

ZHOUYI HE

+1 6172512075 ◊ he@ipfdd.de ◊ [Institute Page](#) ◊ [Google Scholar](#)
Leibniz Institute for Polymer Research, Hohe Str. 6, 01069 Dresden, Germany

EDUCATION

Leibniz Institute for Polymer Research Dresden (IPFDD) Dr. rer. nat. in Physics (Theoretical Biophysics/ Soft condensed matter)	<i>03/23 - now</i> Expected <i>09/26</i>
Doctoral Project: Theory and simulation of biomolecular condensates	
Supervisor: Prof. Jens-Uwe Sommer and Dr. Tyler Harmon	
Hong Kong University of Science and Technology (HKUST) MPhil in Chemistry (Theoretical biophysics)	<i>08/19 - 06/22</i>
University of Science and Technology of China (USTC) BSc in Chemistry (Chemical Physics)	<i>08/15 - 06/19</i>

PUBLICATIONS

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- Zhouyi He**, *et al.* and Tyler S. Harmon. "Born to Condense: Polysomes Drive Co-Translational Condensation of Biomolecular Condensate Proteins." [bioRxiv](#) (2025).
- Zhouyi He**, Jens-Uwe Sommer, and Tyler S. Harmon. "The Impact of Coiled-Coil Domains on the Phase Behavior of Biomolecular Condensates." [ACS Macro Letters](#) (2025).
- M. Hasan*, **Zhouyi He***, *et al.* "Dynamic expedition of leading mutations in SARS-CoV-2 spike glycoproteins." [Computational and Structural Biotechnology Journal](#) (2024). *: Equal contribution.
- Xiaolong Yang, **Zhouyi He**, and Xiao Zheng. "Unit cell consistency of maximally localized Wannier functions." [Electronic Structure](#) (2020).

RESEARCH EXPERIENCE

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| Harvard University, Prof. Eugene Shostakovich
<i>Probing the role of spacer length in multi-component condensate organization</i> | Visiting scholar
<i>08/25 - now</i> |
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- Employing coarse-grained (CG) molecular dynamics and Monte Carlo (MC) simulations of sticker-spacer proteins to elucidate how spacer length governs internal condensate architecture and heterogeneity. Aims to understand mechanism and establish design principles for spatial patterning in synthetic and biological multicomponent condensates.
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| IPFDD, Prof. Jens-Uwe Sommer, Dr. Tyler Harmon
<i>Co-translational condensation (CTC) of polysome and protein</i> | Doctoral Study
<i>12/23 - 08/25</i> |
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- Developed a CG MC and reaction-diffusion modeling framework to understand the co-localization of polysomes and condensates. Found that protein domain architecture controls CTC, polysomes are drivers of condensation and CTC could facilitate post-translational modifications. Our work provides a theoretical framework for understanding condensate interactions with translation machinery.
- Connecting protein architecture to their emergent condensate properties* *05/23 - 12/24*
- Systematically investigated how coiled-coil domains control the phase behavior and the material properties of condensates via CG MC simulations. Provided a physical basis for how specific domain architectures can tune phase separation ability and internal organization.
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| HKUST, Prof. Haibin Su
<i>Sequence-dependent target search and binding dynamics of CRISPR Cas9</i> | MPhil Thesis
<i>01/21 - 03/22</i> |
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- Modeled Cas9 target search as facilitated diffusion, combining 3D diffusion with 1D sliding to map the binding free energy landscape.
- Integrated bioinformatics and kinetic modeling to link protein mutations to specificity, guiding the design of high-fidelity variants.

Dynamic expedition of leading mutations in SARS-CoV-2 spike glycoproteins 05/21 - 01/22

- Developed *deLemus*, a novel time-resolved statistical method, to analyze spike protein evolution dynamics. With single amino-acid polymorphisms and decomposition of mutation matrix, identified dominant mutation patterns and emergent variants to inform spike-targeting therapeutic and vaccine design.

Evolution of CRISPR Cas9 systems in Streptococcus genus 06/20 - 05/21

- Applied statistical coupling analysis to identify co-evolving sectors in 3D protein structures. Revealed an evolutionary trade-off between horizontal gene transfer benefits and antiviral defense levels through analysis of bacterial-viral interaction networks.

USTC, Prof. Xiao Zheng

BSc Thesis

Unit cell consistency (UCC) of maximally localized wannier functions (MLWFs) 09/18 - 07/19

- Investigated UCC of MLWFs, a critical property for accurate electronic structure calculations in solids. Derived analytical and numerical constraints, introducing a symmetry-based criterion to ensure UCC, enhancing the reliability of MLWFs across diverse solid-state systems.

CONFERENCE PRESENTATIONS

19th Dresden Polymer Discussion Biomolecular Condensates and Polymer Phase Transitions (2025).

EMBO Workshop CELLULAR MATTERS: A deeper look into the complex cytoplasm (2025).

"Co-translational (polysome-protein) condensation." German Physical Society (DPG) meeting (2025).

"Connecting protein architecture to their emergent droplet properties." DPG meeting (2024).

"Impact of mutations in CRISPR Cas9 in kinetics and off-targets effects." The 1st International Symposium on Marine Science and Engineering for Young Scientists and Postgraduates (2021)

TECHNICAL SKILLS

Methods: Coarse-Grained Monte Carlo Simulations, Molecule Dynamics, Reaction-Diffusion Models, Bioinformatics, Machine learning (basics)

Programming: FORTRAN, Python, MATLAB, C, Bash, L^AT_EX, Git, HPC, LAMMPS, VMD, etc.

Expertise: Polymer Physics, Statistical Mechanics, Phase Separation, Biophysics, Biomolecular Condensates, Reaction Kinetics, etc.

AWARDS & ADDITIONAL ACTIVITIES

Awards: Research Full Scholarship (HKUST), Outstanding Graduate (USTC), National Endeavor Scholarship (USTC), 3rd prize in China High School Chemistry Olympic Competition

Academic Service: PhD Council Representative (IPFDD), Teaching Assistants (Soft condensed matter physics, Physical chemistry, etc.)

Leadership: Church Youth Group Leader, Basketball Team Captain, Rural Teaching Program Leader

HOBBIES

Cycling, Basketball, Photography, Literature, Music, Movie, Hiking, etc.