求职经验分享会

国外博士后申请过程的经验分享

分享人：刘俊德

2024年9月14日

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CV能够让导师短时间内全方位的了解你，从而获得面试机会

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1 前期材料准备：个人简历（CV）

Junde Liu

Date of Birth: October 1996 **Graduation Date: June 2024**
Email: liujunde@iphy.ac.cn **Tel: +86 151-1631-8190**
Major: Condensed matter physics **Degree: Ph.D. candidate**
Supervisor: Hong Ding and Tian Qian **Address: Beijing, China**
Research interests: ultrafast angle-resolved photoelectron spectroscopy, photo-induced phase transitions, application of machine learning method to data processing

EDUCATION

2014.08 - 2018.07	**University of Chinese Academy of Sciences**	Physics	Bachelor	(GPA : 3.81/4.00)
2017.08 - 2017.12	**National University of Singapore**	Physics	Exchange	(GPA : 4.83/5.00)
2018.08 - Present	**Institute of Physics, CAS**	Physics	PhD	(GPA : 3.96/4.00)

MAJOR COURSES

- Mathematics: Linear Algebra, Mathematical Analysis, Differential Equations, Group Theory, Probability Theory and Mathematical Statistics
- Physics: Advanced Quantum Mechanics, Solid State Theory, Experimental Methods in Solid State Physics, Introduction to Condensed Matter Physics, Nonlinear Optics, Density Functional Theory and Applications, Principles and Applications of Photoelectron Spectroscopy, Superconductivity Physics, Mesoscopic Physics

PERSONAL SKILLS

- **Frontier research in condensed matter physics:** Photo-induced hidden states in strongly correlated materials, laser-induced ultrafast non-equilibrium process
- **Ultrafast laser generation and applications:** Design and construction of deep- and extreme-ultraviolet coherent femtosecond light sources based on the high harmonic generation and nonlinear processes
- **Construction of ultra-high vacuum systems:** Ability to design, build and maintain complex ultra-high vacuum systems independently
- **Measurement of film and surface:** familiar with the vacuum transfer of two-dimensional materials and ARPES/AFM/RHEED characterization
- **Construction of laboratories:** Proven experience in the construction, maintenance, and upgrading of large scientific installations and laboratories
- **Use of scientific software:** Proficiency in Igor Pro, Solidworks, LabView, and Python
- **Language:** Proficiency in English literature reading, writing, academic reporting, and communication

MAJOR PROJECTS

2019.07 - 2021.11 Design and construction of HHG-based time-resolved ARPES

- **Main work:** Designed and built an ARPES system, including an ultra-high vacuum analysis and sample processing system, a fast sample loading and sample transferring system, a helium lamp ultraviolet light source, and a six-axis low-temperature manipulator; Designed and built an extreme ultraviolet light source based on HHG in rare gases, including the generation, monochrome, analysis and focus process; The combination of the coherent pump-probe light source and the ultra-high vacuum ARPES system was designed and achieved, including vacuum differential, the temporal and spatial overlap of the pump-probe laser at the analyzer focal position; The control program of the system and the linkage between the analyzer SES and program of delay stage were written based on LabView and C++; The program for data processing and analysis was written based on Igor Pro, including data loading, data visualization, data transformation, and data model fitting and analysis.
- **Results:** The photon energy of the HHG source covers 12eV to 40.8eV and the HHG-based time-resolved ARPES setup generates a flux of 10^{11} photons/s with tunable photon energy selectively among 12, 16.8, and 21.6eV at high repetition rates (up to 400kHz). The energy and temporal resolution of the 18^{th} order (21.6eV) are determined as 157meV and 154fs, respectively. The ultimate vacuum of the analysis chamber reaches 10^{-11} torr and the measurement temperature of the sample can be as low as 5K.

2022.01 - 2023.03 Design and construction of 6eV/7.2eV time-resolved ARPES based on nonlinear crystal

- **Main work:** Designed and constructed time-resolved ARPES based on femtosecond deep-ultraviolet coherent light source by using nonlinear optical crystal (LBO/BBO/KBBF), including the generation of a deep-ultraviolet coherent laser, pulse width compression based on the concave multi-pass focal cavity, dual-pump coherent light source and Pockels cell-based pulse picking module; Designed and implemented the connection between the atmospheric pressure optical path and ultra-high vacuum ARPES system.
- **Results:** Successfully built time-resolved ARPES system based on multi-band UV light source with three photon energy (1.2eV/2.4eV/3.6eV) of pump laser depending on experimental needs. The energy and temporal resolution are determined as 15meV and 100fs, respectively. The repetition rate can be continuously adjusted from 1kHz to 10MHz. The ultimate vacuum of the analysis chamber reaches 10^{-11} torr and the measurement temperature of the sample can be as low as 5K.

2022.01 - 2022.10 Removal of noise and grid structure from ARPES spectra via deep learning method

- **Overview:** Developed a novel method to improve spectral data quality using deep learning techniques. By applying this method to the spectra processing, the scientists will be able to overcome instrument limitations and obtain higher-quality data more efficiently, which can contribute to discovering detailed physical features.
- **Results:** Based on the low-dimensional structure in the high-dimensional data, a novel spectra-processing algorithm is designed to achieve the effect of removing the extrinsic structure such as noise, grid, and spurious signal by using the correlation information of the data itself without the need for the training set, thus has better robustness and universality, which has wide application in the field of spectra processing.

2022.10 - present Electronic structure study of the hidden state in the strongly correlated system 1T-TaS_2

- **Overview:** 1T-TaS_2, a strongly correlated material with rich physical properties such as charge density wave, Mott phase, interlayer order, and superconductivity, has received close attention from researchers recently. In particular, 1T-TaS_2 can be induced and modulated by ultrashort pulsed laser and electric pulses to the hidden state that cannot be reached in equilibrium. We use the ultrafast laser and time-resolved ARPES to characterize the electronic structure before and after excitation to further understand the mechanism of the transition. At the same time, we increase the efficiency of the writing or erasing process through modulation by pressure, doping, and thinning, thus providing the possibility of ultrafast optical devices.

PUBLICATIONS

1. **Junde Liu***, Dongchen Huang*, Yi-feng Yang and Tian Qian. Removing grid structure in angle-resolved photoemission spectra via deep learning method. *Physical Review B* **107**, 165106 (2023).
2. Dongchen Huang*, **Junde Liu***, Tian Qian and Yi-feng Yang. Spectroscopic data de-noising via training-set-free deep learning method. *Science China Physics, Mechanics & Astronomy* **66**, 267011 (2023).
3. Zhipeng Song*, **Junde Liu***, Qian Fang*, Yi Biao*, Anning Yang, Kefan Wu, Mojun Pan, Chen Liu, Jiaou Wang, Tian Qian, Hui Guo, Hongliang Lu, Xiao Lin and Hong-Jun Gao. Observation of a nonlinear charge density wave in monolayer $TiSe_2$-$NbSe_2$ heterostructure. *Prepare for submission to Nature Communications*.
4. Famin Chen*, Ji Wang*, Mojun Pan*, **Junde Liu***, Jierui Huang, Kun Zhao, Chenxia Yun, Tian Qian, Zhiyi Wei and Hong Ding. Time-resolved ARPES with tunable 12-21.6eV XUV at 400 kHz repetition rate. *Review of Scientific Instruments* **94**, 043905 (2023).
5. Ji Wang*, Famin Chen*, Mojun Pan, Siyuan Xu, Renchong Lv, **Junde Liu**, Yuanfeng Li, Shaobo Fang, Yunlin Chen, Jiangfeng Zhu, Dacheng Zhang, Tian Qian, Chenxia Yun, Kun Zhao, Hong Ding and Zhiyi Wei. High-flux wavelength tunable XUV source in the 12-40.8 eV photon energy range with adjustable energy and time resolution for Tr-ARPES applications. *Optics Express* **31**, 9854 (2023).
6. Jierui Huang*, Tan Zhang*, Sheng Xu*, Zhicheng Rao, Jiajun Li, **Junde Liu**, Shunye Gao, Yaobo Huang, Wenliang Zhu, Tianlong Xia, Hongming Weng and Tian Qian. Electronic structure of the weak topological insulator candidate zintl $Ba_3Cd_2Sb_4$. *Chinese Physics Letters* **40**, 047101 (2023).

1 前期材料准备：推荐信（推荐人名单）

- 不同的课题组情况不一样：
  1. 招聘要求里写明需要提供推荐人名单的
  2. 未做要求，一般可以先不提供，等对方要求时再提供
  3. 推荐信如果要提供一般情况来说都是面试后或者正式接受之后

- 一般是向自己的导师，课题合作导师，或者导师推荐人选寻求推荐信

  （一般是自己写好，用导师邮件发，以及用导师所在单位的信纸格式）

- 主要内容包括：和导师的关系（推荐去哪，基本情况介绍），导师对科研水平和专业能力的评价（课题项目中体现），对未来博后工作表现的高度期望以及感谢

1 前期材料准备：研究计划/声明

少数单位要求，特别是大装置或者公开招聘项目

Quantum materials have emerged as a fascinating class of materials that exhibit extraordinary properties and functionalities. Understanding their behavior under external stimuli, such as light, is crucial for unlocking their potential in various technological applications. In particular, photo-induced phase transitions in quantum materials have garnered significant interest due to their potential for ultrafast switching and control of material properties.

During my PhD research, my main work involved designing and building HHG-based time-resolved ARPES and laser-based time-resolved ARPES setups with exceptional performance. Utilizing these laboratory-based ARPES in IOP-CAS and synchrotron-based ARPES in Shanghai Synchrotron Radiation Facility (SSRF), I investigated the photo-induced hidden state in the strongly correlated material 1T-TaS_2 and topological phase transition in the topological insulator $ZrTe_5$. In addition, I developed a novel deep-learning method to enhance the quality of spectral data, enabling the acquisition of higher-quality data more efficiently.

Photo-induced phase transitions occur when the electronic, magnetic, or structural properties of a material undergo a rapid and reversible change upon exposure to light pulses. These ultrafast processes can lead to unique phenomena, such as light-induced superconductivity or emergent phases with novel electronic properties. However, the underlying mechanisms governing these phase transitions and their dynamics remain poorly understood. Therefore, my research interests aim to explore the time-resolved evolution of photo-induced phase transitions in quantum materials to unravel the fundamental processes at play in the future. This research will contribute to the fundamental understanding of photo-induced phase transitions in quantum materials. By elucidating the mechanisms and timescales involved, it will pave the way for the design and control of novel functional materials with tailored properties. The insights gained from this study will have broad implications for the development of ultrafast optoelectronic devices, energy-efficient memory storage, and quantum information processing technologies.

- 研究的动机：从广泛的角度出发，过渡到实际具体的物理问题
- 研究的方法：针对上述问题，采用了什么手段来研究
- 研究的成果：发现的一些结果和现象，具有什么影响
- 研究的展望：未来或者后续的研究方向，对领域的意义

2 博后招聘信息

- 导师/师兄师姐推荐：组内熟知的课题组，有过合作经历的课题组
- 发表文章中经常关注的课题组：找到相应的课题组主页，看是否有招聘信息，如果没有也不代表不招（也可以发邮件联系）
- 网页搜索：搜索研究方向手段关键词+博后招聘
- 会议套瓷：会议中遇到合适方向的导师可以表明意向

- 熟人推荐的，有过合作的一般希望比较大，流程也相对简单
- 可以先试几个不是最想去的课题组，锻炼一下面试
- 分批海投，避免同一时期出现太多面试
- 广撒网，觉得合适的课题组都可以邮件联系

3 邮件套瓷：Cover letter

Dear committee of Northeastern University,

I am writing to express my sincere interest in open Postdoctoral Research Associate position on Ultrafast Spectroscopy of Quantum Magnets. I would love to pursue my postdoctoral studies as a member of your team. I am currently a graduate student supervised by Professor Hong Ding and Professor Tian Qian at the Institute of Physics, Chinese Academy of Sciences. My research work focuses on ultrafast ARPES, strongly correlated quantum materials and application of machine learning method to data processing.

During my PhD research, my main work involved designing and building HHG-based time-resolved ARPES and laser-based time-resolved ARPES setups with exceptional performance. Utilizing these experimental techniques, I investigated the photo-induced hidden state in the strongly correlated material 1T-TaS_2 and topological phase transition in the topological insulator $ZrTe_5$. In addition, I developed a novel deep-learning method to enhance the quality of spectral data, enabling the acquisition of higher-quality data more efficiently.

This postdoctoral position presents an excellent opportunity to contribute to the research of novel correlated quantum materials by means of ultrafast spectroscopy which is a hot topic in the field of condensed matter physics. It perfectly aligns with my interest in exploring new physical phenomena and mechanisms in quantum materials. I believe that my extensive experience in time-resolved ARPES would be a significant asset to this program. I have attached my CV and research statement. I am also prepared to provide three reference letters upon further request. Please do not hesitate to reach out if you have questions and I look forward to hearing from you.

Thank you for your valuable time and kind consideration.

Sincerely,

Junde Liu

- 个人简介：介绍自己的基本信息，以及研究方向
- 研究成果：介绍自己博士期间主要的研究成果和工作
- 未来博后计划：结合你申请的课题组研究方向，说明自己未来的研究计划和展望，自己的研究经历如何和对方匹配上

1. 面试PPT的准备：个人介绍（研究兴趣、科研技能、教育背景）；博士期间的研究经历（三个最为主要的，包含动机和主要结果）；发表的文章目录和致谢；未来的研究计划（结合面试的课题组）
2. 可以提前把英文稿写好，多练几遍，线上面试也可以看讲稿
3. 总的PPT时间控制在半小时左右比较好，实际也看对方导师是否有具体的要求
4. 提前准备一些可能被问到的问题；了解对方课题组的工作，特别是近期的；同时也准备一些向对方导师提问的问题（博后研究生活上关心的问题）

5 申请签证

1. 提前申请！！！在允许的时间范围内越早越好！以德国为例，物理所的专业一般都会被审查，整个时长将近半年；
2. 以德国为例，签证申请还需要预约或者抢号，所以即使是材料没有准备齐全的时候，也可以适当开始提前预约或者抢号了
3. 准备签证材料的时候尽可能规避一些敏感的词汇：量子、半导体、超导等等，可以替换成通俗简单的名词（例如固体材料）
4. 保持良好的心态，和外国导师多沟通进展，德国审查过程中也可以让导师帮忙联系国外的外管局

6 国外生活（德国）

1. 工作上：德国人几乎不加班（除非做实验的会晚走一点），但是在工作时间内几乎是看不到摸鱼玩手机的，组里基本上的工作时间是上午九点到下午五六点
2. 饮食上：取决于具体的城市，对于小城市来说的话好吃的不多（食堂也基本是白人饭居多），中餐馆或者外卖也很贵，所以自己做饭的情况比国内多很多，口味性价比都比出去吃更好
3. 生活上：相对国内娱乐生活很少，会有很多独处的时间，可以自我安排一些活动（健身，做饭，看视频）来调剂一下
4. 总体来说，德国小城市的生活便利性比国内差远了，物欲相对比较低，生活比较宁静


中国科学院物理研究所
Institute of Physics Chinese Academy of Sciences