Infinite dimensional differential geometry seminar

Topic	Date/ Room	Speaker
Calculus in locally convex vector spaces I Definition and important properties of locally convex vector spaces, Fréchet spaces, introduction to the calculus in lcvs **Proposed literature**: [1, 3, 14, 9, 10].	26.02.10	Christoph Wockel
Bornological concepts in functional analysis I Definition of a bornology (family of bounded sets), bornological vector spaces, relation between bornology and topology, bornologification, topologification, examples of bornologies (equicontinuous, natural, ...). **Proposed literature**: [7] (ch. I, ch. IV: 4.1-4.3), [10, 8, 2] there is also a master thesis of Florian Gach: [13].	05.03.10 SR 3a	Jan-Christoph Weise
Bornological concepts in functional analysis II Fundamental bornological constructions, initial and final bornologies, projective limits, inductive limits; necessary and sufficient conditions for a locally bounded functional to be continuous (see:[10] §28, important for continuity of derivatives in QFT), bipolar theorem, barreled spaces **Proposed literature**: [7] (ch. II), [10, 13, 5]	12.03.10 **09:30** SR 4b	Ole Vollertsen
Mackey (bornological) convergence Definition of Mackey convergence, Mackey nets, Mackey-Cauchy sequences, completeness, comparison with other notions of convergence, examples; Lipschitz curves, Mackey convergence of the difference quotient. **Proposed literature**: [2] (chapter I, section 1), [7, 5, 13]	19.03.10 SR 5	Andreas Degner
Mackey convergence and c^∞-topology definition and properties of the integral of Lipschitz curves, c^∞-topology, definition of a convenient vector space **Proposed literature**: [2] (chapter I, section 2), [5] (section 2.2), [13](section 5), see also: [6].	26.03.10 SR 4b	Benjamin Lang
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Topic	Date	Speaker
Calculus in locally convex vector spaces II Definition of a derivative, Fundamental Theorem of Calculus, chain rule, partial derivatives, higher derivatives **Proposed literature**: [1, 3, 14, 9, 10].	09.04.10 SR 2	Christoph Wockel
Nash-Moser-Hörmander theorem I	23.04.10 SR 5	Pedro Lauridsen Ribeiro
Nash-Moser-Hörmander theorem II	30.04.10 SR 2	Pedro Lauridsen Ribeiro
Cartesian closedness in convenient calculus Proofs of different variants of the exponential law in convenient setting, Boman's theorem, spaces of smooth mappings, definition of the integral, differentiation operator, chain rule. **Proposed literature**: [2] (chapter I, section 3), [5] (section 4.4), [6].	07.05.10 SR 2	Katharina Rejzner
The c^∞-topology Comparision of the c^∞-topology with other topologies, examples, c^∞-topology on a product, when c^∞ is a vector space topology, c^∞-completion, counter-examples **Proposed literature**: [2] (chapter I, section 4), [5], [6].	14.05.10 SR 2	Falk Linder
Uniform boundednes principle and it's consequences Uniform boundednes principle, natural bornology vs. pointwise bornology, spaces of multilinear mappings. **Proposed literature**: [2] (chapter I, section 5), [5] (section 3.6), [6].	21.05.10	
Calculus in locally convex vector spaces		
Infinite dimensional manifolds Definition of an infinite dimensional manifold modeled on a locally convex tvs, properties, examples **Proposed literature**: [1, 14].		
Differential forms Differential forms, exterior derivative, Lie derivative **Proposed literature**: [1, 14].		
Infinite dimensional Lie Groups Definition of infinite dimensional Lie groups, Lie algebras **Proposed literature**: [1, 4].		
Groups of mappings Examples of groups of mappings, diffeomorphism group of a compact manifold **Proposed literature**: [1, 4].		

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Topic	Date	Speaker
Gauge group I, II Gauge grup as an infinite dimensional Lie group, definition and properties **Proposed literature**: [1, 4].		
Infinite dimensional manifolds in the convenient setting		
Infinite dimensional manifolds in the convenient setting I Definition of an infinite dimensional manifold modeled on a convenient vector space, examples and properties **Proposed literature**: [2] (in particular section 27).		
Infinite dimensional manifolds in the convenient setting II Tangent vectors on a convenient vector space, vector bundles and their sections **Proposed literature**: [2] (sections 28-30).		
Infinite dimensional manifolds in the convenient setting III Vector fields, introduction to differential forms, **Proposed literature**: [2] (sections 32-33).		
Infinite dimensional manifolds in the convenient setting IV Differential forms, exterior derivative, Lie derivative (section 33) **Proposed literature**: [2].		
Manifolds of mappings in convenient setting Spaces of mappings as infinite dimensional manifolds, diffeomorphism group of a manifold as an infinite dimensional Lie group **Proposed literature**: [2] (sections 41-43).		

References

[1] Neeb, Karl-Hermann *Monastir Lecture Notes on Infinite-Dimensional Lie Groups*: http://www.math.uni-hamburg.de/home/wockel/data/monastir.pdf

[2] Kriegl, Andreas and Michor, Peter W. *The Convenient Setting of Global Analysis*: http://www.ams.org/online_bks/surv53/surv53.pdf

[3] Hamilton, R.S. *The Inverse Function Theorem of Nash and Moser*

[4] Wockel, Christoph *Infinite-Dimensional Lie Theory for Gauge Groups*: http://www.math.uni-hamburg.de/home/wockel/data/diss.pdf

[5] Frölicher, A.; Kriegl, A., *Linear spaces and differentiation theory*, Pure and Applied Mathematics, J. Wiley, Chichester, 1988.

[6] Frölicher, A.; *Axioms for convenient calculus*, Cahiers de topologie et géométrie différentielle catégoriques, tome **45**, no 4 (2004), p. 267-286

[7] Hogbe-Nlend, H.; *Bornologies and functional analysis*, Mathematics Studies no. 26, North-Holland, Amsterdam, New York, Oxford, 1977

[8] Bourbaki, N.; *Topological vector spaces*, ch. 1-5, Springer-Verlag Berlin, Heidelberg, New York 2003

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[10] Köthe, G. ; *Topological vector spaces*

[11] Omori, H.; de la Harpe, P., *About interactions between Banach Lie groups and finite dimensional manifolds*, J. Math. Kyoto Univ. **12** (1972), 543-570

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[13] Gach, F.; *Topological versus Bornological Concepts in Infinite Dimensions*, Diplomarbeit zur Erlangung des akademischen Grades Magister rerum naturalium, 2004 Wien, betreut von Ao. Univ. Prof. Dr. Andreas Kriegl

[14] Glöckner, H; *Infinite-dimensional Lie groups without completeness condition*, Geometry and Analysis on finite and infinite-dimensional Lie groups, Eds. A. Strasburger, W. Wojtynski, J. Hilgert and K.-H. Neeb, Banach Center Publications **55** (2002), 43-59.

[15] Seip, U.; *A convenient setting for smooth manifolds*, J. Pure Appl. Algebra **21** (1981), 279-305.

[16] Kriegl, A.; *Eine Theorie glatter Mannigfaltigkeiten und Vektorbündel*, Dissertation, Universität Wien, 1980.