

Mason Porter (Mathematical Institute, University of Oxford, UK)  
Title: "Networks: Structure and Dynamics"

"Network Science" is the science of connectivity, and it is one of the most exciting developments in modern science. Complex systems of interacting entities can often be represented using the language of networks, and numerous tools have now been developed to help achieve answers to a host of interesting questions about network structure and function. Here are just a few examples: How does one measure the most important people in a social network or the most important roads in a city? How does one determine the social organization of a university starting from local information about friendships? What is the best vaccination strategy to minimize the propagation of a disease?

I will introduce the subject of networks in three parts. In the first lecture, I will give an introduction to a few basic ideas, network types, and network diagnostics [1]. In the second, I will introduce mesoscale structures in networks. I will concentrate on "community structure" [2], which is the most popular type of mesoscale network structure, but I will briefly discuss others as well. In the third lecture, I will introduce dynamical systems on networks [1,3,4,5]. For this last topic, my main theme will be the effect of nontrivial network structure for dynamical systems on networks.

[1] M. E. J. Newman, *Networks: An Introduction*, Oxford University Press (2010).

[2] M. A. Porter, J.-P. Onnela, *Communities in Networks*, *Notices of the American Mathematical Society*, Vol. 56, No. 9, 1082-1097 and 1164-1166 (2009).

[3] A. Barrat, M. Barthelemy, and A. Vespignani, *Dynamical Processes on Complex Networks*, Cambridge University Press (2008).

[4] J. P. Gleeson, *Binary-State Dynamics on Complex Networks: Pair Approximation and Beyond*, *Physical Review X*, Vol. 3, No. 2, 021004 (2013).

[5] M. A. Porter and J. P. Gleeson, *Dynamical Systems on Networks: A Tutorial* (in preparation).