MONDAY, July 8, 2019, room S2 416-2

10:00 Bernhard Endtmayer *Tutorial: Finite Element Methods*

11:15 Jiayue Qi *Moduli space for* $((\mathbb{P})^1)^n$

LUNCH BREAK

13:00 Sebastian Falkensteiner *Tutorial: A short introduction to Algebraic Geometry*

14:15 Nicolas Allen Smoot *A Connection Between Arithmetic, Analysis, and Topology*

15:15 Martin Schwalsberger *Tutorial: Inverse Problems*

16:30 Get-Together at Teichwerk

Moduli space for $(\mathbb{P})^1)^n$
Jiayue Qi

Let $n \geq 3$ be an integer. We study the equivalence induced by the group action of PGL_2 on the space $(\mathbb{P}^1)^n$: two n-tuples are equivalent if there is a projective automorphism transforming one into the other. Given two n-tuples $p, q \in (\mathbb{P}^1)^n$, it is easy to decide whether they equivalent: one may reduce the question to the case of m pairwise distinct points for $m \leq n$. In this case, equivalence holds if and only if all cross ratios defined by all corresponding quadruples in p and in q coincide.

The purpose of this talk is to give a self-contained construction of a variety that is isomorphic to the Knudsen-Mumford moduli space, using only basic algebraic geometry.

Tutorial: A short introduction to Algebraic Geometry
Sebastian Falkensteiner

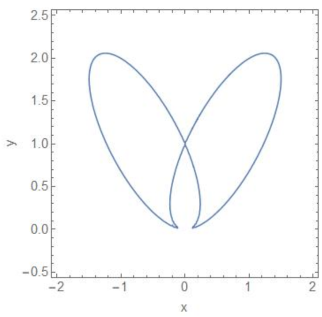
The talk is mainly covering a brief introduction to algebraic geometry. In particular I will speak about polynomial ideals and its relations to algebraic sets, their arithmetic and the possibilities to represent an algebraic set. In the end, this will lead to parametrizations of algebraic curves.

For example the roots of the polynomial

$$f(x,y) = 2x^4 - 3x^2y + y^4 - 2y^3 + y^2$$

in $\mathbb{C}^2$ are a curve in the plane. Another possibility to represent this curve is given by the rational parametrization

$$x(t) = \frac{t^3 - 6t^2 + 9t - 2}{2t^4 - 16t^3 + 40t^2 - 32t + 9}, \quad y(t) = \frac{t^2 - 4t + 4}{2t^4 - 16t^3 + 40t^2 - 32t + 9}.$$



Some questions we want to tackle are:

1. Can we find a framework to describe such objects?
2. Can we actually make computations with such objects?
3. Can we always find such parametrizations of these objects?

[1] J.R. Sendra and F. Winkler and S. Perez-Diaz, *Rational Algebraic Curves - A Computer Algebra Approach*. Springer, 2008.

A Connection Between Arithmetic, Analysis, and Topology

Nicolas Allen Smoot

The first substantial discovery in the arithmetic properties of the partition function p(n) was made in 1918. Ramanujan proved multiple individual partition congruences before making a considerably deep conjecture about an infinite family of congruences. Congruence families of this type have since become a major research problem in contemporary number theory. What appears at first sight to be little more than a question about summation over the natural numbers holds significant and astounding connections—not only with the analytic theory of modular functions, but with the topological properties of Riemann surfaces. In particular, the question of how accessible an infinite family of congruences may be to proof is closely related to the genus of the associated Riemann surface. We will outline the progress made in this subject over the last century by Watson, Atkin, Gordon, Paule, Radu, and others. We will also discuss the increasing complexity of the most recent problems, and how the increasing importance of experimental methods necessitates the application of symbolic computation.