

**Journées du GDR EFI 2022**

**Report of Contributions**

Contribution ID: 1

Type: **not specified**

## Arithmetic dynamics

*Monday, September 12, 2022 10:30 AM (1 hour)*

We give an introduction to arithmetic dynamics and the questions in the area intended for a broad audience with an emphasis on connections to other branches of mathematics.

**Primary author:** BELL, Jason P. (University of Waterloo)

**Presenter:** BELL, Jason P. (University of Waterloo)

Contribution ID: 2

Type: **not specified**

## **Ising model on random planar maps via Tutte's invariants.**

*Monday, September 12, 2022 9:00 AM (1 hour)*

I will present a survey of recent and not so recent results about combinatorial random planar maps decorated (or not !) with a statistical physics model. I will put a special emphasis on the combinatorial aspects of this story. In particular, I will introduce and explain the method of Tutte's invariants to solve some functional equations.

**Presenter:** ALBENQUE, Marie

Contribution ID: 3

Type: **not specified**

# The Fundamental Theorem of Tropical Partial Differential Algebraic Geometry

*Tuesday, September 13, 2022 2:30 PM (40 minutes)*

Given a partial differential equation (PDE), its solutions can be difficult, if not impossible, to describe.

The purpose of the Fundamental theorem of tropical (partial) differential algebraic geometry is to extract from the equations certain properties of the solutions.

More precisely, this theorem proves that the support of the solutions in  $k[[t_1, \dots, t_m]]$  (with  $k$  a field of characteristic zero) of differential equations can be obtained by solving a so-called tropicalized differential system.

**Presenter:** HAIECH, Mercedes (Université de Limoges)

Contribution ID: 4

Type: **not specified**

## Abelian reduction of differential equations

*Tuesday, September 13, 2022 3:30 PM (40 minutes)*

Kolchin's differential Galois theory is a generalization of Picard-Vessiot theory for which the Galois groups are algebraic groups but not necessarily linear. In the one dimensional case, Kolchin's theory can be applied to the study of elliptic differential equations and Riccati equations.

I will describe some structural results concerning the higher-order differential equations (and in particular a full classification of the second-order autonomous equations) to which Kolchin's theory can be applied. This is joint work with Rahim Moosa.

**Presenter:** Dr JAOUI, Rémi (CNRS)

Contribution ID: 5

Type: **not specified**

## Towards a description of the algebraic closure of multivariate power series

*Monday, September 12, 2022 1:30 PM (40 minutes)*

We consider the algebraic closure of  $K((x))$ ,  $x = (x_1, \dots, x_r)$ ,  $\text{char}(K) = 0$ , namely what we call the field of algebroid Puiseux series, viewed as a subfield of the so-called field of rational polyhedral Puiseux series. Our target is to solve the following problems:

- given a polynomial equation  $P(x, y) = 0$  for  $P \in K[[x]][y]$ , provide a closed form formula for the coefficients of an algebroid Puiseux series solution  $y(x)$  in terms of the coefficients of  $P$ ;
- given an algebroid Puiseux series  $y(x)$ , reconstruct algorithmically the coefficients of a vanishing polynomial  $P \in K[[x]][y]$  using the coefficients of the series.

Our strategy involves the answers that we recently obtained to the same type of questions about algebraic Puiseux series, i.e. for the algebraic closure of  $K(x)$ .

Joint work in progress with M. Hickel (U. Bordeaux)

**Presenter:** Dr MATUSINSKY, Mickaël (Institut de Mathématiques de Bordeaux)

Contribution ID: 6

Type: **not specified**

## Algorithms for the holonomic and non-holonomic universe

*Monday, September 12, 2022 3:30 PM (40 minutes)*

A univariate sequence is called holonomic, if it satisfies a linear difference equation with polynomial coefficients. Likewise, a univariate holonomic function satisfies a linear differential equation with polynomial coefficients. In the multivariate (mixed) case, holonomic objects are also characterized through systems of linear difference-differential equations. These equations give a way to finitely represent holonomic objects on the computer. It is well known that based on this representation identities on holonomic expressions can be discovered and proven automatically. Recently with Antonio Jimenez Pastor and Philipp Nuspl, we have studied certain extensions of, e.g., the class of holonomic functions to objects that satisfy linear differential equations with holonomic function coefficients and of computational properties that carry over. In this talk, I want to give an overview on the use of the classical algorithms as well as these recent extensions.

**Presenter:** Dr PILLWEIN, Veronika (Research Institute for Symbolic Computation Johannes Kepler University)

Contribution ID: 8

Type: **not specified**

## The Galois group of irregular $q$ -difference equations

*Monday, September 12, 2022 2:30 PM (40 minutes)*

The Galois group of irregular  $q$ -difference equations with integral slopes was described by Ramis and Sauloy, along with a Riemann-Hilbert correspondence, based on classification results by Ramis-Sauloy-Zhang. The complete determination of a discrete Zariski-dense subgroup, the “wild fundamental group” allowed to solve the inverse problem in that case. For arbitrary slopes, the wild fundamental group has also been determined, but no corresponding progress has been made for the inverse problem. The talk will be purely descriptive.

**Presenter:** SAULOY, Jacques



Contribution ID: 9

Type: **not specified**

## Matzat's conjecture in differential Galois theory

*Tuesday, September 13, 2022 1:30 PM (40 minutes)*

Determining the absolute differential Galois group of interesting differential fields is a central problem in differential Galois theory. For the fields of formal and convergent Laurent series the solution is well-known, but the classical case of rational functions has long resisted a solution. Matzat's conjecture predicts the structure of the absolute differential Galois group of the rational function field, and more generally, of one-variable function fields. In this talk, I will review recent progress towards Matzat's conjecture.

**Presenter:** Mr WIBMER, Michael (Graz University of Technology)

Contribution ID: 10

Type: **not specified**

## Hypergeometric diagonals and a step towards Christol's conjecture

*Wednesday, September 14, 2022 11:40 AM (40 minutes)*

Even though diagonals of multivariate rational functions have been studied from various viewpoints, they still remain quite mysterious objects. An example for this is the widely open conjecture by Christol which characterizes diagonals inside the class of all D-finite functions. In 2012 Bostan, Boukraa, Christol, Hassani, and Maillard created a list with 116 potential counter examples for this conjecture. As of today, using new kinds of identities involving diagonals and hypergeometric functions, 40 of these examples were resolved by the starting work of Abdelaziz, Koutschan and Maillard and the generalization by Bostan and the speaker.

In the talk I will explain how the key identities were found and proven, indicate their various implications, and finally mention limitations and possible extensions. The talk is based on joint work with A.~Bostan.

**Presenter:** YURKEVICH, Sergey (University Paris-Saclay and University of Vienna)

Contribution ID: **11**

Type: **not specified**

## Arithmetic dynamics

We give an introduction to arithmetic dynamics and the questions in the area intended for a broad audience with an emphasis on connections to other branches of mathematics.

**Primary author:** Prof. BELL, Jason P. (University of Waterloo)

**Presenter:** Prof. BELL, Jason P. (University of Waterloo)

Contribution ID: 12

Type: **not specified**

## Arithmetic dynamics

*Tuesday, September 13, 2022 9:00 AM (1 hour)*

We give an introduction to arithmetic dynamics and the questions in the area intended for a broad audience with an emphasis on connections to other branches of mathematics.

**Primary author:** Prof. BELL, Jason P. (University of Waterloo)

**Presenter:** Prof. BELL, Jason P. (University of Waterloo)

Contribution ID: 13

Type: **not specified**

## **Ising model on random planar maps via Tutte's invariants**

*Tuesday, September 13, 2022 10:30 AM (1 hour)*

I will present a survey of recent and not so recent results about combinatorial random planar maps decorated (or not !) with a statistical physics model. I will put a special emphasis on the combinatorial aspects of this story. In particular, I will introduce and explain the method of Tutte's invariants to solve some functional equations.

**Presenter:** ALBENQUE, Marie

Contribution ID: 14

Type: **not specified**

## Arithmetic dynamics

*Wednesday, September 14, 2022 9:00 AM (1 hour)*

We give an introduction to arithmetic dynamics and the questions in the area intended for a broad audience with an emphasis on connections to other branches of mathematics.

**Primary author:** Mr BELL, Jason P. (University of Waterloo)

**Presenter:** Mr BELL, Jason P. (University of Waterloo)

Contribution ID: 15

Type: **not specified**

## **Ising model on random planar maps via Tutte's invariants**

*Wednesday, September 14, 2022 10:30 AM (1 hour)*

I will present a survey of recent and not so recent results about combinatorial random planar maps decorated (or not !) with a statistical physics model. I will put a special emphasis on the combinatorial aspects of this story. In particular, I will introduce and explain the method of Tutte's invariants to solve some functional equations.

**Presenter:** ALBENQUE, Marie