Higher Geometric Structures along the Lower Rhine XII
January 31 - February 1, 2019 - Radboud University Nijmegen

Program

January 31 (all talks in HG01.028)

14:00 - 15:00: ~~Kedziorek~~ Carchedi

15:15 - 16:15: Villatoro

16:15 - 16:45: Coffee break

16:45 - 17:45: Strung

18:30: Conference Dinner

February 1 (all talks in HG00.303)

09:45 - 10:00: Coffee

10:00 - 11:00: Bandklayder

11:15 - 12:15: Yudilevich

12:15 - 14:00: Lunch break

14:00 - 15:00: Rasekh

15:00 - 15:30: Coffee break

15:30 - 16:30: Sepe

Location

All talks take place in the Huygensgebouw, Heyendaalseweg 135, Nijmegen, The Netherlands

Description

This is the twelfth in a series of short workshops jointly organized by geometers and topologists from Bonn, Nijmegen and Utrecht, all situated along the Lower Rhine. The focus lies on the development and application of new structures in geometry and topology such as Lie groupoids, differentiable stacks, Lie algebroids, generalized complex geometry, topological quantum field theories, higher categories, homotopy algebraic structures, higher operads, derived categories, and related topics.

Organizers

The workshop series is organized by Christian Blohmann, Marius Crainic, Ioan Mărcuț, Ieke Moerdijk and Steffen Sagave, and the local organizers for this workshop are Ioan Mărcuț and Steffen Sagave.

Speakers, titles and abstracts

- Lauren Bandklayder (MPIM Bonn): *The Dold-Thom theorem via factorization homology*
  Abstract: The Dold-Thom theorem is a classical result in algebraic topology giving isomorphisms between the homology groups of a space and the homotopy groups of its infinite symmetric product. The goal of this talk is to outline a new proof of this theorem, which is direct and geometric in nature. The heart of this proof is a hypercover argument which identifies the infinite symmetric product as an instance of factorization homology.

- David Carchedi (George Mason University / MPIM Bonn): *Dg-manifolds and a universal property for derived manifolds*
  Abstract: Given two smooth maps of manifolds $f\colon M \to L$ and $g\colon N \to L$, if they are not transverse, the fibered product $M \times_L N$ may not exist, or may not have the correct cohomological properties. Thus lack of transverality obstructs many natural constructions in topology and differential geometry. Derived manifolds generalize the concept of smooth manifolds to allow arbitrary (iterative) intersections to exist as smooth objects, regardless of transversality. In this talk we will describe recent progress of ours with D. Roytenberg on giving an accessible geometric model for derived manifolds using differential graded manifolds. We will also discuss a universal property characterizing the higher category of derived manifolds, and recent progress as to how this concrete model satisfies this property.

- ~~Magdalena Kedziorek~~ (U Utrecht): ~~*Rational G-spectra - an overview*~~
  Talk canceled due to illness

- Nima Rasekh (MPIM Bonn): *An Axiomatic Approach to Algebraic Topology*
  Abstract: An elementary higher topos is a higher category that is defined using only elementary conditions, yet behaves similar to the category of spaces. The goal of this talk is to illustrate this connection by proving classical results from algebraic topology in this abstract setting. Concretely, we will use the fact that it satisfies descent, which a kind of a local-to-global condition, to construct natural number objects. This allows us to use inductive arguments. Using induction, we will then construct truncations and show that we can also prove the Blakers-Massey theorem.

- Daniele Sepe (Universidade Federal Fluminense): *Near toric integrable systems*
  Abstract: In recent years there has been interest in studying families of integrable systems that generalise integrable toric actions while retaining important similarities, like connectedness of the fibres. One such family is that of semitoric systems on four dimensional compact symplectic manifolds: these are integrable systems one of whose integrals generates a circle action and with the property that all singular orbits are either of the types that occur in toric manifolds or are complex hyperbolic (focus-focus). These systems have been intensely studied in recent years: Pelayo and Vu Ngoc have classified them and Le Floch, Pelayo and Vu Ngoc have studied their quantum counterparts. However, there are reasons to look beyond semitoric systems. First, it can be shown that not all compact four dimensional symplectic manifolds endowed with a Hamiltonian circle action possess one such system. Second, the analogous definition in higher dimensions is rather restrictive and does not allow for singularities that appear naturally, say, when considering special Lagrangian fibrations. In this talk we introduce the class of near toric systems that generalises semitoric systems in any dimensions and (should!) allow to deal with the above issues. The aim of the talk is to prove that the fibres of such systems on compact symplectic manifolds are connected and, time permitting, to illustrate how one may go about trying to classify them.
  This is based on joint work with Susan Tolman.

- Karen Strung (RU Nijmegen): *Noncommutative Geometry of the Quantum Grassmannians*
  Abstract: How does one associate a noncommutative geometry to Drinfeld-Jimbo quantum groups? For now, the question remains wide open, but the compact quantum Hermitian symmetric spaces appear to have a fundamental role to play . The notion of noncommutative Kähler geometry was recently introduced to study these quantum spaces and many of the fundamental results of classical Kähler geometry were shown to follow from the existence of such a structure. In particular, it implies a direct noncommutative generalisation of Hodge theory. I will discuss joint work with Andrey Krutov and Réamonn Ó Buachalla which applies this framework to the quantum Grassmannians and their Schubert calculus.

- Joel Villatoro (KU Leuven): *On the singularities of the Weinstein groupoid*
  Abstract: This talk is regarding joint work with Rui Fernandes. Not every Lie algebroid is integrable. In this talk I will revisit the original paper by Crainic and Fernandes where the obstructions to integration were first discovered. Their approach to the problem was by studying the smoothness of the leaf space of an infinite dimensional foliation. In this talk I will show that one can refine their techniques to explicitly compute monodromy and holonomy of this leaf space. I will then discuss the applications of this computation to the subject of integrating algebroids via 2-groupoids.

- Ori Yudilevich (KU Leuven): *Classification Problems of Infinite Type*
  Abstract: An nice application of Lie groupoids and Lie algebroids, which takes its roots in the classical work of Élie Cartan, is their use in classifying geometric structures of a given class. For example, it was recently shown by Fernandes and Struchiner (to appear soon) that Robert Bryant's classification of Kähler-Bochner manifolds (2001) can be understood as the integration of a certain Lie algebroid (that encodes the classification problem) to a Lie groupoid (that encodes the solutions, i.e. the space of structures one is classifying). This method, however, is limited to a special class of classification problems known as problems of "finite type". Roughly speaking, this means that the space of solutions is parametrized by a manifold of finite dimension. In this talk, I will present the notion of a Bryant groupoid and Bryant algebroid (generalizing Lie groupoids and Lie algebroids), a notion that can be used to also tackle classification problems of "infinite type". This notion, which stems from the work of Robert Bryant, exhibits interesting behavior that brings together ideas from Lie theory, on the one hand, and from the theory of geometric PDEs, on the other.
  This talk is based on joint work with Rui Loja Fernandes.