



# Modern Mathematics Workshop 2018

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## SPEAKER TITLES/ABSTRACTS

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**Bio:**

Mathematics degree from UNAM in Mexico City (2002), Masters (Part III, 2003) and PhD (2007) in Cambridge University, Researcher (Investigador Titular) at the Instituto de Matematicas UNAM since 2009, tenured 2016. Carried out long research stays in LMU University of Munich, CIMAT Guanajuato, Max Planck Institute for Mathematics Bonn, UPC Barcelona, University of Nantes, ETH Zurich, IPAM in UC Los Angeles, and UC Santa Barbara. Interests lie in geometry and topology, and the applications they can have to data, networks, and the analysis of cultures.

**Abstract:**

**“Taming the Homotopy of Networked Data”**

Whether comparing networks to each other or to random expectation, measuring similarity is essential to understanding the complex phenomena under study. However, there is no canonical way to compare two networks. Having a notion of distance that is built on theoretically robust first principles and that is interpretable with respect to important features of complex networks would allow for a meaningful comparison between different networks. We introduced an efficient new measure of graph distance, based on the marked length spectrum. It compares the structure of two undirected, unweighted graphs by considering the lengths of non-backtracking cycles. We show how this distance relates to structural features such as presence of hubs and triangles through the behavior of the eigenvalues of the non-backtracking matrix, and we showcase its ability to discriminate between networks in both real and synthetic data sets. By taking a topological interpretation of non-backtracking cycles, this work presents a novel homotopical application of topological data analysis to the study of complex networks.

This is joint work with Leo Torres and Tina Eliassi-Rad, from Northeastern University.