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## Personal Information

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## Education

- 2014-2019 **PhD** at the Center for Free-Electron Laser Science (CFEL), Deutsches Elektronen-Synchrotron (DESY) and University of Hamburg, Germany
- Research direction: *Photon Science*
  - Dissertation title: *Development and Characterization of a Laser-Induced Desorption Source for Free-Electron Laser Experiments*
  - Supervisor: *Prof. Dr. Jochen Küpper and Prof. Dr. Henry N. Chapman (Fellow of the Royal Society)*
  - Member: PIER Helmholtz Graduate School (PHGS), Hamburg, Germany
- 2013-2014 **Research Graduate Student** at the Colorado State University, USA
- Project: *Upgrade the Light-beam induced current system to characterize the uniformity of local photovoltaic performance of thin-film solar cells*
  - Supervisor: *Prof. Dr. James R. Sites*
- 2011-2013 **Bachelors-PhD Progression** at the Shanghai Center for Photovoltaic, Chinese Academy of Science/East China Normal University, China
- Research direction: *Thin-film solar cell*
  - Supervisor: *Prof. Dr. Junhao Chu (Academician of the Chinese Academy of Sciences)*
  - GPA: 3.5/4 (Solid State Theory: 98/100, Modern Semiconductor Device Physics: 94/100, Thin Films Technology and Physics: 93.2/100, Semiconductor Optoelectronics: 91/100, Photoelectronic Device: 95/100, Micro-Nano-Optical-Electro-Mechanical System and Analysis: 91/100)
- 2007-2011 **Bachelor of Science** at the Shandong University, China
- Major: *Physics*
  - Supervisor: *Prof. Dr. Shishen Yan*
  - GPA: 3.5/4 (Quantum Mechanics: 94/100, Thermodynamics and Statistical Physics: 99/100, Electrodynamics: 92/100, Electromagnetics: 92/100, Mechanics: 97/100, Piezoelectric and Ferroelectric Physics: 91/100, Microcomputer Control Technology: 97/100, Advanced Mathematics: 90/100, Probability and Mathematical Statistics: 91/100, Optics: 91.2/100, Linear Algebra: 96/100, Physics Lab: 90/100)

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## Research Experience

Since 06.2022 **Guest Scientist:** Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany

Since 07.2020 **Senior Postdoc:** Faculty of Physics, University of Duisburg-Essen, Duisburg, Germany

- Lead the development of an ultra-high vacuum system for integrating Low Energy Electron Diffraction (LEED), Auger Electron Spectroscopy (AES), Thermal Desorption Spectroscopy, Time-Resolved Sum-Frequency Generation (SFG) Spectroscopy to study (ultrafast) chemical physics process at the solid-gas/solid-liquid/liquid-gas interfaces.
- Study the vibrational assisted charge transfer dynamics across the solid-liquid interface with two photon photovoltage/photocurrent spectroscopy and pump probe time-resolved sum-frequency generation spectroscopy.
- Built pump-probe femtosecond laser beam paths for ultrafast non-linear spectroscopy experiments.
- Developed the device controlling and data acquisition system with LabView and data analysis pipelines to analyze SFG experimental results with Matlab and Julia.

2019-2020 **Postdoc:** Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany

- Worked in Prof. Dr. R. J. Dwayne Miller's group on developing ultrafast electron diffraction (UED) to study photon-induced reaction dynamics of isolated gas-phase molecules and photon-induced structural dynamics of solid-state samples.
- Coupled a desorption by impulsive vibrational excitation (DIVE) molecular source with a femtosecond electron gun to study the structural dynamics of large biomolecules.
- Constructed and commissioned a gas-phase/solid-phase ultrafast electron gun.
- Built the pump-probe femtosecond laser optical paths for the UED experiments.
- Developed data analysis pipelines for analyzing UED experimental results with Matlab and Python.

2014-2019 **Fellow of Joachim Herz Foundation and Graduate Research Assistant:** Center for Free-Electron Laser Science CFEL, Deutsches-Elektronen-Synchrotron DESY, Hamburg, Germany

- Developed a laser-induced acoustic desorption (LIAD) source to bring large thermally labile and non-volatile biomolecules into gas-phase. A gas-dynamic virtual nozzle aerosol spraying method was developed to deposit uniform biosample layers for the LIAD setup. The developed biomolecule source can be used for further experiments, such as X-ray or electron diffraction imaging, matter-wave interferometry, or ultrafast charge migration and energy transfer reactions.
- Coupled the biomolecule source with a time-of-flight mass spectrometer (TOF-MS) and characterized the source with strong-field ionization (SFI) by Ti:Sapphire femtosecond laser.
- Studied the desorption mechanism and biomolecule ionization and dissociation process under strong laser fields.
- Participated in PETRA P11 beamtime for biomolecule coherent diffraction imaging with the tape-drive sample delivery setup.

2013-2014 **Graduate Research Assistant:** Colorado State University, USA

- Investigated the efficiency loss mechanism of thin-film solar cells and upgraded the Colorado State University (CSU) Light-Beam Induced Current (LBIC) system to characterize the uniformity of local photovoltaic performance of thin-film solar cells.

2011-2013 **Graduate Research Assistant:** Shanghai Center for Photovoltaic, Chinese Academy of Science, China

- Achieved 9.3% efficient CdTe thin-film solar modules with an area of  $30 \times 30$  cm<sup>2</sup> and built the current-voltage, capacitance-voltage and voltage dependent quantum efficiency test stations to characterize the large area thin-film solar cells.

2010-2011 **Undergraduate Research Assistant:** Shandong University, China

- Awarded the science and technology innovation funding for university students to study the theoretical method to realize quantum coding and quantum logic gates under the supervision of Prof. Dr. Yujun Zhen.

2009-2010 **Undergraduate Research Assistant:** Shandong University, China

- Awarded the science and technology innovation funding for university students to investigate the coupling between the ferromagnetic and ferroelectric domain in BiFeO<sub>3</sub> under the supervision of Prof. Dr. Guolei Liu.

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## Teaching Experience

2024-2025 Introduction to Solid-State Physics Exercise Class (2 hours per week)

2023-2024 Introduction to Solid-State Physics Exercise Class (2 hours per week)

2022-2023 Introduction to Solid-State Physics Exercise Class (2 hours per week)

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## Honor & Awards

09.2023 Early Career Fellow of Center for Nanointegration Duisburg-Essen (CENIDE)

11.2019 The Hamburg Center for Ultrafast Imaging Additional Fund (11K Euro)

03.2017 WE Heraeus Communication Travel Grant

02.2017 PIER Helmholtz Graduate School Travel Grant

10.2016 Best poster prize, PIER Graduate Week 2016

10.2015 Best poster prize, PIER Graduate Week 2015

11.2013 Doctoral Fellowship of the Joachim Herz Foundation (5 recipients in the call year 2013)

10.2010 First Class Award in Science and Technology Innovation Competition of Shandong Province

10.2009 Second Class Award of Shandong Province in the National Undergraduate Electronic Design Contest

09.2009 Second University Learning Experience Scholarship

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## Skills and expertise

Python, Julia, Autodesk AutoCAD, NI LabView, MathWorks MATLAB, L<sup>A</sup>T<sub>E</sub>X, C/C++, Git, Microsoft offices, Photoshops, etc.

Instrument Development, Ultrafast Laser Techniques, Data Acquisition Software Development, Electronic Device Design, etc.

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## Languages

Chinese Mother tongue  
English Fluent  
German Basic

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## Conference Organization and Volunteer Experience

- 2020-2024 Organizing committee member of the 29th, 30th, 31st, 32nd, 33rd annual conference of the Society of Chinese Physicists in Germany
- Since 10.2020 Secretary-general of the Society of Chinese Physicists in Germany
- 11.2017 Volunteer for the DESY open day 2017
- Since 10.2017 Committee member of the Society of Chinese Physicists in Germany
- Since 2016 Member of the German Physical Society
- 07.2015 Volunteer for the Femto 12 conference at Hamburg
- 11.2015 Volunteer for the DESY open day 2015
- 2014-2016 DESY DoIt PhD Representative
- 05.2014 Volunteer for the 113th General Assembly of the German Bunsen Society for Physical chemistry at Hamburg

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## Research Interests

Ultrafast Electron Diffraction, Ultrafast Optical Spectroscopies, Ultrafast Optical/X-ray Imaging, Mass Spectroscopy, Gas-phase Sample Source Preparation, Femtosecond Electrochemistry, Ultrafast Chemical Physics Process at the Solid-Liquid/Solid-Gas/Liquid-Gas Interfaces, In-situ/In-Operando Ultrafast Dynamics

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## Research Highlights

I am deeply interested in developing advanced experimental techniques and home-built instruments to capture and study the ultrafast physical and chemical dynamics of samples with atomic spatial and (sub-) femtosecond temporal resolution. Below are several state-of-the-art scientific instruments I have developed and constructed for pursuing this aim.

3. An ultra-high vacuum system which integrates argon ion sputtering cleaning, quadrupole mass spectroscopy, Low Energy Electron Diffraction (LEED), Auger Electron Spectroscopy (AES), Thermal Desorption Spectroscopy (TDS), Time-Resolved Polarization and Azimuthal dependent Sum Frequency Generation Spectroscopy, etc.. The instrument enables in-vacuum sample preparation/transfer/characterization (Huang et al., *Review of Scientific Instrument*, 95, 063903 (2024));
2. A scientific instrument which combines a laser-driven molecular beam with a table-top femtosecond electron gun and a pulsed bright-field optical microscope; The instrument enables us to conduct table-top gas-phase/liquid-phase ultrafast electron diffraction and optical imaging simultaneously (Huang et al., *Structural Dynamics* 9, 054301 (2022));
1. A scientific instrument which combines a laser-induced acoustic desorption large molecular source with a time-of-flight mass spectrometer for free-electron laser experiments; The setup enables us to prepare large thermally labile and fragile molecules into gas-phase for ultrafast X-ray imaging and post-ionization mass spectroscopy experiments (Huang et al., *Analytical Chemistry* 90, 3920 (2018)).

## List of Publications

16. **Z. Huang**, M. Bridger, O. A. Naranjo-Montoya, A. Tarasevitch, U. Bovensiepen, Y. Tong and R. Kramer Campen, “A femtosecond resolved view of vibrationally assisted electron transfer across the metal/aqueous interface”, *under revision*, 2024, arXiv: 2304.06684 [physics].
15. **Z. Huang**, T. Roos, Y. Tong and R. Kramer Campen, “Integration of Conventional Surface Science Techniques with Surface-Sensitive Azimuthal and Polarization Dependent Femtosecond-Resolved Sum Frequency Generation Spectroscopy”, *Review of Scientific Instrument*, 2024, 95:063903 (**Editor’s Pick**).
14. M. Kayanattil, **Z. Huang**, D. Gitaric, S. W. Epp, “Rubber-like elasticity in the laser-driven free surface flow of a Newtonian fluid”, *PNAS*, 2023, 120(27): e2301956120.
13. **Z. Huang**, M. Kayanattil, S. A. Hayes, and R. J. D. Miller, “Picosecond infrared laser driven sample delivery for simultaneous liquid-phase and gas-phase electron diffraction studies”, *Structural Dynamics*, 2022, 9(5):054301 (**Selected as a featured article by the editors**).
12. **Z. Huang**, D. A. Horke, and J. Küpper, “Laser-induced acoustic desorption of thermally stable and unstable biomolecules”, 2020, arXiv:1811.05925 [physics].
11. **Z. Huang**, “Development and Characterization of a Laser-Induced Desorption Source for FEL Experiments”, Doctoral dissertation, University of Hamburg, 2019.
10. **Z. Huang**, T. Ossenbrüggen, I. Rubinsky, M. Schust, D. Horke, and J. Küpper, “Development and characterization of a laser-induced acoustic desorption source”, *Analytical Chemistry*, 2018, 90(6): 3920-3927.
9. **Z. Huang**, S. Zhao, L. Sun, P. Sun, C. Zhang, Y. Wu, H. Cao, Z. Hu, S. Wang, P. Yang, and J. Chu, “Voltage dependent quantum efficiency measurement in property study of thin film solar cells”, *Journal of Infrared and Millimeter Waves*, 2014, 33(4): 395-399.
8. J. Ge, J. Jiang, P. Yang, C. Peng, **Z. Huang**, S. Zuo, L. Yang, J. Chu, “A 5.5% efficient co-electrodeposited ZnO/CdS/Cu<sub>2</sub>ZnSnS<sub>4</sub>/Mo thin film solar cell”, *Solar Energy Materials and Solar Cells*, 2014, 125: 20-26.
7. L. Peng, H. Deng, J. Tian, Q. Ren, C. Peng, **Z. Huang**, P. Yang, J. Chu, “Influence of Co doping on structural, optical and magnetic properties of BiFeO<sub>3</sub> films deposited on quartz substrates by sol-gel method”, *Applied Surface Science*, 2013, 268: 146-150.
6. S. Zhao, **Z. Huang**, L. Sun, P. Sun, C. Zhang, Y. Wu, H. Cao, Z. Huang, S. Wang, and J. Chu, “Numerical analysis of the non-ideal current-voltage characteristics of solar cell”, *Journal of Infrared and Millimeter Waves*, 2013, 32(5): 389-393.
5. S. Zhao, **Z. Huang**, L. Sun, P. Sun, C. Zhang, Y. Wu, H. Cao, G. Hu, S. Wang, and J. Chu, “A detailed study of the effect of Schottky barrier on the dark current density-voltage characteristics of CdS/CdTe solar cells”, *Acta Physica Sinica*, 2013, 62(16): 168801.
4. S. Zhao, **Z. Huang**, L. Sun, P. Sun, C. Zhang, Y. Wu, H. Cao, G. Hu, S. Wang, and J. Chu, “Analysis of electrical property parameters of CdS/CdTe solar cells fabricated by close space-sublimation”, *Acta Physica Sinica*, 2013, 62(18): 188801.
3. Y. Lyu, **Z. Huang**, and S. Jia, “Intelligent audio recognition system based on Labview”, *Science and Education Tribune*, 2010, 48(4): 45-49.
2. Y. Zhang, **Z. Huang**, J. Sun and Q. Shi, “Cognition and Application of Granular Matter in Ancient China”, *Journal of Beijing Institute of Technology (Social Sciences Edition)*, 2010, 12(1): 140-144.

1. Y. Lyu, and **Z. Huang**, “The application of MATLAB in physics”, *Journal of Shandong University (Natural Science)*, 2009, 44(s2): 20-24.