Michael Bleher, Dr.

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Experience

2024 - Present **Postdoc**, *STRUCTURES Cluster of Excellence* (Heidelberg University).
Exploratory Project: New methods for single cell data analysis?

- Geometric Neighbour Embeddings
- Magnetic Systems and Stem Cell Differentiation
- Stochastic Models from Topological Data Analysis

Education

2017 - 2023 **PhD Physics and Mathematics**, *Ruprecht-Karls Universität Heidelberg*.
Advisor: Prof. Dr. Johannes Walcher
'Haydys-Witten Instantons and Symplectic Khovanov Homology'

2013 - 2016 **M.Sc. Physics**, *Ruprecht-Karls Universität Heidelberg*.
Advisor: Prof. Dr. Johannes Walcher
'A Survey of Defects in $\mathcal{N} = 4$ Supersymmetric Yang-Mills Theory'

2014 - 2015 **Graduate Course**, *University of Durham, UK* (Student Exchange).
M.Sc. in Particles, Strings and Cosmology at the Centre for Particle Theory.

2010 - 2013 **B.Sc. Physics**, *Ruprecht-Karls Universität Heidelberg*.
Advisor: Dr. Werner Rodejohann
'Neutrinoloser Doppelbeta-Zerfall – Untersuchung einer Methode zur Auswahl eines Nuklearen Matrix-Elements'

Publications

Bleher, Johannes and Michael Bleher (2024). 'An Algebraic Framework for the Modeling of Limit Order Books'. arXiv: 2406.04969 (preprint).

Bleher, Michael (2023). 'Haydys-Witten Instantons and Symplectic Khovanov Homology' PhD thesis, Ruprecht-Karls Universität Heidelberg. DOI: 10.11588/HEIDOK.00034010.

Bleher, Michael (2023). 'The Decoupled Haydys-Witten Equations and a Weitzenböck Formula'. arXiv: 2307.15056 (preprint).

Bleher, Michael (2023). 'Growth of the Higgs Field for Kapustin-Witten Solutions on ALE and ALF Gravitational Instantons'. arXiv: 2306.17017 (preprint).

Neumann, Maximilian, Michael Bleher, Lukas Hahn, Samuel Braun, Holger Obermaier, Mehmet Soysal, René Caspart and Andreas Ott (2022). 'MuRiT: Efficient Computation of Pathwise Persistence Barcodes in Multi-Filtered Flag Complexes via Vietoris-Rips Transformations'. arXiv: 2207.03394 (preprint).

Bleher, Michael, Lukas Hahn, Juan Angel Patino-Galindo, Mathieu Carriere, Ulrich Bauer, Raul Rabadan and Andreas Ott (2021). 'Topology Identifies Emerging Adaptive Mutations in SARS-CoV-2'. arXiv: 2106.07292 (preprint).

Bleher, Johannes, Michael Bleher and Thomas Dimpfl (2020). 'From Orders to Prices: A Stochastic Description of the Limit Order Book to Forecast Intraday Returns'. arXiv: 2004.11953 (preprint).

Presentations

Haydys-Witten Instantons and the Gauge Theoretic Approach to Khovanov Homology. Gauge Theory and Mathematical Physics Seminar, Morningside Center of Mathematics, Beijing. 3rd July 2024.

RNA Velocity Embeddings in Curved Spaces - Exploring Cellular Dynamics. Seminar 24122, Dagstuhl. 20th Mar. 2024.

On Haydys-Witten Instantons and the Gauge Theoretic Approach to Khovanov Homology. HU Gauge Theory Research Seminar, Berlin (invited talk). 31st Jan. 2024.

Haydys-Witten Instantons in the Gauge Theoretic Approach to Khovanov Homology. ULB Geometry Seminar, Brussels (invited talk). 4th Dec. 2023.

Topological Signatures of Convergence in Viral Evolution. CompTopNN Meeting 2023, Sevilla (invited talk). 8th Nov. 2023.

Feature Representation of scRNA Data in Symmetric Spaces. Structures Symposium, Heidelberg (poster). 20th July 2023.

Learning Representations of Symbolic Data in Symmetric Spaces. TDA Research Seminar, Heidelberg. 13th July 2023.

Haydys-Kapustin-Vafa-Witten Floer Theory. Physical Mathematics Seminar, Heidelberg. 10th Feb. 2023.

Persistent Homology Detects Emerging Adaptive Mutations. TDA Journal Club, Heidelberg. 7th June 2021.

Welcome Notes and an Introduction to Mapper. Heidelberg TDA Workshop 2020, Heidelberg (organizer). 26th Oct. 2020.

Scholarships

2017 - 2020 **Distinguished Doctoral Fellowship**, *Heidelberg Graduate School of Fundamental Physics*.