Prof. Dr. Werner Bley
Prof. Dr. Cornelius Greither
Prof. Dr. Gregor Kemper
Prof. Dr. Markus Land
Prof. Dr. Andreas Nickel
Prof. Dr. Andreas Rosenschon

Sommersemester 2024

Arithmetische und Algebraische Geometrie

Mittwoch 16-18, LMU Theresienstr. 39, Raum B251 oder TUM, Garching, Boltzmannstr. 3, Raum 02.08.020

17.04.2024 .
Title:
Abstract:

24.04.2024 Martin Kreuzer (Passau)
Title: On Border Basis Schemes
Abstract: One of the key features of Algebraic Geometry is the existence of moduli spaces, i.e., of schemes whose closed points correspond to certain types of algebraic varieties or schemes. An intensely studied case is the Hilbert scheme $\mathrm{Hilb}^{\mu}(\mathbb{P}^n_K)$ parametrizing 0-dimensional subschemes of a fixed projective space over a field K. Performing explicit computer calculations for these schemes has been notoriously difficult, because the presentations of their coordinate rings provided by Grothendieck's construction are hard to make explicit and involve large numbers of indeterminates and defining equations.

Here border basis schemes come to the rescue. For an order ideal $\mathcal{O}$ of terms, i.e., for a divisor-closed finite set of terms, the border basis scheme $\mathbb{B}_{\mathcal{O}}$ parametrizes all 0-dimensional affine schemes for which the terms in $\mathcal{O}$ define a K-vector space basis of their coordinate ring. These schemes form an open covering of the Hilbert scheme and have explicitly describable, well-manageable defining equations.

After recalling the construction and some basic properties of border basis schemes, we survey some recent joint work with Lorenzo Robbiano (Genova) and Le Ngoc Long (Hue) concerning their computational aspects. We consider important subschemes of $\mathbb{B}_{\mathcal{O}}$ such as the homogeneous border basis scheme, the maxdeg border basis scheme, and various subschemes parametrizing properties such as being locally Gorenstein, strictly Gorenstein, strict complete intersections, having the Cayley-Bacharach property, etc.

The last topic is a new technique, called Z-separating embeddings, for re-embedding schemes from high-dimensional spaces into lower-dimensional spaces which avoids the potentially costly calculation of Gröbner bases and allows us, for instance, to prove that certain border bases schemes are isomorphic to affine spaces and some are not.

08.05.2024 Theodosis Alexandrou (Hannover).
Title: Torsion in Griffiths Groups
Abstract: The Griffiths group $\mathrm{Griff}^i(X)$ of a smooth complex projective variety X is

the group of nullhomologous codimension$-i$ cycles on X modulo algebraic equivalence. Recently Schreieder gave the first examples of smooth complex projective varieties X for which the Griffiths group has infinite torsion. In his examples the infinitely many torsion classes are of order 2. In this talk we show that for any integer $n \geq 2$, there is a smooth complex projective 5$-$fold X whose third Griffiths group contains infinitely many torsion elements of order n.

15.05.2024 Robert Pollack (Boston University)
Title: Slopes of modular forms and the ghost conjecture
Abstract: Modular forms are holomorphic functions with a wealth of symmetries. Even though these functions are borne out of complex analysis, their Fourier coefficients contain a wealth of arithmetic information. Even bounding the sizes of these coefficients involve very deep mathematics – the best bounds follow from Deligne's proof of the Weil conjectures, for which he was awarded the Fields medal.

In this talk, rather than looking at complex absolute values, we will instead focus on the p-adic size of p-th Fourier coefficient for a prime number p. We will state a conjecture (the ghost conjecture) which gives an exact description of these sizes for all modular forms. This funnily named conjecture converts difficult automorphic questions into more accessible combinatorial ones. We will discuss the state of this conjecture and its applications to several open questions on slopes of modular forms.

22.05.2024 .
Title:
Abstract:

29.05.2024 .
Title:
Abstract:

05.06.2024 David Burns (King's College, London)
Title:
Abstract:

12.06.2024 .
Title:
Abstract:

19.06.2024 .
Title:
Abstract:

26.06.2024 .
Title:
Abstract:

03.07.2024 Adebisi Agboola (Santa Barbara).
Title:
Abstract:

10.07.2024 .
Title:
Abstract:

17.07.2024 .
Title:
Abstract:

24.07.2024 .
Title:
Abstract: