MASARYK UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF MATHEMATICS AND STATISTICS

Call 2017 - Public Talks

room	date	time	speaker	title	abstract
M1	**12.6.** Monday	4pm	**Rafael Andrist** (**Swiss**, PhD - **Bern** (2011), positions - **Wuppertal**)	**Symmetries in Complex Geometry**	While the classical function theory devoted to the study of holomorphic functions on complex manifolds is well understood, the systematic study of holomorphic maps and holomorphic automorphisms is a rather recent development and a very active area of research. I will give a short introduction to the Oka principle, i.e. a homotopy principle for holomorphic maps, and will then focus on highly symmetric complex manifolds which enjoy having a large group of holomorphic automorphisms. I will discuss some interesting open problems and present my own contributions.
M1	**13.6.** Tuesday	4pm	**John Bourke** (**Irish**, PhD - **Sydney** (2010), positions - Brno, **Sydney**)	**Skew monoidal categories and their applications**	Many structures in mathematics admit some notion of tensor product. For example, we have the cartesian product of sets, the tensor product of vector spaces and of chain complexes. The common abstract features of such tensor products are captured by the useful concept of a monoidal (aka tensor) category. In 2012 a rather curious generalisation known as a skew monoidal category was introduced by Szlachanyi, in the study of bialgebroids over rings. I will describe some of my own research on skew monoidal categories, which relates to homotopy theory. In particular I will explain how I used them to resolve an old problem of Hyland and Power concerning the construction of monoidal bicategories, as well as some current research with Steve Lack.
M5	**14.6.** Wednesday	3pm	**Georg Biedermann** (**German**, PhD - **Bonn** (2004), positions - Bonn, Barcelona, Bielefeld, Bogota, Osnabrück, **Paris**)	**A generalized Blakers-Massey Theorem**	We will give a short introduction leading to the classical Blakers-Massey theorem (or Homotopy Excision). Then we will explain the ingredients for our generalized Blakers-Massey theorem. These consist of higher topos theory and of our notion of modality, a unique factorization system whose left class is closed under base change. We will then derive the classical Blakers-Massey theorem from our generalized one. If time permits we will mention another application, a Blakers-Massey theorem for the Goodwillie tower of a homotopy functor. This is based on joint work with Anel, Finster, and Joyal.
M5	**14.6.** Wednesday	4pm	**Andrii Khrabustovskiy** (**Ukrainian**, PhD - **Kharkiv** (2010), habil. - KIT Karlsruhe (2017), positions - Nac. Akad. Sci. Ukraine, **KIT Karlsruhe**)	**Periodic media with predefined spectral properties**	It is well-known that the spectrum of self-adjoint periodic differential operators has the form of a locally finite union of compact intervals called *band* . In general the bands may touch each other and even overlap. The bounded open interval $(a,b) \leq \mathbf{R}$ is called a *gap* in the spectrum $\sigma(H)$ of the operator H if $(a,b) \cap \sigma(H)=\emptyset$, a, b in $\sigma(H)$. The presence of gaps in the spectrum is not guaranteed. For example, the spectrum of the Laplacian in $L_2 \mathbf{R}^n$ has no gaps: $\sigma(\Delta_{\mathbf{R}} n)=(-\infty,0]$. Therefore the natural problem arises here: to construct examples of periodic operators with non-void spectral gaps. This problem has been actively studied since mid of the 90th and currently a lot of examples for various classes of periodic operators are available in the literature. The interest in this problem is motivated by various applications, in particular, to photonic crystals. For applications, it is important not only to open spectral gaps, but also be able to control their location and length via a suitable choice of operator coefficients or/and geometry of the medium. In the talk we give an overview of the results, where this problem is studied for various classes of periodic differential operators. In a nutshell, our goal is to construct an operator (from some given class of periodic operators) with spectral gaps being close to predefined intervals.
M1	**15.6.** Thursday	4pm	**Matthias Hammerl** (**Austrian**, PhD - **Vienna** (2009), habil. - Vienna (2015), positions - Vienna, **Greifswald**)	**Geometric overdetermined differential equations: Questions, Methods and Challenges**	Overdetermined PDEs govern a wide range of interesting phenomena in differential geometry, ranging from the study of infinitesimal symmetries to metrization problems. Solutions also exhibit highly interesting singularity sets which have a close relationship with special properties of the background geometry. In this talk I will discuss classical problems and equations and review currently available methods and tools for their study. In particular, I will discuss how holonomy methods yield information about the zero sets of solutions. Finally, I will give a short outlook on the main future challenges in this area.
M1	**16.6.** Friday	3pm	**Katharina Neusser** (**Austrian**, PhD - **Vienna** (2010), positions - Vienna, Canberra, **Prague**)	**Symmetry and Geometric Rigidity**	In differential geometry many important geometric structures are geometrically rigid in the sense that their automorphism groups in some natural topology are finite-dimensional Lie groups. Prominent examples of such structures are Riemannian manifolds, conformal manifolds, projective structures and in general all geometric structures admitting equivalent description as so-called Cartan geometries, which comprise a huge variety of geometric structures. Generically these geometric structures have trivial automorphism groups and so the ones among them with large automorphism groups or special types of automorphisms are typically geometrically and topologically very constrained and hence can often be classified. Recall for instance that a Riemannian manifold with an isometry group of largest possible dimension is isometric to a space of constant curvature. In this talk I will present several new and also discuss some classical results along these lines, concerned with (local) automorphism groups of various geometric structures and local and global questions of geometric rigidity.
M5	**19.6.** Monday	4pm	**Phuoc-Tai Nguyen** (**Vietnamese**, PhD - **Orléans** (2012), positions - Haifa, Hochimin City, **Santiago de Chile**)	**Nonlinear elliptic equations and singular problems**	Over the last decades nonlinear elliptic equations have become a central subject of study in the theory of partial differential equations since they play an important role in the modeling of a great number of phenomena in various areas such as: physics, astrophysics and population dynamics. An important family of such equations is that consisting of two competing effects: the diffusion expressed by a differential operator and the reaction produced by a super-linear nonlinearity. In this talk, I will present recent results concerning singular problems for such equations with different types of diffusion and reaction and discuss some related problems.
M1	**20.6.** Tuesday	4pm	**Alexey Remizov** (**Russian**, PhD - **Moscow** (2003), positions - Moscow, Porto, Trieste, CNRS, Sao Paulo, **Ecole Polytechnique Paris**)	**Two selected topics in the theory of differential equations: singularities of the geodesic flows in pseudo-Riemmanian metrics and anthropomorphic image reconstruction**	The first topic lies between ordinary differential equations, singularity theory and differential geometry. A study of singularities of the geodesic flows in pseudo-Riemannian metrics with varying signature is of great interest from mathematical and physical viewpoints. In this talk, we restrict our attention to the basic local properties of such flows and the local behavior of geodesics at points where the metric degenerates. For instance, geodesics cannot pass through a degenerate point in all tangent directions, but only in some admissible directions. In the second part of the talk, I present an approach to the inpainting problem based on some classical ideas from neurogeometry of vision, sub-Riemannian geometry and theory of partial differential equations. The main tool is so-called hypoelliptic (sub-Riemannian) diffusion on the projectivized tangent bundle of the plane. Developing this approach, we obtain a completely parallelizable numerical method for image reconstruction, which is effective even for highly corrupted images.