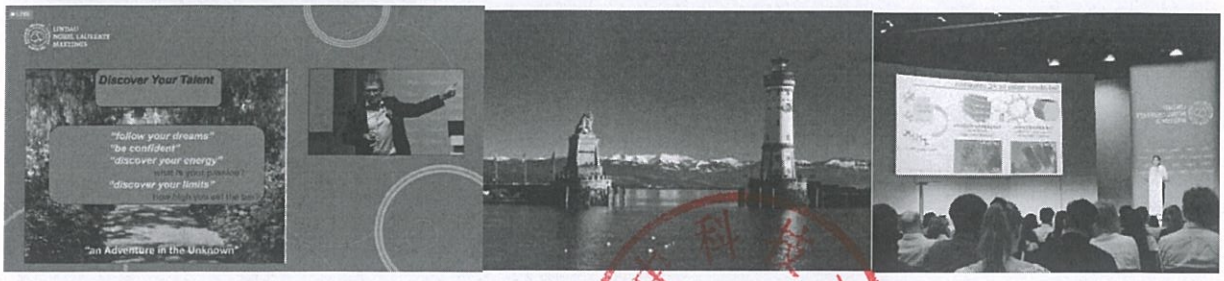
Chinesisch-Deutsches Zentrum für Wissenschaftsförderung
中德科学中心

APPLICATION FOR THE LINDAU PROGRAM

Topic	**Interdisciplinary (Chemistry, Physics and Medicine/Physiology)**		
Time of the Meeting	**2026.6.28-07.03**		
Time of the Science Tour	**The specific time will be advised in due course**		
Place	**Lindau and other German cities during the Science Tour**		
Name	Lin Zhou	**Gender**	Male
Date of Birth	06/08/2001	**Place of Birth**	Beihai, Guangxi Province
Institute/University	Huazhong University of Science and Technology School of Physics		
Address/Zip Code Phone E-Mail	Address: Huazhong University of Science and Technology, No. 1037, Luoyu Road, Hongshan District, Wuhan, Hubei Province, P. R. China Zip code:430074 Phone: +86 18077974437 E-Mail: 1822548678@qq.com		
Field of Research	Astrophysics, Gamma-Ray Burst, Data science		
Certificates of English and other languages	College English Test-6 (CET6): 458		
Expected Date of Graduation	06/2029		



1. Statement of your qualifications and reasons for wishing to attend the Nobel Laureate Meeting

I am Lin Zhou, a Ph.D. student in the class of 2025 at the School of Physics, Huazhong University of Science and Technology. I will make a statement in the following four aspects: my research field, reason behind my field selection, international experiences, and career plans.

Research Field

My research focuses on GRB detection in the field of high-energy astrophysics, with its core focus on "analyzing GRB physical mechanisms using multi-platform observational data and developing transient source detection techniques". My current accomplishments are as follows: For GRB searches based on TESS satellite data, I designed data screening and feature recognition algorithms, leading to the identification of 2 GRB afterglow signals and 1 prompt emission signal from a three-year dataset; regarding the study of jet properties of GRB 221009A in the TeV energy band, I independently constructed a mathematical model to fit the TeV light curve observed by the Large High-Altitude Air Shower Observatory (LHAASO). This work successfully derived small off-axis angle parameters, and the results are consistent with the current mainstream jet theoretical framework. These findings have been published in Monthly Notices of the Royal Astronomical Society (MNRAS) with the **DOI: 10.1093/mnras/stae1644**. Currently, I am developing weak transient source detection technology for the LHAASO observatory. I have completed the construction of a stacking pipeline suitable for LHAASO data, and its feasibility has been verified using multiple sets of observational data. In subsequent work, this pipeline will be used to conduct stacking searches for gamma-ray bursts.

This research is interdisciplinary, sitting at the intersection of physics (a discipline with a history of Nobel Prize recognition) and data science (a branch of natural science). It encompasses high-energy astrophysics as well as data science techniques such as machine learning and data mining, representing the application of data science in the field of high-energy physics.

Reason Behind My Field Selection

My decision to pursue a doctoral degree stems from my passion for and curiosity about exploring astrophysics. My current research focus is shaped by three key factors: 1. The completion of next-generation ground-based high-energy observational facilities like LHAASO provides a unique platform for researchers in China to conduct high-level research. In particular, its high-sensitivity observation capabilities in the TeV energy band can address certain gaps in international research on GRB TeV radiation. Choosing this direction allows me to fully leverage the advantages of domestic large-scale scientific facilities and achieve differentiated breakthroughs in research; 2. Guidance from my supervisor in the areas of high-energy astrophysics and interdisciplinary research; 3. Support from fellow teachers and classmates around me.

International Experiences

I have only delivered a poster presentation at the LHAASO Collaboration Conference in 2024 and have not given oral academic presentations at other international conferences yet.

Career Plans

1. concentrate on my current research, aiming to publish two high-impact academic papers.
2. After graduation, plan to join the LHAASO astrophysics research team. I will continue to contribute to "interdisciplinary research on high-energy transients" and advance studies on GRB physical mechanisms and detection technologies.

Therefore, I treasure the oppotunity to travel to Germany and participate in the Lindau program, to deeper learn about the relevant research currently by professors in Germany.

Declaration

We confirm with our signature that the information provided by the applicant is true. We are willing to recommend the applicant to participate in the selection of the 75th Lindau Nobel Laureate Meeting organized by the Sino-German Center.

Lin Zhou.

Signature of the applicant

Seal of the university

Attachment

1. Letter of recommendation from your thesis advisor and/or the academic committee of your current institution. Please fill in the template.
2. Curriculum vitae and publication list (5 most relevant publications for all participants) (If you are not the only author, please list your co-authors). (one page at most, use Arial 12 point characters, single-spaced)
3. Copy of ID card
4. Published articles, Certificates of Scholarships and Certificates of English and other languages

To Whom It May Concern,

It is my great honor to recommend my doctoral student, Lin Zhou, for participation in the 2026 Lindau Nobel Laureate Meetings to be held in Lindau, Germany. Since joining my research group in 2023, Zhou has consistently maintained a passion for scientific research, demonstrating outstanding academic potential and excellent cross-cultural academic communication skills.

Zhou's research experience—from his undergraduate studies to the current joint training program at the Cosmic Ray Center of the Large High-Altitude Air Shower Observatory (LHAASO)—fully reflects his exceptional academic competence. During the undergraduate period, he participated in a GRB search project based on data from the TESS. From three years of observational data, he successfully identified 2 cases of GRB afterglow signals and 1 case of prompt emission signal. In August 2023, Zhou conducted research on the off-axis angle of the jet in the TeV energy band of GRB 221009A. He independently developed a mathematical model, and fitting verification showed that the results were highly consistent with mainstream theories in the field. The relevant research findings have been incorporated into the paper Determining the viewing angle from TeV light curve of GRB 221009A (DOI: 10.1093/mnras/stae1644), which fully demonstrates his academic research capabilities. During the joint training at LHAASO, Zhou independently designed the framework for the data stacking and processing workflow for weak transient source detection, and verified its technical feasibility through multiple sets of tests.

Zhou possesses the foundational ability to independently plan and execute research activities, as well as strong cross-cultural academic communication skills. In advancing relevant work, he proactively conducted literature and technical material research, actively engaged in academic discussions with the cooperative supervisor's team, and proposed targeted solutions to key technical issues—all of which prove his foundational ability to independently plan and execute research activities. Currently, Zhou has passed the College English Test Band 6 and has given a poster presentation at an LHAASO academic conference, providing evidence of his cross-cultural academic communication skills.

In addition, Zhou is diligent, generous in interpersonal interactions, and willing to share his knowledge and experience. He holds a sustained passion for astronomy, proactively follows cutting-edge developments in the field, and has dabbled in multiple sub-fields such as exoplanet detection, high-energy cosmic ray physics, and gravitational waves. At the same time, he has a wide range of hobbies, including astrophotography, Japanese language, and the art of painting. His all-round development will undoubtedly help him build friendships with others more easily.

The Lindau Nobel Laureate Meetings serve as a valuable platform for young scholars to access cutting-edge science and broaden their international perspectives. This represents a rare opportunity for Zhou. I am confident that he will be an outstanding participant at the Meetings, engaging in exchanges and learning with distinguished scientists from around the world. This experience will lay a more solid foundation for his future research career and enable him to make greater contributions to scientific research in both China and Germany.

Therefore, I strongly recommend Zhou for participation in the Lindau Nobel Laureate Meetings and firmly believe that he will demonstrate excellent scientific talents.

Please do not hesitate to contact me if you have any questions.

Sincerely,
Yuan-Chuan Zou

Yuanchuan Zou

October 15, 2025

Professor
School of Physics, Huazhong University of Science and Technology
1037 Luoyu Road, Wuhan, 430074, China

Personal Resume

Education

2019.09-2023.06: Huazhong University of Science and Technology, Bachelor's Degree
2023.09-Present: Huazhong University of Science and Technology, Ph.D. Candidate (Integrated Master's and Ph.D. Program)

Conferences & Award

August 2024: Participated in the LHAASO Summer School in 2024

October 2024: Attend the First LHAASO Collaboration Conference in Chengdu, Sichuan Province, China, presented an poster report.

August 2025: Participated in the LHAASO Summer School in 2025

Academic Publications

[1]**Zhou, L.** and Zou, Y.-C., "Determining the viewing angle from TeV light curve of GRB 221009A", Monthly Notices of the Royal Astronomical Society, vol. 532, no. 2, OUP, pp. 2189–2195, 2024. doi:10.1093/mnras/stae1644.

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Shuangqing Road 83
Haidian District
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Chinesisch Deutsches Zentrum für Wissenschaftsförderung
中德科学中心

Dear applicant,

Thank you for submitting your application for the Lindau programme to the Sino-German Center for Research Promotion (SGC). In order to comply with relevant regulations on personal data protection, we need to obtain your informed consent by signing the following statement. Please return the signed form to us, both as a hard copy and a scanned copy by e-mail to Ms. Zhu Meilan (Zhu@sinogermanscience.org.cn).

The Sino-German Center for Research Promotion

Informed Consent form for applicants in the Sino-German Center for Research Promotion Lindau programme

☑ I hereby agree to the Sino-German Center for Research Promotion (hereinafter referred to as SGC) and its parent institutions (National Nature Science Foundation of China and Deutsche Forschungsgemeinschaft) storing and processing my personal information (including but not limited to: surname, first name, academic title, field of research and specialism, country, gender, date of birth, telephone number, postal address, e-mail address, current university/research institution) and the application materials for the purpose of review and funding management in the SGC's programme. I consent to my data being shared with the reviewers in the course of the application evaluation process, with the Lindau Foundation and the Lindau Council in case of a positive decision, and with Third Party data Processors such as Evaluation Agencies supporting the SGC in assessment of its funding programmes.
I am aware that I can withdraw my consent, partially or wholly, at any time, with or without giving reasons, by writing to Ms Zhu Meilan under zhu@sinogermanscience.org.cn. If my consent is withdrawn, any processing of my data which occurred on my consent before the withdrawal of the same shall not be considered objectionable.

☑ I also agree to the SGC using my contact data for informational purposes and to including me in the Lindau Alumni information network.

For more details please see the attached file for personal information processing.

Lin Zhou
Name in print

2025/10/11 Lin Zhou 周霖
Date, Signature

Huazhong University of Science and Technology
Name of University/Research Institution

Bin Wang

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MNRAS 532, 2189–2195 (2024) https://doi.org/10.1093/mnras/stae1644
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Determining the viewing angle from TeV light curve of GRB 221009A

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ABSTRACT

Gamma-ray bursts (GRBs) are among the most powerful explosive events in the Universe. LHAASO recently observed the most luminous one: GRB 221009A, and unveiled its TeV light curve. The light curve exhibits a distinct jet break at around 670 s, enabling the derivation of the viewing angle based on the smoothness of the jet break. We constructed two models with or without considering the high-latitude radiation, where the viewing angle was treated as a free parameter, to fit the TeV light curve. The viewing angles obtained were 9.4×10^{-4} and 5.9×10^{-3} rad, respectively. These values closely resemble an on-axis scenario, given the opening angle is 1.4×10^{-2} rad.

Key words: gamma-ray burst: individual: GRB 221009A – stars: jets.

1 INTRODUCTION

Gamma-ray bursts (GRBs) are one of the most powerful explosive events in the Universe, releasing extremely highly energetic gamma-ray radiation. For a long time, GRBs have been a fascinating research topic for astronomers because their origins and nature involve a series of complex physical processes.

On 2022 October 9, the brightest GRB (GRB 221009A) initially triggered at 13:16:59.988 UTC by the *Fermi* Gamma-Ray Burst Monitor (*Fermi*-GBM; Meegan et al. 2009) in the gamma-ray band (Lesage et al. 2022; Veres et al. 2022). This event was also detected (Pillera et al. 2022) by the *Fermi* Large Area Telescope (*Fermi*-LAT; Atwood et al. 2009). The Large High Altitude Air Shower Observatory (LHAASO; Cao et al. 2019) also reported the detection of gamma-rays, reaching up to 18 TeV (Huang et al. 2022). *Swift* Burst Alert Telescope (*Swift*-BAT; Barthelmy et al. 2005) also detected the same event approximately an hour after the initial trigger. About 143 s later, the *Swift* X-ray Telescope (*Swift*-XRT; Burrows et al. 2005) pinpointed the target, with the *Swift* Ultraviolet/Optical Telescope (UVOT; Roming et al. 2005), locating it at (RA, Dec.) = (288.26452°, 19.77350°) with a 90 per cent confidence error radius of about 0.61 arcsec (Dichiara et al. 2022). The event was quickly classified as a GRB (Veres et al. 2022), and according to X-shooter/VLT reports, it occurred at a redshift of 0.151 (Izzo et al. 2022), confirming it as the brightest event ever recorded by any GRB detector. After 2 d, reports of a soft X-ray ring due to dust scattering were released, based on observations from the *Swift*-XRT (Tiengo et al. 2022). Multiwavelength observations were reported later (e.g. Bright et al. 2022; Kennea et al. 2022).

The variation in the light curve and the corresponding physical processes of GRB 221009A have become a highly discussed research topic. The half-opening angle and the viewing angle are elements that influence the light curve during the afterglow decay phase. The half-opening angle $\theta_{\rm jet}$ is the angle at which the cone-shaped region extends from the central axis of the jet towards one side. The viewing angle $\theta_{\rm obs}$, also known as the observer's angle, represents the angular deviation of the observer from the cone axis. Both lead to a steepening decay in the late afterglow.

GRB 221009A is believed to have a narrow opening angle and a slightly off-axis direction, as evidenced by the jet break in the later stages of the afterglow light curve.

Considerable amount of studies have been devoted to the investigation of the jet opening angles of this GRB (e.g. Laskar et al. 2023; Ren et al. 2023; Williams et al. 2023). However, limited attention has been given to the consideration of off-axis angles. LHAASO Collaboration (2023) estimated a half-opening angle $\theta_{\rm jet}$ to be approximately 0.8°, equivalent to 0.140 rad. This determination was made using the jet break time and applying their late afterglow model (e.g. Sari, Piran & Halpern 1999), assuming a viewing angle of zero. O'Connor et al.'s (2023) findings yielded $\theta_{\rm obs} \lesssim 0.016$ rad and $\theta_{\rm jet} \geq 0.4$ rad with a structured jet model. This study discussed a situation about a structured jet with extended wings and determined the viewing angle.

Gill & Granot (2023) built a semi-analytical model to analyse an adiabatic spherical blast wave and extended the model to angular structured jets. They found that the viewing angle was comparable to the core angle of the energy profile, $\theta_{\rm obs} \sim \theta_{\rm c,\epsilon}$, which was determined to be 0.02 rad. This was employed to explain the high fluence of the gamma-ray emission and to interpret the multiwaveband light curve.

Polarimetry was used to infer the viewing angle (e.g. Ghisellini & Lazzati 1999). Negro et al. (2023) took a set of parameters to give a polarization consistent with the IXPE spectropolarimetric measurement and found it favours a jet opening angle approximately 1.5°, and a viewing angle about two-thirds of the jet opening angle, which correspond to 0.026 and 0.017 rad, respectively.

In this work, we focus on the TeV light curve around the jet break. We draw Fig. 1 as a sketch. If the viewing angle is zero,

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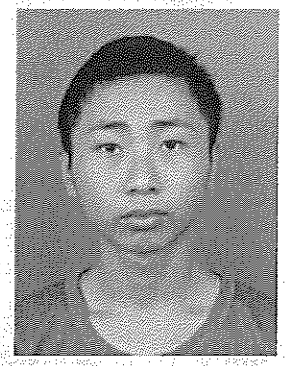

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考试时间：2021年6月

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458	180	136	142

口　试

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考试时间：--

等级	--

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