

# MICHAEL BLEHER, DR.

DATE OF BIRTH 02.06.1990

NATIONALITY german

✉ mbleher@mathi.uni-heidelberg.de

🆔 0000-0002-7796-1665

🌐 <https://michael.bleher.me>

---

## 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

*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*.