

# LECTURE 25



## **Dr. Henri Berestycki**

- **Professor at the School for Advanced Studies in the Social Sciences in Paris and Chair of Mathematical Analysis and Modeling Program IAS Senior Visiting Fellow. His accolades include the Carriere Prize from the French Academy of Sciences (1988) William Noris Chair, Department of Computer Science and Engineering, University of Minnesota, 2006-present**
- **the Humboldt-Gay Lussac Award from the Alexander von Humboldt Foundation in Germany (2004) Fellow of the American Association for the Advancement of Science (AAAS), 2011**
- **the Knight of the Legion of Honour in France (2010); Fellow of the American Mathematical Society (2013); International Honorary Member of the American Academy of Arts and Sciences (2013)**
- **Sackler Scholar at the Advanced Studies Institute of Tel Aviv University (2017); and Honorary Professor at Harbin Institute of Technology (2017).**

**Date: 2024.03.19**

TAMKANG CLEMENT AND CARRIE CHAIR

# Modelling epidemics with diffusion

**Henri Berestycki, Ph.D.**  
(School for Advanced Studies in the Social Sciences  
and University of Maryland, USA)

**3.19** 2024 (Tue), 14:00-16:00 守謙國際會議中心有連廳  
理學院 數學學系 敬邀

AI+SDGs=∞ ESG+AI=∞

## INTRODUCTION

- Professor Henri Berestycki is a professor and chair of the Mathematical Analysis and Modeling Program at the Ecole Supérieure des Sciences Sociales in Paris, France. He is a senior visiting researcher at IAS. His research interests include partial differential equations, nonlinear analysis, calculus of variations, mathematical physics, and nonlinearity. Qualitative theory of parabolic and elliptic partial differential equations, reaction-diffusion equations, communication phenomena, mathematical modeling in physics,

biology, ecology, epidemiology and social sciences. He is a CSE Distinguished Professor of the University of Minnesota in 2005, the William Norris Chair of the University of Minnesota, since 2006, SIAM (*Society for Industrial and Applied Mathematics*) Fellow class of 2010, a Fellow of the AAAS (*American Association for the Advancement of Science*), 2011, and the 2023 recipient of the SIAM John von Neumann Prize.

- Published more than 160 high-quality SCI journal papers, cited 9170 times by 3857 authors. He received his PhD from the Sorbonne

in 1975. He is currently the Director of the Center for Mathematical Analysis and Modeling at the Ecole Supérieure des Sciences Sociales. He has served on the editorial boards of numerous journals, most notably *Annales de l'Institut Henri Poincaré Analyze nonlineaire* and *Journal of the European Mathematical Society*. He has served as associated editors of journals: *SIAM Journal on Numerical Analysis*, *IEEE Journal on Parallel and Distributed Computing*, *Computer Physics Communications*, and *SIAM Journal on Matrix Analysis*. He is now an Associated Editor of journals: *Electronic Transactions of Numerical Analysis* (since 2001), *Journal of Numerical Linear Algebra with Applications* (since 1992).

- Received many honors and awards.

This includes the Carriere Prize of the French Academy of Sciences in Paris (1988); the Humboldt-Guy-Lussac Prize of the Humboldt Foundation in Germany (2004); Chevalier de la Legion d'honneur (2010); Fellow of the American Mathematical Society (2013); International Honorary Fellow of the College of Arts and Sciences (2013); Sackler Scholar at Tel Aviv University's Institute for Advanced Study (2017); and Emeritus Professor of Harbin Institute of Technology (2017). He is often invited to be a keynote speaker at international conferences. We hope that through the opportunity of this Panda Lecture invitation, we can provide our colleagues with forward-looking and innovative research suggestions.

## Topic : Modelling Epidemics with Diffusion

### **ABSTRACT**

**Numerical linear algebra is at the core of virtually every field of science and engineering, whether in solving linear systems that arise from simulations of physical phenomena, or in obtaining various solutions of optimization problems in data related applications. As the world around us is progressively being analyzed or modeled with the help of available data, the types of computational problems encountered are changing, and as a result the field is currently**

undergoing a deep transformation. This lecture will present an overview of the methodologies used in both the scientific computing and the data science disciplines, with an emphasis on what distinguishes these two worlds. We will examine in some detail the idea of 'dimension reduction', a common tool that is exploited in solving data mining and machine learning problems. Dimension reduction is based on the precept that the observed data often lies in a noisy version of a low-dimensional subspace and so it is critical to work in this subspace not only to reduce computational cost but also to improve accuracy. At the core of dimension reduction methods are low-rank approximation techniques which are also quite common in various applications in science and engineering. One of the difficulties encountered in this class of methods is to find the inherent approximate rank of the data at hand. We will show how a few simple random sampling methods for computing spectral densities and counting eigenvalues can be used for this purpose. Among other topics, the talk will also cover applications of graph Laplaceans, such as clustering and image segmentation, as well as methods for analyzing networks. It will also illustrate how the idea of graph coarsening has been developed independently by data scientists and numerical analysts. Finally, in an era where Deep Learning is becoming omnipresent, it is essential to discuss how this trend is impacting numerical methods in general, starting with the change in the kinds of mathematical analysis tools employed to the change of software and programming languages used. As an example, we will see how nonlinear acceleration methods developed mainly for scientific computing have been adapted for accelerating optimization algorithms in neural networks

# MINUTE

## Meet with the Chairperson of the Board, Dr. Henri Berestycki



Meet President Ge Huanzhao and TKU colleagues



**Dr. Zhang Jianbang of Tamkang University and Mr. and Mrs. Zhang Jiangwenqi's Panda Lectures were delivered at the International Conference Center**

- **Professor Henri Berestycki visited Tamkang University during March 19, 2024. Prof. Jong-Shenq Guo at the Department of Mathematics of TKU made receptions and accompanied him during his stay at Hwei-wen Hall. His visit was honored by Tamkang Clement and Carrie Chair Lecture Fund in Taiwan.**
- **Before the lecture at TKU, Professor Henri Berestycki visited the president of the school Huan-Chao Keh and the chairman Zhang Jiayi. A warm welcome to the first Chairman's Lecture. Professor Henri Berestycki also visited the Tamsui campus of Tamkang University and was deeply impressed by the beautiful campus.**
- **Professor Henri Berestycki delivered a two-hour Chair Lecture on and Modeling epidemics with diffusion conference center on March 19, 2024. There were many faculty and hundreds of students from the Department of Mathematics attending the lecture. When delivering his speech, Professor Henri Berestycki received great attentions from the audience and interacting with the audience during the Q&A session**

**activity photos**



**Dean of the Faculty of Science, Dr. Szezengeren presented a bronze panda trophy to Professor **Henri Berestycki****



**Photos with Dean of Science College, Dr. Tzenge-Lien Shih and Mathematics Faculty**





speech scene



speech scene



Participating teachers and students focus on listening



Participating teachers and students focus on listening



Take a group photo with Dr. Schzengelian, Dean of the School of Science, and teachers from the Department of Mathematics



Campus photo