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# Maxime Lucas

## Current position

10/2021– **Postdoctoral researcher**, *ISI Foundation*, Turin, Italy.

## Past positions

2019–2021 **CENTURI Postdoctoral Fellow**, *Aix-Marseille University*, Marseille, France.

## PhD Thesis

Title *Synchronisation and stability in nonautonomous oscillatory systems*

Supervisors Pr. Aneta Stefanovska and Pr. Duccio Fanelli

Institutions Joint degree between Lancaster University, UK, and University of Florence, Italy

Description This thesis investigates synchronisation and stability in driven systems and networks of coupled oscillators, with an eye on possible applications in biological and other real life systems.

Funding COSMOS, a Marie Curie Initial Training Network (ITN) of the type European Joint Doctorate (EJD).

Dates October 2015–February 2019

## Education

2014–2015 **Master of Artificial Intelligence**, *Katholieke Universiteit Leuven*, Leuven, Belgium, *cum laude*.
Thesis: Instabilities in Cortical Networks with Embedded Synfire Chains

2012–2014 **MSc Physics**, *Université Libre de Bruxelles*, Brussels, Belgium, *magna cum laude*.
Thesis: Instabilités dynamiques de systèmes de billards avec interactions rares

2012 **One-term exchange programme**, *University of Toronto*, Toronto, Canada.

2009–2012 **BSc Physics**, *Université Libre de Bruxelles*, Brussels, Belgium, *cum laude*.

## Publications

### Journal articles


- Zhang, Y. *., Lucas, M. *. & Battiston, F. Do higher-order interactions promote synchronization? *arxiv:2203.03060* (2022).
- Newman, J., Lucas, M. & Stefanovska, A. Stabilization of cyclic processes by slowly varying forcing. *Chaos* **31,** 123129 (2021).

- Lucas, M. *et al.* Inferring cell cycle phases from a partially temporal network of protein interactions. *bioRxiv (preprint)* (2021).
- Lucas, M., Cencetti, G. & Battiston, F. Multiorder Laplacian for synchronization in higher-order networks. *Phys. Rev. Research* **2,** 033410 (2020).
- Battiston, F. *et al.* Networks beyond pairwise interactions: structure and dynamics. *Phys. Rep.* (2020).
- Lucas, M., Fanelli, D. & Stefanovska, A. Nonautonomous driving induces stability in network of identical oscillators. *Phys. Rev. E* **99,** 012309 (2019).
- Newman, J., Lucas, M. & Stefanovska, A. Limitations of the asymptotic approach to dynamics. arXiv:1810.04071 (preprint) (2019).
- Lucas, M., Fanelli, D., Carletti, T. & Petit, J. Desynchronization induced by time-varying network. *Europhys. Lett.* **121,** 50008 (2018).
- Lucas, M., Newman, J. & Stefanovska, A. Stabilization of dynamics of oscillatory systems by nonautonomous perturbation. *Phys. Rev. E* **97,** 042209 (2018).
- Duncan, R. & Lucas, M.. Verifying the Steane code with Quantomatic. *Electronic Proceedings in Theoretical Computer Science* **171,** 33–49 (2014).

### Book chapters

- Lucas, M., Newman, J. M. I. & Stefanovska, A. in *Physics of Biological Oscillators: New Insights into Non-Equilibrium and Non-Autonomous Systems* (eds Stefanovska, A. & McClintock, P. V. E.) *85–110* (Springer International Publishing, Cham, 2021).
- Newman, J. M. I., Lucas, M. & Stefanovska, A. in *Physics of Biological Oscillators: New Insights into Non-Equilibrium and Non-Autonomous Systems* (eds Stefanovska, A. & McClintock, P. V. E.) *111–129* (Springer International Publishing, Cham, 2021).

## Presentations

### Oral at conferences, workshops, and schools

2021 **BeNet2021**, Namur, Belgium, 18 November.
2021 **XIX Curso Boliviano de sistemas complejos**, Online, 5 October.
2021 **Networks 2021**, Online, 5-10 July.
2021 **NetBioMed (Networks2021 satellite)**, Online, 25 June.
2021 **Complenet Live**, Online, 24-26 May.
2020 **CENTURI day, Aix-Marseille University**, Marseille, France, 20 November.
2020 **Belgian Network Research Meeting (BeNet)**, Brussels, Belgium, 12 November.
2020 **Toponets (NetSci satellite)**, Rome, Italty, 18–19 September.
2020 **Networks and Molecular Biology winter school**, Marseille, France, 2–6 March.
2019 **Belgian Network Research Meeting (BeNet)**, Hasselt, Belgium, 22 February.
2018 **COSMOS meeting**, Dolenjske Toplice, Slovenia, 24–27 September.
2018 **Workshop on Long-range Interactions and Synchronization**, São Paulo, Brazil, 28–31 June.
2017 **COSMOS toolbox laboratory**, Brijuni, Croatia, 8–13 October.
2017 **Dynamics Days**, Szeged, Hungary, 5–9 June.

2017 **COSMOS retreat**, Wittenberg, Germany, 26–31 March.

2016 **COSMOS workshop 2**, Amsterdam, Netherlands, 11–16 December.

2016 **COSMOS school 2**, Aberdeen, UK, 27 June–6 July.

2013 **Quantum Physics and Logic (QPL) workshop**, Barcelona, Spain, 17–19 July.

### Seminars

2021 **naXys, Université de Namur**, Namur, Belgium, 18 February.

2021 **CENTURI seminar, Aix-Marseille University**, Marseille, France, 4 February.

2019 **naXys, Université de Namur**, Namur, Belgium, 16 May.

2019 **Department of Network and Data Science, Central European University**, Budapest, Hungary, 29 March.

2018 **Université Libre de Bruxelles**, Brussels, Belgium, 3 April.

2017 **University of Florence**, Florence, Italy, 7 December.

### Posters

2022 **Oustanding challenges in nonlinear dynamics**, Les Houches, France, 21–25 March.

2020 **NetSci**, Rome, Italy, 17–25 September.

2020 **NetBioMed2020 (Netsci satellite)**, Rome, Italty, 17 September.

2020 **Alea day**, Marseille, France, 7 February.

2019 **4th CENTURI day**, Marseille, France, 22 February.

2019 **IBDM days**, Arles, France, 3–4 October.

2019 **Workshop on Higher-order Interaction Networks: Dynamics, Structure, Data**, Oxford, UK, 9–11 September.

2019 **Complenet**, Tarragona, Spain, 18–21 March.

2018 **Analysis and Modeling of Complex Oscillatory Systems (AMCOS)**, Barcelona, Spain, 19–23 March.

2017 **STATPHYS26**, Lyon, France, 18–22 July.

2016 **International conference on biological oscillations (ESGCO)**, Lancaster, UK, 10–14 April.

2015 **Lancaster University Christmas Conference**, Lancaster, UK, 15 December.

## Conference organisation and scientific committees

2018 **Co-organiser of the "Analysis and Modeling of Complex Oscillatory Systems" (AMCOS) conference**, *Barcelona, Spain*, international conference with about 100 participants, website: amcosconference.com.

## Teaching and outreach

2021 **Taught S8BIO2021: Artificial Intelligence**, *École Centrale Marseille, France*, March, 3x2h of introduction to AI for bioengineering students.

2020 **Supervision of undergrad internship**, *Marseille, France*, July, 2-month internship of Alex Townsend-Teague (Uni. Oxford).

2020 **Supervision of undergrad internship**, *Marseille, France*, July, 1-month internship of Arthur Morris (Uni. Oxford).

2017 **Interview for Radio Moka**, *Florence, Italy*, 17 November.

2017 **Masterclass "Waves and oscillations"**, *Lancaster University, UK*, 13 July, We hosted 30 A-level students within the programme Headstart from all over the UK.

2017 **Masterclass "Waves and oscillations"**, *Lancaster University, UK*, 1 March, We hosted 9 A-level students.

2010–2015 **Private tuitions in physics and maths**.

2014 **Teacher at Reussit'school**, *individual tuitions*.

## Awards and grants

2020 **Travel grant**, *from COSTNET Short Term Scientific Mission (STSM)*.

2019 **Travel grant**, *from COSTNET Short Term Scientific Mission (STSM)*.

2018 **Best group project "Plan Bee"**, *at the Mediterranean School of Complex Networks (MSCx)*, Salina, Italy.

2015 **COSMOS PhD Fellowship**, *Marie Curie ITN EJD*.

2011 **Gold medal with the ULB-Brussels Team**, *at the international Genetically Engineerd Machine competition (iGEM) organised by MIT*, Amsterdam, Netherlands.

## Administration

2015–2018 **Early Stage Researcher (ESR) representative**, on the Supervisory board of the COSMOS ITN.

2011–2012 **Student representative**, at the Physics Department, Université Libre de Bruxelles, Brussels, Belgium.

## Service

Referee for Sci. Rep., Commun. Phys., Philos. Trans. Royal Soc. A, PLOS ONE, Chaos, Commun. Nonlinear Sci. Numer. Simul.

Program committee for FRCCS

## Computer skills and project

Languages Python, Matlab, Fortran, Java, Prolog, LaTeX

OS Windows, Linux

Other LaTeX template for conference booklet: `github.com/maximelucas/AMCOS_booklet`

Phasik: python package to infer temporal phases in temporal networks, `phasik.readthedocs.io/`

CompleX Group Interactions (XGI): python package that provides data structures and algorithms for modeling and analyzing complex systems with group (higher-order) interactions, `xgi.readthedocs.io/`

## Languages

- French: mother tongue
- English: fluent (IELTS: 8/9 in 2015)
- Italian: advanced
- Dutch: advanced
- Hungarian: beginner

## Interests

Music (play the violin), football, squash, hiking, former youth movements leader

## References

**Alain Barrat, CNRS Research Director.**
Centre de Physique Théorique, Aix-Marseille University, France.
Email: alain.barrat@cpt.univ-mrs.fr

**Bianca Habermann, CNRS Research Director.**
Computational biology group, IBDM, Aix-Marseille University, France.
Email: bianca.habermann@univ-amu.fr

**Aneta Stefanovska, Professor.**
Nonlinear and Biomedical Physics, Physics Department, Lancaster University, UK.
Email: aneta@lancaster.ac.uk

**Duccio Fanelli, Assoc. Professor.**
CSDC, Departement of Physics and Astronomy, University of Florence, Florence, Italy.
Email: duccio.fanelli@unifi.it