



# Complex networks: theory, methods and applications

Lake Como School of Advanced Studies, 18-22 May 2015 (Como)



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## Complex networks: theory, methods, and applications

Many real systems can be modeled as networks, where the elements of the system are nodes and interactions between elements are edges. An even larger set of systems can be modeled using **dy-namical processes on networks**, which are in turn affected by the dynamics. Networks thus represent the backbone of many **complex systems**, and their theoretical and computational analysis makes it possible to gain insights into numerous applications. **Networks permeate almost every conceivable discipline** —including sociology, transportation, economics and finance, biology, and myriad others — and the study of “network science” has thus become a crucial component of modern scientific education.

The school “**Complex Networks: Theory, Methods, and Applications**” offers a succinct education in network science. It is open to all aspiring scholars in any area of science or engineering who wish to study networks of any kind (whether theoretical or applied), and it is especially addressed to **doctoral students** and **young postdoctoral scholars**. The aim of the school is to deepen into both theoretical developments and applications in targeted fields.

Download the [mini-poster](#) (pdf) of the school.

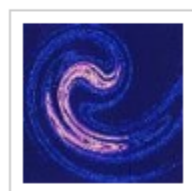
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## Application

**The School will be open to 50 qualified and selected students.**

Registration fee: **400 euro**, VAT 22% included.

The fee covers all lectures; course material; wi-fi connections; lunches and coffee breaks for four days.

**HOW TO APPLY:** Prospective participants have to fill out and submit the form below, and upload a 1-page letter succinctly describing their educational background, current position, research interests, and motivations for participating in the School.

### Deadlines

- Student application: March 15, 2015
- Notification of acceptance: March 31, 2015
- Registration (only accepted students): April 15, 2015

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*The [Complex Systems Society](#) (CSS), in the framework of the [TSS Program](#), grants 3 fee waivers to support the attendance of PhD students and Junior Post Doctoral researchers (no more than two years from their PhD completion) who are members of the CSS.*

*Prospective participants who are eligible for the TSS grant should accompany their application (see the form below) with an email to the Organizing Committee (Carlo Piccardi, email [carlo.piccardi@polimi.it](mailto:carlo.piccardi@polimi.it)) requiring the fee waiver, providing evidence of their eligibility. The acceptance will be notified together with the admission to the school (before March 31, 2015).*

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### APPLICATION FORM

**APPLICATIONS CLOSED ON MARCH 15, 2015.**

**We received 112 applications (with 7 TSS fee waiver requests), we will process them in the next days in order to notify acceptance before March 31, as scheduled.**





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## Payment by credit card

Payments will be processed through the **secure PAYPAL system**.

You do not need to set up a PayPal account to complete the transaction (but you can use yours if you have one!). *Please note: for some countries (eg. France) a Paypal account might be needed!*

**Please note: inform us if the participant is not the cardholder!**

NTMA registration fee - Euro 400,00 (VAT22% included)

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Additional remarks :

**Pay Now**





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## Contacts

For enquiries about **the content of the course**, please contact Carlo Piccardi ([carlo.piccardi@polimi.it](mailto:carlo.piccardi@polimi.it)) or any other member of the [Organizing Committee](#).

For enquiries about the **venue** of the school, **travel**, **accommodation**, and **application** procedure, please contact Alessandra Cazzaniga ([alessandra.cazzaniga@centrovolta.it](mailto:alessandra.cazzaniga@centrovolta.it)) at Centro Volta, Como.





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## Lecturers



**Stefano Battiston**  
*University of Zurich*  
<http://www.bf.uzh.ch/cms/de/battiston.stefano.html>



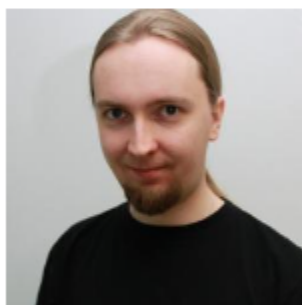
**Vittoria Colizza**  
*Inserm & Université Pierre et Marie Curie, Paris, and ISI Foundation, Turin*  
<http://www.epicx-lab.com/vittoria-colizza>



**Santo Fortunato**  
*Aalto University*  
[http://becs.aalto.fi/en/personnel/staff/fortunato\\_santo.html](http://becs.aalto.fi/en/personnel/staff/fortunato_santo.html)



**Petter Holme**  
*Sungkyunkwan University*  
<http://www.tp.umu.se/~holme/>



**Mikko Kivelä**  
*University of Oxford*  
<http://www.maths.ox.ac.uk/people/mikko.kivela>



**Yamir Moreno**  
*University of Zaragoza*  
<http://cosnet.bifi.es/people/yamir-moreno>



**Carlo Piccardi**  
*Politecnico di Milano*  
<http://home.deib.polimi.it/piccardi/>



## Participants



**1 / 2** Santo Fortunato **3** Tomas Balint **4** Federico Botta **5** Gianluigi Rossi **6 / 7** Ricardo Silva **8** Migowski da Silva Ana Lucia **9** Delphine Nicolay **10** Nadezhda Semenova **11 / 12** Young Jin KIM **13** Kohei Tamura **14 / 15** Amir Sani **16** Carlo Piccardi **17** Andrea Capozucca **18** Olga Baranov **19** Inaki Aldasoro **20** Ariel Wirkierman **21 / 22** Eleonora Andreotti **23** Evelina Giacchi **24** Soudeh Yaghouti **25 / 26** Silvia mara Lavezzi **27** David Schlachtberger **28** Viktorija Veselic **29** Giulia Carra **30** Olga Sokolova **31** Francesca Arrigo **32** Francesca Ieva **33** Pietro Coletti **34** Alberto Areta **35 / 36** Jusaf Dana **37** Mateusz Wilinski **38** Domenico Brunetto **39** Bryan Iotti **40** Schaar Konstantin **41 / 42 / 43 / 44** Mirko Di Giacomo **45** Mattia Bongini **46** Tommaso Panini **47** Francisco Lique **48** Lorenzo Ricciardi **49** Giacomo Albi **50** Irene Sanchez Arjona **51** Arlindo Flavio da Canceiçao **52 / 53** Bohr Brask Josefina **54 / 55** Alice Guerini **56** Julien Petit **57** Ville Merila **58** Alessandro di Stefano **59 / 60 / 61 / 62 / 63** Jason Basset **64** Federico Canobbio (Fondazione Volta) **65** Giulio Casati (Fondazione Volta)



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## Program

### Monday, 18 May, morning (9.30-12.30)

**Introduction to complex networks** (Piccardi): What is a (complex) network. Types of networks and their representation. Quantifying network properties: Distance, diameter, clustering coefficient, degree distribution, centrality. Network models: random (Erdos-Rényi), scale-free (Barabási-Albert), small-world (Watts-Strogatz).

### Monday, 18 May, afternoon (14.30-17.30)

**Temporal networks** (Holme): Types and representations of temporal networks. Spreading processes. Data sets and algorithms. Randomization techniques. Measures of temporal network structure. Open problems and future challenges.

### Tuesday, 19 May, morning (9.30-12.30)

**Community detection in networks** (Fortunato): Introduction. Basic notions of communities and partitions. Modularity optimization, limits. Local approaches. Testing methods. Consensus clustering. Testing the zero-postulate: annotated versus real clusters.

### Tuesday, 19 May, afternoon (14.30-17.30)

**Multilayer networks** (Kivelä): Introduction and background. Conceptual and mathematical framework. Classifying multilayer networks. Data and tools. Models, methods, diagnostics, and dynamics.

### Wednesday, 20 May, morning (9.30-12.30) and afternoon (14.30-17.30)

**Complex financial networks** (Battiston): The lectures cover the main theoretical notions to understand network models of financial contagion. Some time is also devoted to practical exercises with provided software-tools (Gephi and Matlab) introducing the students to the analysis of empirical financial networks and to simple stress-tests on real financial networks.

### Thursday, 21 May, morning (9.30-12.30) and afternoon (14.30-17.30)

**Contagion dynamics: epidemics on networks** (Colizza, Moreno): Infectious diseases modeling: background and principles. Homogeneous mixing. Contact networks. Advanced modeling topics. Applications to real epidemics.

### Friday, 22 May

no lectures





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## Organizing Committee



**Stefano Battiston**  
*University of Zurich*  
<http://www.bf.uzh.ch/cms/de/battiston.stefano.html>



**Vittoria Colizza**  
*Inserm & Université Pierre et Marie Curie, Paris, and ISI Foundation, Turin*  
<http://www.epicx-lab.com/vittoria-colizza>



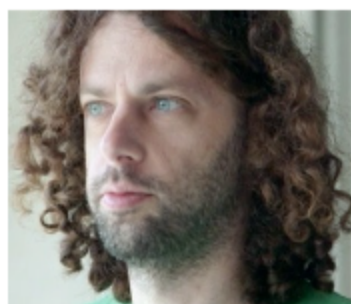
**Petter Holme**  
*Sungkyunkwan University*  
<http://www.tp.umu.se/~holme/>



**Yamir Moreno**  
*University of Zaragoza*  
<http://cosnet.bifi.es/people/yamir-moreno>



**Carlo Piccardi**  
*Politecnico di Milano*  
<http://home.deib.polimi.it/piccardi/>



**Mason Porter**  
*University of Oxford*  
<https://people.maths.ox.ac.uk/porterm/>







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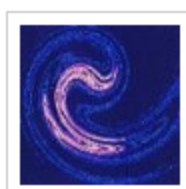
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[Oxford University Press](#)

*Download the leaflet (pdf, 2 pages) [Complex Networks from Oxford University Press](#).*

*You can get a special 20% discount off OUP titles. Visit <http://ukcatalogue.oup.com> and add WEBLCSA discount code at the checkout (valid until 31/12/2015).*



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## Venue and accommodation

The School is housed in [Villa del Grumello](#), Como, which is set in a park over Como lake.



### How to get there

[Click here for information on how to reach Como.](#)

Villa del Grumello is 20 min on foot from Como city center – you can also take a bus, lines 6 and 11 (bus stop: “Como Via Regina Piscine Villa Olmo”, just after “Villa Olmo”).

From the main Train Station (Como S. Giovanni), the nearest bus stop to catch line 6 and 11 is “Piazzale Rocchetto”.

[Click here for a map.](#)

### Accommodation

Villa del Grumello has a **guest house** (“foresteria”) with 19 beds in 2- or 4-bed rooms. The rate is **37 euros** per night (breakfast not included; a kitchen for self preparing breakfast is available).

A few rooms have been blocked in 2- and 3-star **hotels in Como**, with rates ranging from 80 to 112 euros per night (breakfast included).

The **School Secretariat** will take care of the accommodation of the accepted students who have accomplished the payment of the fee, and who have filled out and sent a suitable [accommodation form](#) before April 24, 2015.

