# HUA, PENG

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Research Interest: Multiphysics simulation, image segmentation using deep learning and AI

## EDUCATION

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| **The Hong Kong University of Science and Technology,** HKSAR | **Sep 2021 - Present** |
| **Expected Graduation Date:** | **Aug 2026** |

Ph.D. candidate in Nanoscience & Technology
RedBird PhD (top 5%)

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| **The Hong Kong University of Science and Technology,** HKSAR | **Sep 2020 - Aug 2021** |

Master of Chemical & Biomolecular Engineering
School of Engineering Excellent Student (top 3%)
**GPA**: 3.86/4.3 (Excellent)

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| **University of Missouri-Columbia,** U.S.A. | **Aug 2016 – May 2020** |

Bachelor of Chemical Engineering
Member of Tau Beta Pi (top 3%)
**GPA**: 3.89/4.0 (Magna Cum Laude)

## AWARDS AND HONORS

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| Best TA Award, HKUST | 2023-2024 |
| RedBird PhD Award, HKUST | 2021-2022 |
| Excellent Student Scholarship in Chemical and Biomolecular Engineering, HKUST | 2020-2021 |
| Magna Cum Laude Honors, University of Missouri-Columbia | 2020 |
| Honors Scholar, University of Missouri-Columbia | 2020 |
| Chemical Engineering Development Scholarship, University of Missouri-Columbia | 2019-2020 |
| Chan Scholarship in Chemical Engineering, University of Missouri-Columbia | 2019-2020 |
| High Dean's Honor Roll, University of Missouri-Columbia | 2017-2020 |
| Undergraduate Honor Research, University of Missouri-Columbia | 2019 |

## RESEARCH EXPERIENCES

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| **Modeling of Field-Driven Granular Collective Dynamics** | **Sep 2023 - Present** |
| *Supervisor: Prof. Yilong Han* | *HKUST* |

· Developed a hybrid machine vision framework (YOLO-Unet-OpenCV) for high-speed granular tracking, achieving >95% segmentation accuracy under magnetic interference.
· Simulated collective bead motions via COMSOL & C++ simulation, coupling electromagnetic fields, contact mechanics, and fluid-structure interactions to resolve self-organized pattern formation.

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| **Multiscale Dynamics of Magnetically Programmable Confined Systems** | **Sep 2021 - Present** |
| *Supervisor: Prof. Yilong Han* | *HKUST* |

· Simulated 2D phase transitions in binary system via LAMMPS, revealing critical melting dynamics and defect evolution under thermal gradients.
· Engineered 50-nm accuracy E-beam lithography nanoparticles for enhanced thermal dissipation, achieving 40% heat transfer efficiency matching COMSOL electro-thermal predictions.

- Assembled SU8-based microrobots via photolithography, enabling magnetic-field-driven collective shape morphing for targeted drug delivery with 1 μm spatial precision.
- Designed a monolayer-confined microchannel (depth = 1 μm) to spatially confine micron-scale particles in 2D, enabled precise probing of low-dimensional dynamics.

### Machine Learning in Calcium Carbonate Nucleation Mechanism · Sep 2020 - Jul 2021
*Supervisor: Prof. Richard Lakerveld* · *HKUST*

- Developed a conductivity-based kinetic assay for $CaCO_3$ nucleation in supersaturated solutions, correlating ion depletion rates with amorphous-to-crystalline phase transitions
- Trained an ensemble learning algorithm (MATLAB) on multimodal data (conductivity/pH/temperature), predicting dominant nucleation pathways (dense liquid phase vs. direct ion attachment) with >92% accuracy.

### Machine Learning Assisted Discovery in Porous Carbon · Sep 2018 - Jul 2020
*Supervisor: Prof. Jian Lin* · *University of Missouri-Columbia, U.S.A.*

- Constructed a database of 2,100+ porous carbon samples with 12 descriptors (SSA: 200–3,500 m²/g, PSD: 0.5–50 nm, surface functionalities) for methane uptake prediction (±3.5% error vs. experimental).
- Developed a hybrid MLP-GBDT model trained on $CO_2$ adsorption isotherms to predict $CO_2/CH_4$ selectivity ratios, achieving 90% accuracy in identifying top-performing materials for natural gas purification.

### Electrochemical Performance of Cathode Material · Aug 2018 - Aug 2019
*Supervisor: Prof. Yangchuan Xing* · *University of Missouri-Columbia, U.S.A.*

- Conducted experiments including preparing and synthesizing $LiMn_{0.4}Ni_{0.4}Co_{0.2}O_2$ layered compounds, assembled coin cells under vacuum condition, operated $ARBIN$ battery tester independently.
- Selected material characterization methods and analyzed test data (MATLAB) independently.

## PUBLICATIONS

- **Peng Hua**, Yilong Han, "Searching for various melting scenarios of 2D crystals", *Matter* 7.1 (2024): 19-22. (Impact factor: 18.9)
- Chi Zhang, Dawei Li, **Peng Hua**, Jian Lin, "Machine learning assisted rediscovery of methane storage and separation in porous carbon from material literature", *Fuel* 290 (2021): 120080. (Impact factor: 7.5)
- **Peng Hua**, Yilong Han, "Magnetic-field-induced crystal-hexatic-liquid-crystal transition in 2D binary crystals ", (under revision)
- **Peng Hua**, Yilong Han, "Antihyperuniformity Emergence at the Hexatic Criticality in 2D Melting", (under preparation)

## SKILLS

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| **Language Skills** | Mandarin, Cantonese, English, German |
| **Computer Languages** | C, C#, C++, Python, JAVA, Swift, MatLab |
| **Software Skills** | Aspen Plus, Sprint, SolidWorks, AutoCAD, COMSOL, Sketchup, Blender, LAMMPS, Adobe After Effects, Adobe Audtion, Premiere |
| **Processing Skills** | Photolithography, E-beam lithography, Nanoscribe 3D printing, optical tweezers, image recognition & segmentation, molecular dynamics (MD) simulation, multi-physics (optical, magnetic/electric field, fluid dynamics) simulation, 2D & 3D product rendering, animation rendering |