Plenary Lectures
Conférences plénières

LAURA DEMARCO, Northwestern University
Complex dynamics and arithmetic equidistribution

I will explain a notion of arithmetic equidistribution that has recently found application in the study of complex dynamical systems. It was first introduced about 25 years ago, by Szpiro-Ullmo-Zhang, to analyze the geometry and arithmetic of abelian varieties. In 2011, Matt Baker and I used the theory to study periodic points of maps on $\mathbb{P}^1$. In this talk, I will explain some dynamical questions that were inspired by questions about elliptic curves, and then how the dynamical results allowed us to solve problems in the original setting of abelian varieties. The new results are joint with Holly Krieger and Hexi Ye.

HENRY FOWLER, Navajo Technical University
Naayee – The Warrior that Overshadows Poverty

Henry Fowler Abstract Plenary Lecture Canadian Mathematical Society

Naayee – The Warrior that Overshadows Poverty

The landscape is occupied by Monsters according to the Navajo oral traditional teaching. The Monsters slayed the People using their sharp eyes. Some Monsters still live among the People today. The Navajo Nation and Navajo leaders are challenged by Navajo students underachieving in mathematics in grades 3 to 12. I will discuss my initiative to combat the Monster of Navajo students' failure to be proficient in mathematics and share some culturally relevant math lessons. Navajo Math Circles was originated to assist in addressing the dismaying outlook of Navajo students' achievement in math education. Navajo Math Circles works with over 50 mathematicians to promote math education in the Navajo Nation. The Math Circles is directly looking at the eye of the Monster and transforming math education for teachers and students to find joy in learning mathematics. The Navajo Math Circles is the Warrior Naayee, combating poverty in the Navajo Nation through mathematics.

FLORIAN HERZIG, University of Toronto
On the p-adic Langlands program

The p-adic Langlands correspondence is a conjectural link between p-adic representations of $\mathrm{GL}(n)$ (or more general reductive groups) and p-adic Galois representations, generalising the classical Langlands correspondence. In the case $n = 2$ this is by now well-understood and has yielded some exciting arithmetic applications, whereas for $n > 2$ the situation has so far been much more mysterious. I want to give a gentle introduction to this subject, not assuming previous exposure to the Langlands program.

ANITA LAYTON, University of Waterloo
Modeling and Simulation for Drug Development

Computational modeling can be used to reveal insights into the mechanisms and potential side effects of a new drug. Here we will focus on two major diseases: diabetes, which affects 1 in 10 people in North America, and hypertension, which affects 1 in 3 adults. For diabetes, we are interested in a class of relatively novel drug treatment, the SGLT2 inhibitors (sodium-glucose co-transporter 2 inhibitors). E.g., Dapagliflozin, Canagliflozin, and Empagliflozin. We conduct simulations to better understand any side effect these drugs may have on our kidneys (which are the targets of SGLT2 inhibitors). Interestingly, these drugs may have both positive and negative side effects. For hypertension, we want to better understand the sex differences in the efficacy of some of the drug treatments. Women generally respond better to ARBs (angiotensin receptor blockers) than ACE inhibitors (angiontensin converting enzyme inhibitors), whereas the opposite is true for men. We have developed the first sex-specific computational model of blood pressure regulation, and applied that model to assess whether the "one-size-fits-all" approach to blood pressure control is appropriate with regards to sex.

YANIV PLAN, University of British Columbia
The role of random models in compressive sensing and matrix completion

Random models lead to a precise and comprehensive theory of compressive sensing and matrix completion. The number of random linear measurements needed to stably recover a sparse signal, or a low-rank matrix, or, more generally, a structured signal are now well understood. Indeed, this boils down to a question in random matrix theory: How well conditioned is a random matrix restricted to a fixed subset of R^n? We discuss recent work addressing this question in the sub-Gaussian case. Nevertheless, a practitioner with a fixed data set will wonder: Can they apply theory based on randomness? Is there any hope to get the same guarantees? We discuss these questions in compressive sensing and matrix completion, which, surprisingly, seem to have divergent answers.