Montag, 8. April 2019, Hörsaal 11 — Balázs Szendröi (University of Oxford)

15:00 Uhr: Didaktischer Vortrag
"Rational parametrisation of conics"

I will prove that a nonsingular projective plane conic over field, containing a point, can be rationally parametrised. I will illustrate the main theorem by a concrete example, where the parametrisation will lead to classical formulae. Previewing what will come later in the course, I will also discuss what happens when the degree of the curve increases.

15:35 Uhr: Wissenschaftlicher Vortrag
"Hilbert schemes of points on singular surfaces and representation theory"

Given a smooth algebraic surface S over the complex numbers, the Hilbert scheme of points of S is the starting point for many investigations, leading in particular to generating functions with modular behaviour (due to Goettsche) and Heisenberg algebra representations (due to Grojnowski and Nakajima). I will explain aspects of a similar story for surfaces with rational double points (partly based on joint work with Gyenge and Nemethi), where the representations arising are those of affine Lie algebras and (conjecturally) their W-algebras. I will also briefly mention generalisations of these ideas to threefolds (partly based on joint work with Davison and Ongaro).

Donnerstag, 11. April 2019, Hörsaal 2 — Gavril Farkas (Humboldt Universität zu Berlin)

15:00 Uhr: Didaktischer Vortrag
"Der Hilbertsche Syzygiensatz"

Bewiesen in 1890, der Hilbertsche Syzygiensatz spielt heutzutage eine Schlüsselrolle in der algebraischen Geometrie, der kommutativen Algebra und der Computeralgebra. Der Satz besagt, dass jeder endlich erzeugter Modul über dem Polynomring in n+1 Variablen, eine Auflösung der Länge n besitzt. Ich werde über die verschiedenen Beweise berichten.

15:35 Uhr: Wissenschaftlicher Vortrag
"Algebraic curves, syzygies and topological invariants of groups"

I will discuss the deep connection between the structure of the equations of certain algebraic varieties and Alexander invariants of groups. On the algebro-geometric side, this parallelism has recently led to a very simple proof of Green's Conjecture on syzygies of canonical curves, whereas on the topological side has produced a universal bound on the nilpoteny index of the fundamental group of non-fibred compact Kähler manifolds.

Freitag, 12. April 2019, Hörsaal 15 — Bruno Klingler (Humboldt Universität zu Berlin)

9:00 Uhr: Didaktischer Vortrag
"Around quaternions"

On which finite dimensional real vector spaces can we define an associative bilinear multiplication with unit making them into fields (not necessarily commutative)? In 1843 Hamilton discovered such a field structure on $\mathbb{R}^4$: the field of quaternions $\mathbb{H}$. And can we classify all such fields? In 1877 Frobenius proved that any such field is isomorphic either to $\mathbb{R}, \mathbb{C}$ or $\mathbb{H}$. After recalling Hamilton's construction and the proof of Frobenius' theorem, we will dive into the beautiful properties of quaternions.

9:35 Uhr: Wissenschaftlicher Vortrag
"Tame topology and algebraic geometry"

In "Esquisse d'un programme" Grothendieck argues that general topology, which was developed for the needs of analysis, should be replaced by a "tame topology" if one wants to study the topological properties of natural geometric forms. Such a tame topology has been developed by model theorists under the name "o-minimal structures". The goal of this lecture will be to explain in simple topological terms the notion of o-minimal structure and its applications in algebraic geometry, in particular for studying periods of algebraic varieties.

Freitag, 12. April 2019, Hörsaal 11 — Nero Budur (KU Leuven)

15:00 Uhr: Didaktischer Vortrag
"Quadratic reciprocity"

The quadratic reciprocity law of Gauss is one of the most important results in number theory. Its modern ramifications lead to very active research areas in mathematics such as, for example, the Langlands program. In this lecture we will motivate and introduce quadratic reciprocity as a fast decision algorithm for deciding if simple quadratic equations have solutions modulo a prime number, and we will present one of the shortest proofs of quadratic reciprocity known.

15:35 Uhr: Wissenschaftlicher Vortrag
"Groups and geometry"

The space of representations of the fundamental group of an algebraic variety form important topological invariants connecting group theory with geometry. In this talk, we illustrate the principle that the geometry of these spaces and of all their natural subspaces is extremely rich and rigid at the same time. In rank one, this principle is a theorem. In higher rank, focusing on the smallest non-trivial varieties, curves, we provide a purely group-theoretic application, the currently best bound for the growth rate of the numbers of irreducible complex representations of $SL_n(Z)$ of a fixed dimensions.