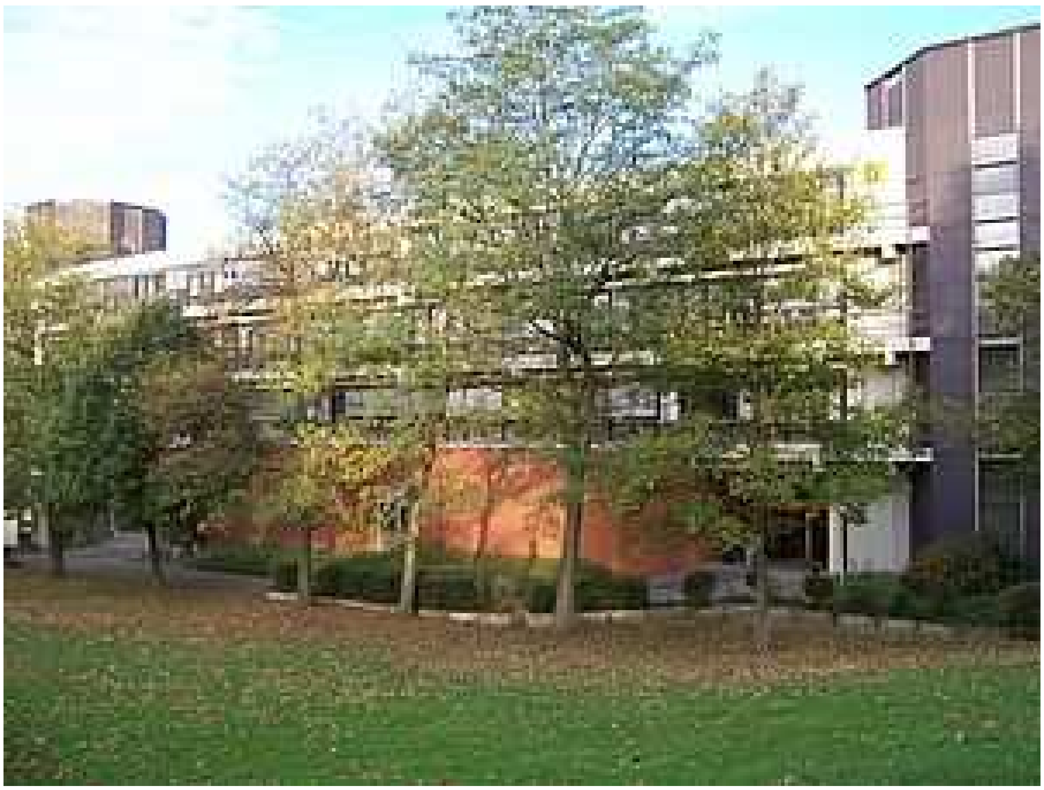
Workshop on Infinite-dimensional Lie Groups and Related Functional Analysis



University of Paderborn
November 6 - 8, 2008

Contents

1 Minicourses

1.1 Manifolds of bounded geometry and their diffeomorhpism groups

by J. Eichhorn

Let

$$Au = 0 \quad (D)$$

be a (linear or non-linear) PDE on a Riemannian manifold (M^n, g), $\mathcal{G}$ the automorphism group of (D), $\mathcal{L}$ the set of all possible solutions of (D), $\mathcal{S}$ the set of all solutions,

$$\mathcal{C} = \mathcal{L}/\mathcal{G}$$

the configuaration space

$$\mathcal{M} = \mathcal{S}/\mathcal{G}$$

the moduli space of (D).
The main task of global analysis consists in establishing $\mathcal{S} \neq \emptyset$ and in calculating the topology and geometry of $\mathcal{M}$.
Examples are Einstein equations

$$\mathrm{Ric}(g) = \kappa g, \ \mathcal{G} = \mathrm{Diff}(M),$$

equations of gauge theory

$$\delta R^\omega = 0, \ \mathcal{G} = \text{ gauge group.}$$

To attack these problems, we need reasonable and natural topologies in $\mathcal{L}$, $\mathcal{G}$, $\mathcal{C}$, $\mathcal{S}$, $\mathcal{M}$, in particular $\mathcal{G}$ as a good completed group, with a good action and - if any possible - a slice. For M^n compact, to introduce such topologies is not a serious problem. This has been done by Eells/Palais already 40 years ago.
For M^n open, their approach fails, and the construction of Banach manifolds of maps was for a long time an open problem.
We considered manifolds of bounded geometry and defined appropriate Sobolev uniform structures and by means of them completed spaces of maps

$$\Omega^{p,r}((M, g)(N, h)),$$

the components of which are Sobolev manifolds, for $p = 2$ even Hilbert manifolds.
In case $(N, h) = (M, g)$, we obtain by restriction completed diffeomorphism groups

$$\mathcal{D}_{\omega}^{p,r}(M, g, \omega),$$

ω a symplectic or volume form, and other ones. The main problem is to establish the uniform structure, i.e. to prove that the defined family of neighbourhoods of the diagonal is a basis for a metrizable uniform structure. This amounts to Sobolev estimates of the derivatives of Jacobi fields which are really very terrible.

References

1. J. Eichhorn, *Global analysis on open manifolds*, New York, 2007, 664 pp.

2. J. Eichhorn, The manifold structure of maps between open manifolds, *Annals of Global Analysis and Geometry* **11** (1993), 253 -300.

3. J. Eichhorn, R. Schmid, Form preserving diffeomorphisms on open manifolds, *Annals of Global Analysis and Geometry* **14** (1996), 147-206.

4. J. Eichhorn, G. Heber, The configuration space of gauge theory on open manifolds of bounded geometry, *Banach Center Publ.* **39** (1997), 269-286.

5. J. Eichhorn, R. Schmid, Lie groups of Fourier integral operators on open manifolds, *Comm. Anal. Geom.* **9** (2001), 983-1040.

1.2 Infinite dimensional Lie groups and semibounded representations

by Karl-Hermann Neeb

In the first part of this minicourse we give a survey on some aspects of general infinite-dimensional Lie theory. Here we put an emphasis on integrability problems (which are mostly trivial for finite-dimensional groups). A central question is how to decide for a locally convex Lie algebra if it integrates to an infinite-dimensional Lie group and to integrate morphisms of locally convex Lie algebras? Other related problems are: integrating Lie algebra extensions, integrating Lie subalgebras and integrating Lie algebras of vector fields.
In the second part we turn to some functional analytic issues of unitary representations of infinite-dimensional Lie groups. We discuss the class of semibounded representations (spectra of many infinitesimal generators are bounded below) and some of its basic properties. Finally we discuss a few classes of groups with a rich supply of semibounded representations.

1.3 Spaces of real analytic functions

by Dietmar Vogt

In recent time the space $A(\Omega)$ of real analytic functions on an open set $\Omega \subset \mathbb{R}^d$ or on a real analytic manifold has been studied by various authors with interesting new results. We will present and explain some of these results. Our topics will be:

- The canonical locally convex topology on $A(\Omega)$ and its basic properties.
- Homological properties, relation to certain topological linear invariants.
- Nonexistence of bases on $A(\Omega)$.
- Linear partial differential equations on $A(\Omega)$.
- Real analytic subvarieties of $\mathbb{R}^d$.
- Complemented ideals in $A(\mathbb{R}^d)$.

1.4 Inductive limits of Fréchet spaces

by Jochen Wengenroth

(LF)-spaces, that is, countable inductive limits of Fréchet spaces in the category of locally convex spaces, were introduced by Dieudonné and Schwartz and later on investigated by Grothendieck and many others.
In this minicourse we will show that several apparently technical regularity problems are essential for example in applications to partial differential operators and we will present the complete solution of these problems for the class of inductive limits of Fréchet-Montel spaces. In particular, the open problem from Grothendieck's thesis has a positive solution in this case.
We will briefly explain a concrete application to linear partial differential equations and, if the time permits, contrast the general results with (seemingly) similar questions in the catgory of locally m-convex algebras.

2 Main lectures

2.1 Compact holomorphic mappings

by Richard Aron

A holomorphic function $f : E \to F$ between complex Banach spaces is said to be *compact* if for all $x \in E$ there exists a neighborhood V_x of x such that $\overline{f(V_x)}$ is compact. We will review some properties of compact holomorphic mappings, thereby reprising work done with R. M. Schottenloher that in turn uses work of R. Meise and K.D. Bierstedt. In addition, we will discuss some recent developments and problems in this area.

2.2 Triangular integrals with applications to Lie group decompositions

by Daniel Beltiţă

The triangular integrals are suitable infinite-dimensional versions of the operation of taking the upper triangular part (the lower diagonal part, or the diagonal, respectively) of a square matrix. In the case of the operators on infinite-dimensional spaces, triangularity is defined by means of a totally ordered set of closed linear subspaces. The order type of this set plays a central role in the process of computing the triangular integrals as limits of the block triangular matrices defined with respect to finite partitions of the totally ordered set under consideration. We are going to take a close look at these integrals, since they provide one of the main functional analytic ingredients of a method of constructing smooth Iwasawa decompositions for many of the classical Banach-Lie groups of Hilbert space operators. Some of the key points of our exposition can be summarized as follows:

- operator ideals and sequence spaces;
- symmetric norming functions and the corresponding norm ideals;
- convergence of triangular integrals and factorizations;
- classical groups associated with operator ideals;
- Iwasawa decompositions for Banach-Lie groups.

2.3 Spaces of continuous and holomorphic functions with weight conditions

by Klaus D. Bierstedt

We survey some properties of spaces of continuous and holomorphic functions the topology of which is given by weighted sup-seminorms. The building blocks are the spaces

$$\begin{aligned} Cv(X) &:= \{f \text{ continuous complex valued on } X;\ p_v(f) = \sup_X v|f| < \infty\}, \\ Cv_0(X) &:= \{f \in Cv(X);\ vf \text{ vanishes at infinity on } X\}, \end{aligned}$$

where X is a completely regular Hausdorff space and v is a nonnegative upper semicontinuous weight, resp. the corresponding spaces $Hv(G)$, $Hv_0(G)$ of holomorphic functions on an open set G in N complex dimensions.
Intersections of the building blocks lead to Nachbin's weighted spaces $CV(X)$ and $CV_0(X)$. Many examples can be given. Nachbin used the spaces to discuss the weighted approximation problem and to prove (for $CV_0(X)$) generalizations of the Stone-Weierstrass theorem and of Bishop's theorem in approximation theory.
Countable unions of the building blocks, endowed with the locally convex inductive limit topology, are the so-called weighted inductive limits $\mathcal{V}C(X)$ and $\mathcal{V}_0C(X)$. Their holomorphic counterparts $\mathcal{V}H(G)$ and $\mathcal{V}_0H(G)$ occur in many applications. Together with R. Meise and W.H. Summers, projective hulls of these spaces were introduced, and the projective description problem was studied in order to get an explicit formula for a basis of the continuous seminorms of the inductive limit topology.
The following two references only mark the beginning of long developments:

References

1. Leopoldo Nachbin, Elements of approximation theory, xii + 119 pp., Reprint of the 1967 edition, Krieger 1976.

2. Klaus D. Bierstedt, Reinhold Meise, William H. Summers, A projective description of weighted inductive limits, Trans. Amer. Math. Soc. **272**, 107 -160 (1982).

2.4 Composition and superposition operators on weighted Banach spaces of holomorphic functions of type H^∞

by José Bonet

The purpose of this lecture is to present a survey on recent research on composition operators $C_\varphi : f \to f \circ \varphi$, for a self-map φ on D, on weighted spaces of holomorphic functions $Hv(D)$ and $Hv_0(D)$ on the unit disc D of the complex plane. These Banach spaces are defined by weighted sup-seminorms and were investigated by Shields, Williams, Lusky and others. We will discuss continuity, compactness, essential norm, the spectrum, compactness of differences of compositon operators, isometries and operators with compact range among other topics, thus reporting on work which started in a paper by Bonet, Domański, Lindström and Taskinen [1] and continued in many other articles, like the recent one [2].
Superposition opertors $S_\varphi : f \to \varphi \circ f$, for an entire function φ on the same weighted Banach space will be briefly considered.

References

1. J. Bonet, P. Domański, M. Lindström, J. Taskinen, Composition operators between weighted Banach spaces of analytic functions, J. Austral. Math. Soc. (Series A) 64 (1998), 101-118.

2. J. Bonet, M. Lindström, E. Wolf, Isometric weighted composition operators on weighted Banach spaces of type H^∞, Proc. Amer. Math. Soc. 136 (2008), 4267-4273.

2.5 The philosophy behind convenient calculus

by A. Kriegl

The ideas behind convenient calculus will be sketched. The case of Denjoy-Carleman mappings as a new instance will serve as illustration of the general principles, including some basic ideas of proofs.

2.6 Infinite dimensional Lie groups via convenient calculus

by Peter W. Michor

After a very short presentation of convenient calculus (smooth, holomorphic, real analytic, Denjoy-Carleman) and its main properties I will sketch its uses in the field of infinite dimensional Lie groups, in particular groups of diffeomorphisms of certain classes, including Denjoy-Carleman classes.

2.7 Diffeomorphism groups and complex fluids

by Tudor Ratiu

This talk will present an overview of the affine Lie-Poisson reduction theorem and will concentrate on its application to complex fluids. In particular, the equations of motion of liquid crystals are presented in both the director as well as the micropolar theory. The role of diffeomorphism groups and their infinite dimensional representations is emphasized throughout the talk.

2.8 On the differentiable structure of analytic transformations

by Thierry Robart (joint work with Niky Kamran)

At the conclusion of a decade-long collaborative effort we published in [1] in 2004 the following existence theorem for Lie pseudogroups of infinite type.

Each local Lie pseudogroup of analytic transformations admits an analytic manifold structure. That latter is moreover compatible for the operations of its isotropy subgroup.

Our proof is based on the existence of a canonical chart of the second kind. This lecture will be devoted to surveying the main steps of our construction.

References

1. N. Kamran, T. Robart, An Infinite-Dimensional Manifold Structure for Analytic Lie Pseudogroups of Infinite Type, IMRN 2004, no. 34, p. 1761-1783

2.9 Mapping properties of composition operators acting on Sobolev spaces of fractional order

by Thomas Runst

We give a survey of some recent results on sufficient and necessary conditions on composition operators

$$T_f : g \to f \circ g$$

to map one Sobolev space of fractional order into another. Furthermore we discuss some interesting (open) problems.

2.10 The invariant measure with respect to the infinite-dimensional Cartan group and representations of the parabolic current group

by Anatoly Vershik

There is a unique up to scalar infinite-dimensional Lebesgue measure in the space of Schwartz distributions which is invariant under the infinite-dimensional Cartan group (see arXiv:0806.2215). That measure allows to define the representation of the current group of the maximal parabolic subgroups of the semisimple groups of rank 1 (see arXiv: 0809.1387). The model of the representation is completely different from the well-known model of the Fock space.

3 Short presentations

3.1 Complex analytic mappings on (LB)-spaces and applications in Lie theory

by R. Dahmen

An infinite dimensional analytic Lie group is a group which is at the same time an analytic manifold modelled on some locally convex topological vector space such that the group operations are analytic. In order to construct new classes of analytic Lie groups it is useful to have tools at hand ensuring analyticity of nonlinear mappings between locally convex spaces. This talk provides a sufficient criterion for complex analyticity in the case where the modelling space is an (LB)-space, i.e. a locally convex direct limit of an ascending sequence of Banach spaces. These new Lie groups turn out to be regular Lie groups (in Milnor's sense) if the (LB)-space is compactly regular.

3.2 Homotopy groups of topological spaces containing a dense directed union of manifolds

by Helge Glöckner

Consider a topological space X which is a union $X = \cup_{n=1}^{\infty} X_n$ of topological spaces

$$X_1 \subset X_2 \subset \cdots ,$$

such that all inclusion maps $X_n \to X_{n+1}$ and $X_n \to X$ are continuous. If every compact subset of X is a compact subset of some X_n (i.e., in the case of *compact regularity*), it is easy to see that the homotopy groups of X can be expressed as direct limits of those of the steps:

$$\pi_k(X, p) = \lim_{\rightarrow} \pi_k(X_n, p), \qquad (1)$$

for all $k \in \mathbb{N}$ and $p \in X$. In the talk, I discuss situations where (1) still holds, although compact regularity need not be available. The altenative approach is based on approximation arguments, and assumes (among other things) that each X_n is a (possibly infinite-dimensional) manifold. It applies just as well if the union $\cup_{n=1}^{\infty} X_n$ is merely dense in X, and also in the case of uncountable directed unions.

Fundamental groups and second homotopy groups are needed in the extension theory of infinite-dimensional Lie groups (as developed recently by K.-H. Neeb). Many infinite Lie groups can be expressed as ascending unions of better-understood Lie groups, or contain such a union as a dense subgroup.

The results entail a solution to a long-standing open problem. Given a Lie group H with Lie algebra $L(H)$, one can consider a certain weighted mapping group $\mathcal{S}(\mathbb{R}^l, H)$ modelled on the Schwartz space $\mathcal{S}(\mathbb{R}^l, L(H))$ of $L(H)$-valued rapidly decreasing functions. Answering a question of BOSECK, CZICHOWSKI and RUDOLPH from 1984 in the affirmative, one deduces that always

$$\pi_k(\mathcal{S}(\mathbb{R}^l, H)) \cong \pi_{k+l}(H).$$

3.3 On compactness of operators acting on Bergman spaces

by Mikael Lindström

Compactness of a bounded operator T on the Bergman space A^1 can be characterized by the criteria $\lim_{|z|\to 1} \frac{\|T(K_z^\alpha\|_{A^1}}{\|K_z^\alpha\|_{A^1}} = 0$, where the reproducing kernel $K_z^\alpha(w) = \frac{1+\alpha}{(1-\overline{x}w)^{2+\alpha}}$, $\alpha > 0$, and $\|K_z^\alpha\|_{A^1} \equiv (1-|z|^2)^\alpha$. The purpose of this talk is to discuss if a corresponding criterium is also valid for bounded operators on the standard Bergman space A^2.

3.4 Lie group structure on groups of holomorphic maps

by Friedrich Wagemann

This is a report on joint work with Karl-Hermann Neeb (TU Darmstadt). The question we address is on the existence and uniqueness of regular Lie group structures on the topological groups of smooth maps of the form $\mathcal{C}^\infty(M, K)$, where M denotes a non-compact smooth manifold and K a possibly infinite dimensional Lie group, and of holomorphic maps of the form $\mathcal{O}(M, K)$, where now M is a complex manifold and K a possibly infinite dimensional complex Lie group. Concerning the same question about a compact manifold M, the answer is (well known and) positive with respect to the natural smooth compact open topology for $\mathcal{C}^\infty(M, K)$.
About the unicity, we show that in case K is regular, a regular Lie group structure on $\mathcal{C}^\infty(M, K)$ which is compatible with evaluations (i.e. imposing smoothness of all evaluation maps $\mathrm{ev}_m : \mathcal{C}^\infty(M, K) \to K, m \in M$) and with given Lie algebra $\mathfrak{g} = \mathcal{C}^\infty(M, \mathfrak{k})$ (with $\mathfrak{k}$ the Lie algebra of K) is indeed unique.
We then show existence of such a Lie group structure on $\mathcal{C}^\infty(M, K)$ and $\mathcal{O}(M, K)$ for a large class of 1-dimensional manifolds M. In the smooth case, this permits via products to show the existence for manifolds of the form $M = \mathbb{R}^k \times C$ for some compact manifold C.
In the complex case, we show existence for a non-compact complex curve M with finitely generated fundamental group and K a complex Banach Lie group. The proof shows that in this case the subgroup of based maps $\mathcal{O}_*(M, K)$ is a submanifold in the infinite dimensional Fréchet space $\Omega^1_h(M, \mathfrak{k})$ of holomorphic 1-forms with values in $\mathfrak{k}$, embedded via the logarithmic derivative. We use a regular value theorem in infinite dimensions which is based on Glöckner's parametrized implicit function theorem [1].

References

1. Helge Glöckner, Implicit functions from a topological vector space to Banach spaces, Isr. J. Math. **155** (2006), 205-252.

2. Karl-Hermann Neeb, Friedrich Wagemann, Lie group structures on groups of smooth and holomorphic maps on non-compact manifolds, Geom. Dedicata **134** (2008), 17-60.

3.5 Hecke operators on inverse limits of modular curves

by Tilmann Wurzbacher

This talk presents work in progress, joint with Mike Dostert (Metz).

Motivated by the idea –coming from theoretical physics– of viewing modular forms and their asymptotics via neo-classical large N-limits (compare [1]), we consider the modular group

$$\Gamma_0(N) = \left\{ \begin{pmatrix} a & b \\ c & d \end{pmatrix} \in SL_2(\mathbb{Z}) \,\middle|\, c \equiv 0 \mod [N] \right\},$$

the associated moduli spaces $Y_0(N) = \Gamma_0(N)\backslash\mathbb{H}_+$ and their compactifications $X_0(N) = \Gamma_0(N)\backslash\mathbb{H}_+^*$, the so-called "modular curves", given by adjoining the appropriate cusps. Modular forms of degree k and weight N are now given as homorphic sections of the k-th power of the canonical line bundle of $X_0(N)$. It is well known that going with k to infinite corresponds to the semi-classical limit of letting the Planck constant going to zero. Here we want to study the limit of N going to infinity in a geometric way. Our first result, analogous to known results (see [2]) in the case of

$$\Gamma(N) = \left\{ \begin{pmatrix} a & b \\ c & d \end{pmatrix} \in SL_2(\mathbb{Z}) \,\middle|\, a, d \equiv 1 \mod [N] \text{ and } b, c \equiv 0 \mod [N] \right\}$$

is

Theorem 1. The inverse limit $\varprojlim Y_0(N)$ over N in $\mathbb{N}$ is isomorphic to the space $SL_2(\mathbb{Z})\backslash\{\mathbb{H}_+ \times \mathbb{P}_1(\hat{\mathbb{Z}})\}$ where $\hat{\mathbb{Z}} = \prod_p \mathbb{Z}_p$ is the product of the p-adic integers for all prime numbers p.

Motivated by the related idea of treating Hecke operators quantum mechanically (as discrete multi-time evolution evolution operators), we construct Hecke operators directly at the limit:

Theorem 2. On an appropriate space of $\mathbb{C}$-valued functions on a principal $\mathbb{C}^*$-bundle over the inverse limit $\varprojlim Y_0(N)$, containing the modular forms for $\Gamma(N)$ for all N and all k, there are infinite weight Hecke operators via index-n lattices and torsion data.

The construction of the Hecke operators is given in terms of summimg over sublattices decorated with sequences fixing half of the N-torsion of the associated elliptic curves for all N simultaneously. The construction of a standard Hecke algebra in Proposition 3.87 in [3] is completely different and relates only to the case of the congruence groups $\Gamma(N)$.

References

1. S. G. Rajeev, *New Classical Limits of Quantum Theories*, in *Infinite Dimensional Groups and Manifolds*, *IRMA Lect. Math. Theor. Phys.*, de Gruyter, Berlin, 2002.

2. David Mumford, *Tata lectures on theta. I*, Progress in Mathematics, Birkhäuser Boston Inc., Boston, MA, 1983.

3. Alain Connes and Matilde Marcolli, *Noncommutative geometry, quantum fields and motives*, American Mathematical Society, Providence, RI, 2008.

4 Time Schedule

8:00–9:00 *registration desk*

time \ day	Thu, Nov 6
9:00–9:50	Karl-Hermann Neeb 1
9:50–10:30	*discussion and coffee break*
10:30–11:20	Jochen Wengenroth 1
11:20–11:30	*discussion and break*
11:30–12:20	Dietmar Vogt 1
12:20–14:00	*discussion and lunch*
14:00–14:40	Richard Aron
14:40–14:50	*discussion and break*
14:50–15:30	Klaus Bierstedt
15:30–16:00	*discussion and coffee break*
16:00–16:40	José Bonet
16:40–16:50	*discussion and break*
16:50–17:15	Mikael Lindström
17:15–17:25	*discussion and break*
17:25-18:05	Thomas Runst

Conference dinner

8:00–9:00 *registration desk*

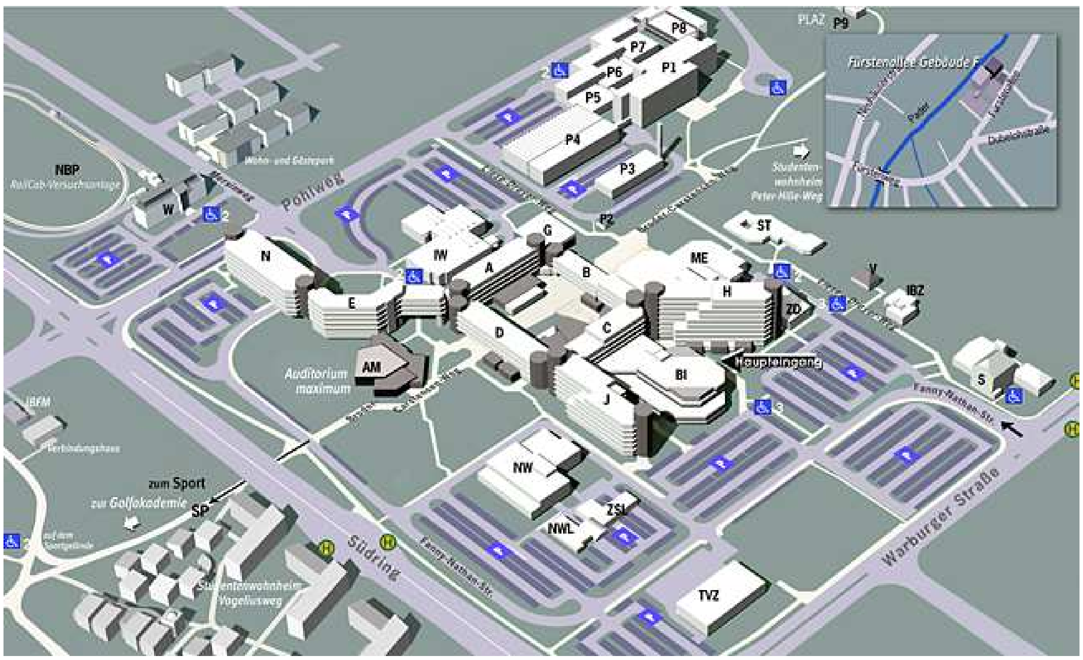
time \ day	Fri, Nov 7
9:00–9:50	Jürgen Eichhorn 1
9:50–10:30	*discussion and coffee break*
10:30–11:20	Jochen Wengenroth 2
11:20–11:30	*discussion and break*
11:30–12:20	Dietmar Vogt 2
12:20–14:05	*discussion and lunch*
14:05–14:45	Thierry Robart
14:45–14:55	*discussion and break*
14:55–15:20	Rafael Dahmen
15:20–15:55	*discussion and coffee break*
15:55–16:35	Peter Michor
16:35–16:45	*discussion and break*
16:45–17:25	Andreas Kriegl
17:25–17:35	*discussion and break*
17:35 –18:00	Friedrich Wagemann

18:00–19:30 *registration desk*

time \ day	Sat, Nov 8
9:00–9:50	Karl-Hermann Neeb 2
9:50–10:30	*discussion and coffee break*
10:30–11:20	Jürgen Eichhorn 2
11:20–11:30	*discussion and break*
11:30–12:10	Anatoly Vershik
12:10–14:00	*discussion and lunch*
14:00–14:40	Tilmann Wurzbacher
14:40–14:50	*discussion and break*
14:50–15:35	Tudor Ratiu
15:35–16:05	*discussion and coffee break*
16:05–16:50	Daniel Beltiţă
16:50–17:00	*discussion and break*
17:00-17:30	Helge Glöckner

5 Maps and hints

Below you find a map of the campus of the University of Paderborn.



Busses to the university

From the city or the main railway station you can reach the university directly using the bus lines **4** (direction Dahl), **9** (direction Kaukenberg) or **68** (direction Schöne Aussicht). The lines 4 and 9 stop at the bus stop 'Uni/Südring', while the line 68 stops at the bus station 'Uni/ Schöne Aussicht' (see arrow pointing towards 'Fanny-Nathan-Str.' on the above map). Additionally, from the main railway station you can use the line **UNI**. It stops at both university bus stations, i.e. first at 'Uni/Schöne Aussicht' and then at 'Uni/Südring'. It is possible to buy tickets on the bus or from the vending-machines to be found at some of the bus stations. Please be aware of the fact that most of the lectures at the university start at 9 a.m. which means that the busses might be quite crowded.

Lectures

The lectures will take place in the lecture hall D2 (which is located on the ground level of building D).

Registration desk

Thursday 8-9 a.m., Friday 8-9 a.m. and Friday, 6-7.30 p.m. there will be a registration desk in front of the lecture hall D2.

Coffeee breaks

The coffee breaks will take place upstairs in rooms D2.343 and D2.314.

Internet

You will have computer access in room D3.301 on Thursday and Friday until 6 p.m. The necessary information will be handed out during registration.

Lunches

On Thursday and Friday we recommend to have lunch at the Mensa (building ME on the map above). On Saturday we suggest to go to the shopping center called 'Südring Center', within easy reach of the university. Several fast food restaurants can be found there.

Conference dinner

The conference dinner will take place Thursday, 7 p.m. in the restaurant 'Il Postino' in Paderborn's town centre. The address is Jühenplatz 1-3. You can get there from the university using the bus lines **4** or **9** from the station 'Uni/Südring'. Leave the bus at the bus stop 'Rathausplatz' and then enter the 'Rathauspassage'. You follow the 'Rathauspassage' for approximately 30 meters. Suitable busses leave at 6.29 p.m. (line 9), at 6.47 p.m. (line 4) and at 6.59 p.m. (line 9) from the bus stop 'Uni/Südring'.

6 Participants

Richard Aron (Kent State University)

Daniel Beltiţă (Romanian Academy Bucharest)

Hans Biebinger (University of Paderborn)

Klaus Dieter Bierstedt (University of Paderborn)

José Bonet (Polytechnical University of Valencia)

Olga Cerbu (State University of Moldova)

Rafael Dahmen (University of Paderborn)

Paweł Domański (Adam Mickiewicz University Poznań)

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Nicolas Kenessey (University of Liège)

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Cornelia Vizman (West University of Timisoara)

Dietmar Vogt (University of Wuppertal)

Friedrich Wagemann (University of Nantes)

Stefan Wagner (Darmstadt University of Technology)

Boris Walter (University of Paderborn)

Sven-Ake Wegner (University of Paderborn)

Jochen Wengenroth (University of Liège)

Christoph Wockel (University of Göttingen)

Wojtiech Wojtynski (University of Warsaw)

Elke Wolf (University of Paderborn)

Tilmann Wurzbacher (University of Metz)

Piotr Zioło (Adam Mickiewicz University of Poznań)