. 220020363. James S. McDonnell Foundation, USA,
450000\$. **Principal investigator**
- 2018-2020** *Big Data Systems: embedding large complex networks in low-dimensional hidden metric spaces*,
Fundación Banco Bilbao Vizcaya Argentaria (BBVA),
100000€. **Principal Investigator**
- 2016-2020** *Adaptabilidad y Cooperación en Sistemas Biosociales en la Multiescala II*, FIS2016-76830-C2-2-P. Ministerio de Economía y Competitividad,
121000€. **Principal investigator**
- 2014-2016** *Evolución espacio-temporal de topologías complejas en las TIC, sistemas biológicos y materiales bioestructurados*, FIS2013-47282-C2-1-P. Ministerio de Economía y Competitividad,
47000€. **Co-Principal Investigator**
- 2014-2016** *Complexity Lab Barcelona*, 2014SGR608.
Generalitat de Catalunya,
30000€. **Senior researcher**

- 2012-2016** ***Decentralized Online Social Networks iSocial***, FP7-PEOPLE-2012-ITN 316808. European Commission, 382444.46€ (node UB). **Senior researcher**
- 2012-2016** ***Foundational Research on Multilevel Complex networks and Systems MULTIPLEX***, FP7-ICT-2011-8 317532. European Commission, 374955€ (node Catalunya). **Senior researcher**
- 2012-2015** ***multi-Layer SpAtiotemporal Generalized Networks LASAGNE***, FP7-ICT-2011-8 318132. European Commission, 198443€ (node UB). **Senior researcher**
- 2011-2014** ***Estructura, Redes y Motivos ('motifs') Celulares***, BFU2010-21847-C02-02. Ministerio de Ciencia e Innovación, 66550€. **Co-Principal Investigator**
- 2009-2014** ***Self-Organized Complexity and Self-Assembling Materials***, SOC&SAM2009SGR1055. Generalitat de Catalunya. **Senior researcher**
- 2010-2013** ***Discovering Hyperbolic Metric Spaces Hidden Beneath the Internet and Other Complex Networks***, NSF CNS-0964236. National Science Foundations. **External Collaborator**
- 2009-2011** ***Additonal funding, Ramón y Cajal contract***, RYC-2008-027245. Ministerio de Ciencia e Innovación, 15000€. **Principal Investigator**
- 2007-2010** ***Estructura y procesos dinámicos en sistemas físicos auto-ensamblados***, FIS2007-66485-C02-01. Ministerio de Ciencia y Tecnología. **Senior researcher**
- 2008-2009** ***BCNetWORKSHOP 2008 Trends and Perspectives in Complex Networks***, FIS2008-01732-E/FIS. Ministerio de Ciencia y Tecnología. **Senior researcher**
- 2008-2009** ***Ajuts accions mobilitzadores: BCNetWorkShop 2008-Trends and Perspectives in Complex Network Science***, 2008ARCS100120. AGAUR, Generalitat de Catalunya. **Senior researcher**
- 2004-2008** ***Dynamically Evolving, Large-Scale Information Systems DELIS***, DELIS IST-2002 001907. FET Open Project of the EU Commission. **Postdoctoral Researcher**
- 2002-2005** ***Coevolution and Self-Organization in Dynamical Networks COSIN***, COSIN IST-2001-33555. FET Open Project of the EU Commission. **Postdoctoral Researcher**
- 1998-2000** ***Gravitació i Cosmologia Relativistes i Sistemes Estocàstics***, 1998SGR00015. Comissionat per a Universitats i Recerca, Generalitat de Catalunya. **Predoctoral Researcher**

1997-2000 **Relatividad General Clásica**, PB96-0384. Secretaría de Estado de Educación, Universidades, Investigación y Desarrollo. **Predoctoral Researcher**

Endorsement of scholarships and fellowships

Postdoctoral

2018 **Juan de la Cierva postdoctoral contract**, MICINN,
Dr. Antoine Allard

Predoctoral

2022 **FPU PhD contract**, Ministerio de Universidades Spain,
Laia Barjuan

2022 **FI PhD grant**, Generalitat de Catalunya,
Robert Jankowski

2019 **APIF PhD grant** of the University of Barcelona,
Elisenda Ortiz

2017 **APIF PhD grant** of the University of Barcelona,
Guillermo García-Pérez

Professional services

Advisory committees

Aug 7-11, 2023 **International Advisory Committee of the 8th IUPAP International Conference on Statistical Physics STATPHYS28**, Tokyo, Japan

Organization of conferences, workshops, and schools

Jul 6-10, 2020 **Program Committee Chair of NetSci 2020**, International School and Conference on Network Science, Rome, Italy

- Nov 6-8, 2017** **General Chair of the International Workshop MACFANG**, *Mapping Complexity: Foundations and Applications of Network Geometry*, Barcelona, Spain
- Jun 19-20, 2017** **School Chair of NetSci 2017**, *International School and Conference on Network Science*, Indianapolis, Indiana, USA
- Jun 19-22, 2017** **Chair of the Minisymposium on Chemical Networks**, *Engineering of Chemical Complexity International Conference 2017, 9th edition*, Vilanova i la Geltrú, Barcelona, Spain
- Sep 16-20, 2013** **Local Committee of the ECCS13** *European Conference on Complex Systems*, Barcelona, Spain
- May 24, 2012** **Chair of II Jornada Complexitat.cat**, *Catalan Networks for the Study of Complex Systems*, Barcelona, Spain
- Dec 10-12, 2008** **Organizing and Scientific Committee of the BCNetWORKSHOP 2008** *Trends and Perspectives in Complex Networks*, Barcelona, Spain
- Media coverage**
el Periódico, December 22, 2008
La teoría de los 'seis grados' se abre un hueco en la ciencia
La teoria dels 'sis graus' es fa un lloc en la ciència

Program committees

- Jan 20-23, 2020** **NetSciX 2020**, *International School and Conference on Network Science*, Tokyo, Japan
- Jul 1-3, 2019** **CCS/Italy 2019**, *Italian Regional Conference on Complex Systems*, Trento, Italy
- Mar 18-21, 2019** **CompleNet 2019**, *10th International Conference on Complex Networks*, Tarragona, Spain
- Jun 11-15, 2018** **NetSci 2018**, *International School and Conference on Network Science*, Paris, France
- Jan 5-8, 2018** **NetSciX 2018**, *International School and Conference on Network Science*, Hangzhou, China
- Jun 25-27, 2018** **Summer Solstice 2018 International Conference on Discrete Models of Complex Systems**, Gdansk, Poland
- Sep 17-22, 2017** **CCS 2017**, *Conference on Complex Systems*, Cancun, Mexico
- Mar 23-25, 2016** **CompleNet 2016**, *International Workshop on Complex Networks*, Bourgogne, France

Jan 11-13, 2016	NetSci X 2016, International School and Conference on Network Science , Wroclaw, Poland
Jun 17-19, 2015	Summer Solstice 2015 International Conference on Discrete Models of Complex Systems , Toronto, Canada
Mar 25-27, 2015	CompleNet 2015, International Workshop on Complex Networks , New York, USA
Mar 12-14, 2014	CompleNet 2014, International Workshop on Complex Networks , Bologna, Italy
Jun 22-25, 2014	Summer Solstice 2014 International Conference on Discrete Models of Complex Systems , Ljubljana, Slovenia
Apr 8-13, 2013	Joint CRM-Imperial College School and Workshop in Complex Systems 2013 , Bellaterra, Spain
Mar 13-15, 2013	CompleNet 2013, International Workshop on Complex Networks , Berlin, Germany
Jun 27-29, 2013	Summer Solstice 2013 International Conference on Discrete Models of Complex Systems , Gdansk, Poland
Mar 7-9, 2012	CompleNet 2012, International Workshop on Complex Networks , Florida, USA
Jun 9-10, 2011	Summer Solstice 2011 International Conference on Discrete Models of Complex Systems , Turku, Finland
Oct 13- 15, 2010	CompleNet 2010, International Workshop on Complex Networks , Rio de Janeiro, Brazil
May 26-28, 2009	CompleNet 2009, International Workshop on Complex Networks , Catania, Italy
Dec 10-12, 2008	BCNetWORKSHOP 2008 Trends and Perspectives in Complex Networks , 2008, Barcelona, Spain
29 Jun-1 July, 2006	IEEE TIC-SCH-SENCs International Conference, APFA5 International Conference, 5th SigmaPhi International Conference 2006 , Torino, Italy

Participation in PhD committees

May 2022	Giulia Bertagnolli, Università degli Studi di Trento , Italy
Apr 2018	Dr. Roberta Amato, Universitat de Barcelona , Spain
Oct 2017	Dr. Valerio Gemmetto, University of Leiden , The Netherlands

Aug 2017	Dr. Oriol Senan Campos, Universitet Rovira i Virgili , Spain
Jun 2017	Dr. Federico Battiston, Queen Mary University of London , United Kingdom
May 2017	Dr. Jill Meier, TU Delft , The Netherlands
Jul 2016	Dr. Oleguer Sagarra Pascual, Universitat de Barcelona , Spain
Jun 2016	Dr. Kaj Kolja Kleineberg, Universitat de Barcelona , Spain
Mar 2016	Dr. Pablo Fleurquin Amorós, IFISC , Spain
Jan 2016	Dr. Mario Gutiérrez Roig, Universitat de Barcelona , Spain
Feb 2015	Dr. Juan Ignacio Deza, UPC , Spain
Dec 2014	Dra. Esther Ibáñez Marcelo, UPC , Spain
Jan 2014	Dr. Przemyslaw A. Grabowicz, IFISC , Spain
Apr 2010	Dr. Xavier Castelló, IFISC , Spain
Jul 2009	Dra. Marta Sánchez de la Lama, IFCA , Spain
Jul 2008	Dr. Michele Catanzaro, UPC , Spain

Evaluation committees for fellowships of institutions and agencies

Mar 2023	Professorship in Data Science , Graz University of Technology
2018	Supporting grant “To the Mothers of Science” , Barcelona Institute of Science and Technology BIST
2012	Postdoctoral Fellowships : Mobility stays for young doctors in foreign countries “José Castillejo”, Ministry of Education, ANEP (Spanish National Evaluation and Foresight Agency), Spain
2008-2011	Postdoctoral Fellowships : CSIC JAE-Doc Program, Spain
2010	Postdoctoral Fellowships : Subprogramme “Juan de la Cierva” MICINN, ANEP (Spanish National Evaluation and Foresight Agency), Spain
2008-2011	Predocctoral Fellowships : CSIC JAE-Predoc Program, Spain

Other committees

03/2010 - 02/2012 Equality Commission, Facultat de Química,
Universitat de Barcelona

Reviewing activities

Journals

Nature Physics, Nature Communications, Physical Review X, Physical Review Letters, Physical Review E, Scientific Reports, New Journal of Physics, Europhysics Letters, European Physical Journal B, Journal of Physics A, Journal of Statistical Mechanics: Theory and Experiment, Royal Society Interface, PLOS One, Network Science, Advances in Complex Systems, IEEE Communication Letters, EPJ Data Science, Reports on Mathematical Physics, Physica A, Journal of Economic Dynamics and Control...

Research projects

- 2023** **ERC Synergy grant**, remote reviewer
- 2021** **Dutch Research Council NWO**, Open Competition ENW M20-4 programme
- 2020** **Dutch Research Council NWO**, Domain Applied and Engineering Sciences
- 2020** **Spanish State Research Agency AEI**, Plan Estatal BIO-Biociencias y biotecnología
- 2017** **Spanish National Evaluation and Foresight Agency ANEP**, Plan Estatal Físicas y Ciencias del Espacio
- 2016** **Vienna Science and Technology Fund**, Austria
- 2016** **The Royal Society of New Zealand**, Marsden Fund, New Zealand
- 2016** **German Research Foundation**, DFG Deutsche Forschungsgemeinschaft, Germany
- 2010** **Dutch Research Council NWO**, Complexity Program, Physical Sciences Division
- 2015** **Spanish National Evaluation and Foresight Agency ANEP**, Plan Estatal Físicas y Ciencias del Espacio
- 2013** **Spanish National Evaluation and Foresight Agency ANEP**, Plan Estatal Físicas y Ciencias del Espacio

- 2012** **Spanish National Evaluation and Foresight Agency ANEP**, Plan Estatal Físicas y Ciencias del Espacio
- 2007** **United States-Israel Binational Science Foundation**, USA

Book proposals

Oxford University Press, Cambridge University Press

Teaching

Bachelor's theses, Universitat de Barcelona

Each degree final project has an associated teaching dedication of 8h

- Jun 2023** ***Estimating the dimensionality of complex networks using network geometry and persistent homology***
Mertixell Vila Miñana
- Self-similarity of human brain connectomes***
Carlos Arnedo Joya
- Jan 2023** ***A complex network model for the quantum Internet***
Anna Fernández Albert
- The backbone of a complex weighted network***
Carne Muntada Martorell
- Jun 2022** ***Optimization of the training process in echo state networks***
Aleix Segué Vázquez
- Jun 2020** ***Global vs local rich club metrics in complex networks***
Marc Flo Ponsà
- Jun 2019** ***Regularization of a neural network for binary classification***
Andreu Bécares Mas
- Jun 2018** ***Oriented majority-vote model in social dynamics***
Marc Plana Caballero
- Information transmission in complex neural networks***
Juan José Ojeda Guerrero

- Jan 2018** ***Multiscale dynamics of the Voter model***
Àlex Arcas Cuerda
- Simulation of the Daisyworld model with infiltration***
Juan Carlos Rivera Hernández
- Jun 2017** ***Threshold models and latency states in complex networks***
Aitor Marín Buznego
- Large-scale organization of metabolic networks in cancer and healthy cells***
Orion Pietx
- Sep 2015** ***Analyzing the backbones of fossil fuels international trade networks***
Maurici Victory Molné
- Jun 2013** ***A complex networks approach to the statistics of prime numbers***
Guillermo García Pérez, Extraordinary award

Regular courses, Universitat de Barcelona

- 2022 - 2023** ***Complex Networks***
Màster en Modelització Computacional Atomística i Multiescala en Física, Química i Bioquímica and Master en Física del Sitemes Complexos i Biofísica; 15h
- 2021 - 2022** ***Complex Networks***
Màster en Modelització Computacional Atomística i Multiescala en Física, Química i Bioquímica and Master en Física del Sitemes Complexos i Biofísica; 15h
- 2021 - 2022** ***Biologia de Sistemes Computacional***
Màster en Modelització Computacional Atomística i Multiescala en Física, Química i Bioquímica; 10h
- 2018 - 2019** ***Biologia de Sistemes Computacional***
Màster en Modelització Computacional Atomística i Multiescala en Física, Química i Bioquímica; 10h
- 2017 - 2018** ***Biologia de Sistemes Computacional***
Màster en Modelització Computacional Atomística i Multiescala en Física, Química i Bioquímica; 10h
- 2016 - 2017** ***Biologia de Sistemes Computacional***
Màster en Modelització Computacional Atomística i Multiescala en Física, Química i Bioquímica; 10h
- Complex Systems***
Màster en Física Avançada; 20h

- 2015 - 2016** **Biologia de Sistemes Computacional**
Màster en Modelització Computacional Atomística i Multiescala en Física, Química i Bioquímica; 10h
- Complex Systems**
Màster en Física Avançada; 20h
- Física, 1er semestre**
Grau de Ciències Biomèdiques; 30h
- 2014 - 2015** **Complex Systems**
Màster en Física Avançada; 20h
- Física, 1er semestre**
Grau de Ciències Biomèdiques; 60h
- 2013 - 2014** **Complex Systems**
Màster en Física Avançada; 20h
- Física, 1er semestre**
Grau de Ciències Biomèdiques; 60h
- 2012 - 2013** **Física, 1er semestre**
Grau de Ciències Biomèdiques; 60h
- Càlcul d'una variable, 1er semestre**
Grau d'Enginyeria Electrònica de Telecomunicació i Enginyeria Biomèdica; 15h
- 2011 - 2012** **Càlcul de varies variables, 2n semestre**
Grau d'Enginyeria Electrònica de Telecomunicació i Enginyeria Biomèdica; 8h
- Informàtica Aplicada, 1er semestre**
Grau d'Enginyeria Química; 30h
- Bioenergètica i Transport, 3er semestre**
Grau de Bioquímica; 9h
- 2010 - 2011** **Informàtica Aplicada, 1er semestre**
Grau d'Enginyeria Química; 30h
- Recursos Informàtics, 2n semestre**
Grau de Química; 33,5h
- Bioenergètica i Transport, 3er semestre**
Grau de Bioquímica; 18h
- 2009 - 2010** **Recursos Informàtics, 2n semestre**
Grau de Química; 36h
- Bioenergètica i Transport, 3er semestre**
Grau de Bioquímica; 6h

Intellectual property

- 2000** **PULSAR, portfolio optimization software**
Gerard Torrent Gironella and M. Ángeles Serrano Moral
Registre Provincial de la Propietat Intelectual de Barcelona,
no. B-37245 02/2000/822.
<http://www.generacio.com/aac/index.html>