云南大学中国西南天文研究所简报
SWIFAR NEWSLETTER

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研究所网站 SWIFAR Website: http://www.swifar.ynu.edu.cn

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一、 科研 Research

亮点工作 Featured Science:

近日，云南大学中国西南天文研究所陈丙秋、李广兴副教授和刘晓为教授利用本团组构建的国际上首个高精度、覆盖整个银盘的星际尘埃三维分布图，搜寻银盘分子云并精确测量了它们的距离，发布了国际上首个具有精确距离测量的大样本银盘分子云表。

Recently, a team consisting of associate Profs. Bingqiu Chen, Guangxing Li, and Prof. Xiaowei Liu from the South-Western Institute for Astronomy Research (SWIFAR) at Yunnan University has searched for molecular clouds in the Galactic plane and determined their accurate distances using the world's first high-precision three-dimensional distribution of the interstellar dust grains covering the entire Galactic plane constructed by the team, and released a large catalogue of molecular clouds in the Galactic plane with accurate distance measurements.

银河系星际分子气体主要存在于低温、稠密的巨大分子云中。分子云的主要成分是分子氢，但也包含少量的重元素分子如一氧化碳分子以及尘埃颗粒。分子云温度只有 10 – 30 开尔文（零下 263 – 零下 243 摄氏度），典型大小约 100 光年，质量约 10 万倍太阳质量，主要分布在银盘中。银河系大约有数千个分子云，它们是恒星形成的场所。研究分子云的物理特性对阐述恒星形成物理过程，揭示银河系的恒星形成历史与演化过程具有重要的意义。

Most molecular gas in our Galaxy exists in molecular clouds where stars form. The formation of molecular clouds and the birth of stars are key processes in the life cycle of galaxies. The study of molecular clouds is thus of pivotal importance. For that purpose, accurate distance determinations are essential to estimate the basic physical properties of the clouds, including sizes and masses.

精确测量分子云距离是获取分子云基本物理特性的基础，但十分困难。传统基于分子云视向速度获得的运动学距离典型误差高达 30-50%，只有极个别邻近著名分子云有高精度的距离测量。建立一个具有精确距离测量的大样本银盘分子云表至关重要。云南大学中国西南天文研究所团组基于该团组构建的国际上首个高精度覆盖整个银盘的星际尘埃三维分布图（见 http://www.swifar.ynu.edu.cn/info/1111/1931.htm），采用聚类分层算法，分离出银盘中 567 个分子云，并基于本团组之前发展的算法，给出了这些分子云的精确距离，精度高达 2 - 5%。这是目前国际上首个具有精确距离测量的大样本分子云表。基于该样本，研究团组还发现了银河系旋臂中一个新的毛刺结构（spur）。该项研究工作发表在国际专业学术期刊《皇家天文学月刊》(*Monthly Notices of the Royal Astronomical Society*)（文章链接：https://academic.oup.com/mnras/article/493/1/351/5716681）。

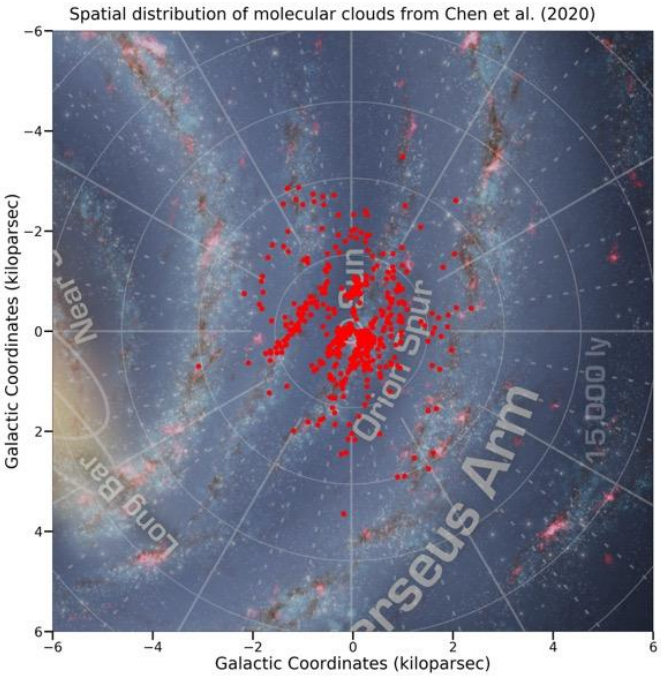

图 1.1：样本中分子云的空间分布（红色圆点），背景为 NASA/JPL-Caltech/R. Hurt (SSC/Caltech)绘制的银河系俯视效果图

However, building a large sample of molecular clouds with accurate distance determinations is a daunting task. Kinematic distances estimated from light-of-sight velocities suffer from large uncertainties due to the uncertainties in the Galactic rotation curve and the effects of the peculiar velocities and the noncircular motions of the clouds, on top of the well-known near/far-side ambiguity. Most molecular clouds reside in the Galactic disk. Hitherto only a few local well-studied molecular clouds at low Galactic latitudes have accurate distance estimates. In the current study, 567 molecular clouds in the Galactic plane have been identified and isolated by applying a technique of hierarchical clustering analysis to the 3-dimensional colour excess distribution produced by the dust grains in the Galactic disk, previously constructed by the team (http://www.swifar.ynu.edu.cn/info/1111/1931.htm). Accurate estimates of their distance estimates are then obtained with a dust model fitting algorithm. Typical uncertainties of the resultant distances are 2 - 5 per cent. The resulted catalogue of molecular clouds is the first one with accurate distance estimates for a large number of molecular clouds in the Galactic plane. Based on the catalogue, a possible spur connecting the Local and the Sagittarius Arms in the fourth quadrant of the Galactic disk has also been identified. The paper has recently been published in the *Monthly Notices of the Royal Astronomical Society* (article link: https://academic.oup.com/mnras/article/493/1/351/5716681).

基金申请 Grant Application:

过去两年，中国西南天文研究所申请国家自然科学基金表现出色。

In the past two years, SWIFAR has achieved outstanding performance in national grant applications.

2018 和 2019 两个年度，中国西南天文研究所申请并获批主持国家自然科学基金 8 项，包括重点项目 2 项，面上项目 2 项，青年科学基金项目 3 项，国际（地区）合作与交流项目 1 项。此外，研究所申请并获批主持国家重点研发计划子课题 1 项、博士后基金面上项目 2 项。

In 2018 and 2019, SWIFAR applied for and was awarded a total of 8 grants by the National Natural Science Foundation of China (NSFC), including 2 of Key Program, 2 of General Program, 3 of Young Scientists Fund, and 1 of International (Regional) Cooperation and Exchange Program. A sub-project was also awarded by the National Key Research and Development Program. In addition, 2 grants of General Program were awarded by the National Postdoctoral Foundation.

2020 年，研究所将申请 6 项国家自然科学基金，包括优秀青年科学基金 1 项，面上项目 2 项，青年科学基金 2 项，外国青年学者研究基金 1 项。

In 2020, SWIFAR shall submit 6 NSFC grant applications, including 1 of Outstanding Young Scientists Fund, 2 of General Program, 2 of Young Scientists Fund and 1 of International Young Scientists Research Fund.

二、 学术活动 Academic Activities

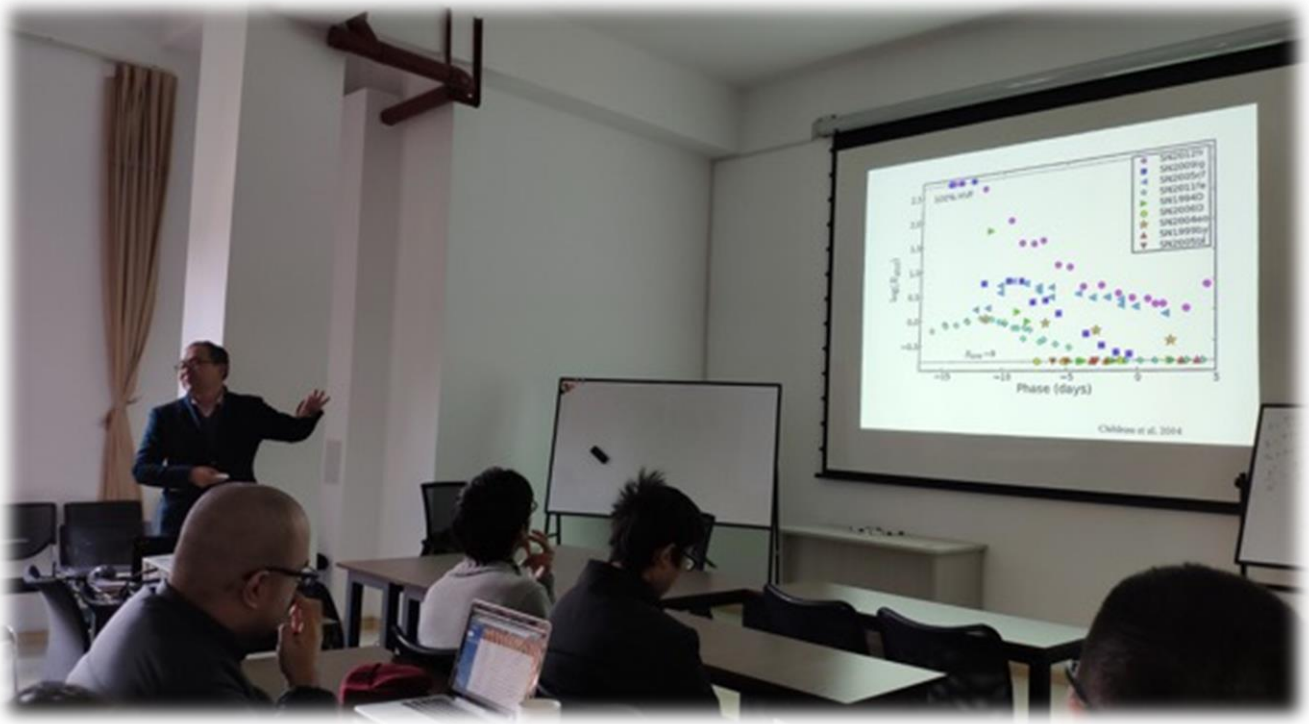

图 2.1：孟祥存研究员在云南大学天文楼作报告 Research Professor Xiangcun Meng giving a colloquium

学术报告 Colloquia:

时间： 2020 年 1 月 8 日，报告人：孟祥存 （中国科学院云南天文台）
题目：高速特征作为 Ia 型超新星星族探针
地点：云南大学天文楼 2111 室
摘要：Ia 型超新星是天体物理中非常有用的探针，它们具体的机制还是不清楚，例如，前身星和爆发模型。Ia 型超新星光谱中高速特征能够提供很多有用的信息。我将展示 SNIa 中 CaII 红外三线的最大亮度与星族的关系。CaII IR3 的强度与 Si II 吸收线的速度权重的差值有线性依赖关系。我还会讨论高速特征的起源，以及对我们所发现的 SNIa 的前身星模型的限制。

Time: January 8, 2020, Speaker: Xiangcun Meng (YNAO)
Title: High-velocity feature as the indicator of stellar population of Type Ia supernovae
Venue: Room 2111, YNU Astronomy Building
Abstract: Although Type Ia supernovae (SNe Ia) are very useful in many astrophysical fields, their exact nature is still unclear, e.g., the progenitor and explosion models. The high-velocity features (HVFs) in the optical spectra of SNe Ia could provide some meaningful information to constrain the nature of SNe Ia. Here, I show strong evidence that the SNe Ia with a strong Ca II infrared triple (Ca II IR3) HVF around maximum brightness are associated with a relatively younger population than those with a weak Ca II IR3 HVF. I also find that the strength of the Ca II IR3 HVF is linearly dependent on the difference of the absorption-weighted velocities between the Ca II IR3 and Si II 635.5 nm absorption lines. I will discuss the origin of the HVFs and the constraints from our discoveries on the progenitor model of SNe Ia.

时间：2020 年 3 月 26 日，报告人：王建民（中国科学院高能物理研究所）
报告题目：宇宙学距离的几何测量
报告地点：Zoom 视频报告
报告摘要：近期 GRAVITY/VLTI 通过干涉实现了高空间分辨率的观测，这使得我们有希望实现宇宙学距离的几何测量。本报告中将仔细介绍利用反响映射和干涉观测测量第一个类星体 3C273 的距离，以及对哈勃常数的测量。

Time: March 26, 2020, Speaker: Jianmin Wang (IHEP)
Title: Geometric measurement of cosmological distance
Venue: Video Presentation via Zoom
Abstract: Recently, the GRAVITY/VLTI manages to achieve high spatial resolution observations through interferometry. It allows us to measure the cosmological distance using the geometric method. In this talk, I will show the details of interferometry measurement, and how we measure the distance of first-discovered QSO 3C273 using reverberation mapping, and the estimate of Hubble constant.

午餐讨论会 Lunch talks:

时间：2020 年 1 月 15 日，报告人：李楠（中国科学院国家天文台）
报告地点：云南大学天文楼 2111 室
报告题目：大数据时代的强引力透镜
报告摘要：引力透镜已经成为研究宇宙黑暗面最有力的工具。宇宙学强引力透镜可以探测暗物质晕团致密核的性质，同时提供研究遥远宇宙的机会。随着下一代望远镜的允许，例如 LSST，Euclid 和 WFIRST，天体物理和宇宙学将步入大数据的时代，数百亿的天体将被发现。在这样大数据的情况下，寻找和建模引力透镜需要自动化的方法。为了实现这个目标，我们建立了相关的机器学习算法。在这个报告中，我将首次描述传统机器学习方法和深度学习方法对透镜搜寻和建模的自动化管道构建。然后通过透镜模拟程序，呈现管道在模拟数据上的表现。除了机器学习之外，我还介绍其它尝试分析强引力透镜的方法，这是另一种替代机器学习求解天体物理和宇宙学中大数据的策略。

图 2.2：李楠博士在云南大学天文楼作午餐讨论会报告
Dr. Nan Li giving a lunch talk

Time: January 15, 2020
Speaker: Nan Li (NAOC)
Venue: Room 2111, YNU Astronomy Building
Title: Strong Gravitational Lensing in the Big Data Era
Abstract: Gravitational lensing has become one of the most powerful tools available for investigating the "dark side" of the Universe. Cosmological strong gravitational lensing, in particular, probes the properties of the dense cores of dark matter halos and offers the opportunity to study the distant Universe at flux levels and spatial resolutions otherwise unavailable. Moreover, with the capabilities of next-generation telescopes, first with LSST, and then Euclid and WFIRST,

astrophysics and cosmology are stepping into the big data era, i.e., tens of billions of objects will be observed. Hence, searching and modeling strong lenses in such enormous datasets require automated approaches. For this purpose, we build programs with machine learning algorithms. In this presentation, I will first describe the construction of pipelines for automated lens-finding and -modeling adopting traditional machine learning and deep learning, then present the performance of the pipelines on simulated data created by a lensing simulation program named PICS. Furthermore, beyond machine learning, I will also introduce some attempts to analyse strong lenses in the manner of citizen science, which is an alternative way of machine learning for solving the big data problems in astrophysics and cosmology.

时间：2020 年 3 月 23 日，报告人：刘良端（北京师范大学）
报告地点：Zoom 视频报告
报告题目：超亮超新星和快速光学变源的物理性质
报告摘要：大视场光学巡天的快速发展正在彻底改变时域天文学。过去十年时域天文学的发展在恒星如何死亡这个问题上打开了新的视野。一些极端的变源现象加入了“变源动物园”，例如超亮超新星和快速光学变源。超亮超新星极高光度的物理起源目前是天体物理学中的热门课题。在这个报告中，我将介绍多种模型解释什么样的条件下可以产生超亮超新星，包括大质量恒星核塌缩、毫秒磁星和星周介质的相互作用，除此之外，我还将介绍光球半径演化的基本理论。我们发现，不论密度轮廓怎样演化，光球半径始终先增加后减小。这种行为可用来诊断快速光变源是否有着和超新星爆发类似的起源。

Time: March 23, 2020, Speaker: Liangduan Liu (BNU)
Venue: Video Presentation via Zoom
Title: The Physics of Superluminous Supernovae and Fast Optical Transients
Abstract: The rapid development of several wide-field optical surveys is revolutionizing the field of time-domain transient astrophysics. The past ten years have opened up a new parameter space in time-domain astronomy with the discovery of transients defying our understanding of how stars explode. These extremes of the transient paradigm represent the brightest — called superluminous supernovae, and the fastest — known as fast optical transients, of the transient zoo. The physical origins of the extreme luminosity emitted by SLSNe are a hot topic in astrophysics research. In this talk, I will introduce multiple models for what conditions may produce an SLSN, including core collapse in particularly massive stars, millisecond magnetars, interaction with circumstellar material (CSM model). In addition, I will introduce a general theory of homologous explosions with constant opacity, paying special attention to the evolution of the photospheric radius. We find that regardless of the density distribution profile, the photosphere always increases early on and decreases at late times. This general behavior can be used to quickly diagnose whether the source originates from a supernova-like explosion.

时间：2020 年 3 月 30 日
报告人：伊团（厦门大学）
报告地点：Zoom 视频报告
报告题目：双星舞会：恒星和它看不见的伴侣
报告摘要：致密星是恒星演化结束的残余天体。寻找致密星是一个重要而有趣的课题，可以帮助我们更好地理解恒星演化模型和它们的质量分布。许多致密星位于双星系统，具有很亮的伴星，可以使得看不见的致密星变得可测量。由于 LAMOST 等设备的大样本光谱巡天，径向速度方法使得我们可以完成这一项任务。在这个报告中，我将介绍从 LAMOST 光谱巡天数据中寻找恒星级质量黑洞的方法和相关背景。我将展示银河系中有多少恒星级质量黑洞被 LAMOST 发现。我还将展示一个特殊的双星系统，里面可能包含一个大质量白矮

星。这种方法可以用于任何包含明亮的恒星及隐藏的致密星的双星系统。

Time: March 30, 2020, Speaker: Tuan Yi (XMU)
Venue: Video Presentation via Zoom
Title: Dancing Party of Binaries: A Story of Stars and Their Dark Companions
Abstract: Compact objects (BH/NS/WD) are the remnants of evolved stars at the end of their life. Searching for compact objects is an important and interesting subject that may help us understand better the stellar evolution models and the mass distributions of these bizarre objects. Many compact objects reside in binary systems that contain a luminous companion, which makes the invisible compact object measurable. Thanks to large spectroscopic surveys like LAMOST, the radial velocity method can be implemented to the searching task. In this talk, I will be focusing on the backgrounds and the aspects of searching for candidates of stellar-mass BHs by utilizing multi-epochs spectroscopic data of the LAMOST survey. I will present our estimation of how much Galactic stellar-mass BHs may be found by LAMOST, and I will present a peculiar binary system that may contain a high-mass WD in detail. The method can be used to search for any binary system that contains a luminous star and an invisible dark companion.

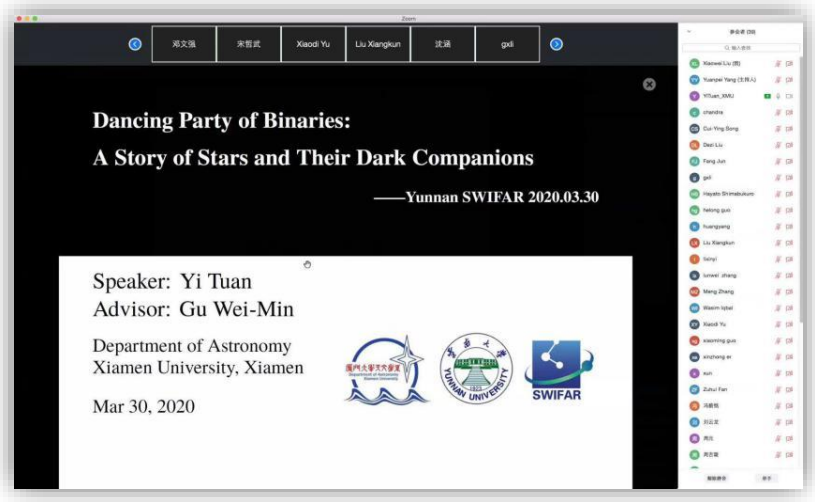

图 2.3：伊团博士通过 Zoom 视频会议作午餐讨论会报告
Dr. Tuan Yi giving a lunch talk via Zoom

文献研讨会 Journal Club:

- 研究生文献研讨会 Postgraduate Journal Club

题目：z~1.5 处 3 个富含尘埃正在形成恒星的星系：主序上的并合和盘
报告人：张伦纬
时间：2020-03-19 16:30
地点：Zoom 视频报告

Title: Three dusty star forming galaxies at z~1.5: mergers and disks on the main sequence
Speaker: Lunwei Zhang
Time: 2020-03-19 16:30
Venue: Video Presentation via Zoom

题目：星系自旋与初始条件相关性的探测
报告人：何紫朝
时间：2020-03-19 16:30
地点：Zoom 视频报告

Title: Observational detection of correlation between galaxy spins and initial conditions
Speaker: Zizhao He
Time: 2020-03-19 16:30
Venue: Video Presentation via Zoom

题目：长周期造父变星定标源 SV Vul 的星团属性
报告人：孙宝坤
时间：2020-03-26 16:30
地点：Zoom 视频报告

Title: Cluster membership for the long period Cepheid calibrator SV Vul
Speaker: Baokun Sun
Time: 2020-03-26 16:30
Venue: Video Presentation via Zoom

题目：活动星系核中恒星级黑洞并合率的宇宙学演化
报告人：李梓炜
时间：2020-03-26 16:30
地点：Zoom 视频报告

Title: Cosmic Evolution of Stellar-mass Black Hole Merger Rate in Active Galactic Nuclei
Speaker: Ziwei Li
Time: 2020-03-26 16:30
Venue: Video Presentation via Zoom

- 教师文献研讨会 Faculty Journal Club

题目：宇宙空洞中星系和大质量黑洞性质
报告人：刘项琨
时间：2020-01-07
地点：Zoom 视频报告

Title: Properties of galaxies and supermassive black holes in cosmic voids
Speaker: Xiangkun Liu
Time: 2020-01-07
Venue: Video Presentation via Zoom

题目：星流中强周期密度刺探测：暗物质子晕的证据缺失？
报告人：黄样
时间：2020-03-17
地点：Zoom 视频报告

Title: Detection of Strong Epicyclic Density Spikes in the GD-1 Stellar Stream, An Absence of Evidence for the Inuence of Dark Matter Subhalos?
Speaker: Yang Huang
Time: 2020-03-17
Venue: Video Presentation via Zoom

题目：强波与周围介质相互作用产生快速射电暴
报告人：杨元培
时间：2020-03-24
地点：Zoom 视频报告

Title: Fast radio bursts as strong waves interacting with ambient medium
Speaker: Yuanpei Yang
Time: 2020-03-24
Venue: Video Presentation via Zoom

题目：太阳邻域的银河系尺度气体波
报告人：李广兴
时间：2020-03-31
地点：Zoom 视频报告

Title: A Galactic-scale gas wave in the Solar Neighborhood
Speaker: Guangxing Li
Time: 2020-03-31
Venue: Video Presentation via Zoom

访问学者项目 SWIFAR Visitors Program:

中国西南天文研究所访问学者计划旨在邀请国际学者较长时间访问研究所，开展科学合作研究。截至目前，研究所共邀请了 5 位学者来访，已有两篇合作文章发表。其中一篇为范祖辉教授与来访的俄国科学院空间研究所 Oleg Yu Tsupko 博士就利用黑洞阴影作为标准尺开展宇宙学研究的文章 (*Classical and Quantum Gravity*, 2020, 37, 065016)，另一篇为范祖辉教授团组与来访的意大利那不勒斯大学 Giovanni Covone 教授合作、利用 VOICE 多次曝光数据寻找变源的文章，该文章第一作者为研究所博士后刘德子(*MNRAS*, 2020, 493, 3825)。

The SWIFAR Visitors Program was set aiming to invite distinguished colleagues worldwide to visit our institute for an extended period to conduct collaborative research. So far, five fellows have visited us. Two collaboration papers have been published. One is about using black hole shadow as a potential standard ruler for cosmological studies (*Classical Quantum Gravity*, 2020, 37, 065016). The idea originated from a discussion between Prof. Zuhui Fan and the SWIFAR visiting fellow Dr. Oleg Yu Tsupko from Space Research Institute of Russian Academy of Sciences. The other is from Prof. Zuhui Fan's group in collaboration with the SWIFAR visiting fellow Prof. Giovanni Covone from the University of Napoli 'Federico II', Italy. Led by SWIFAR postdoc, Dr. Dezi Liu, the study developed and applied a new method to the VOICE data to search for variables (*MNRAS*, 2020, 493, 3825).

三、 平台建设 Platform Development

云南大学 1.6 米多通道测光巡天望远镜项目 The MEPHISTO Project:

• 望远镜建设 Telescope Construction

2020 年 3 月 2 日，作为双边每月例会之一，研究所组织召开了 1.6 米多通道测光巡天望远镜（Mephisto）建设讨论会。南京天文光学技术研究所项目组介绍了望远镜在光学系统、机械结构、电控系统等方面的进展，整体进展顺利。虽因新冠肺炎疫情影响，部分研制进度可能受限，但项目组将尽力赶工，争取年底前完成出厂验收。

On March 2, 2020, as one of the monthly series, a bilateral workshop with the Nanjing Institute of Astronomical Optics & Technology (NIAOT) on the construction of the Multi-channel Photometric Survey Telescope (Mephisto) was held. The NIAOT project team presented the recent development of the telescope optical system, mechanical structure, and electronic control system. Good progress was made. While some delay is expected due to the impacts of the Covid-19 pandemic, the project team will step up the effort. Currently, they aim to finish the telescope construction and complete the in-house acceptance review before the end of the year.

综合考虑极限星等、颜色效应以及对恒星参数的敏感度等因素，研究所团队完成了滤光片方案设计并转给了天光所团队。

Taking into account factors including limiting magnitudes, color effects, and sensitivities on stellar parameters, the team at SWIFAR has completed the design of the Mephisto filter set and communicated it to the NIAOT team.

• 台址建设 Site Development

2020 年 2 月 27 日，研究所组织召开了 1.6 米多通道测光巡天望远镜台址建设讨论会，明确了负责 Mephisto 望远镜室外工程建设的施工方和相关负责人。台址建设进入工程阶段。

On February 27, 2020, a meeting was held with regard to the potential developer of the outdoor work related to the Mephisto observatory site. The site development has entered the construction phase.

2020 年 3 月 9 日，高美古丽江观测站现场召开基础设施一期改造工程开工筹备会，会上对 Mephisto 望远镜项目的林木采伐、地基开挖要求、开工施工进度和工作机制等进行了确认。

On March 9, 2020, a preparatory meeting for the commencement of the 1st phase infrastructure reconstruction project was held at the Gaomeigu site of the Yunnan Observatories of CAS (YNAO). At the meeting, the requirements of deforestation and foundation excavation, as well as work timeline and mechanism, were confirmed.

2020 年 3 月 15 日，林木采伐工作完成。
On March 15, 2020, the work of tree cutting was completed.

图 3.1：林木采伐 Cutting the trees

图 3.2：基岩开挖 Bedrock excavation

2020 年 3 月 18-21 日，刘晓为所长赴高美古丽江观测站进行实地考察，推进相关工作。

From March 18 to 21, 2020, Director Prof. Xiaowei Liu inspected the Gaomeigu site to push forward the site development work.

图 3.3：刘晓为所长与云南天文台工作人员在高美古丽江观测站实地考察

Director Prof. Xiaowei Liu and the staff of Yunnan Observatories at the Mephisto observatory site

2020 年 3 月 20 日，高美古丽江观测站现场召开 1.6 米多通道测光巡天望远镜主体工程基础部分现场讨论会，会上对望远镜基墩位置、地勘补充钻孔位置（见封面图片或图 3.4 三角形处）、数据中心和风机房的位置进行了确定。

On March 20, 2020, an on-site meeting on the Mephisto telescope main building (tower and dome) was held at the Gaomeigu site of YNAO. In order to find a suitable site for the base pier of the telescope, the geological drilling locations (see the cover picture, as well as Figure 3.4) were determined. The geological drilling locations for the construction of the Data Centre and Ventilator Room were also determined.

2020 年 3 月 26 日，主体工程地勘工作完成，情况良好。云南省设计院正在修改完善基墩详细方案。

On March 26, 2020, the work of geological drilling was completed, yielding good results. Yunnan Architectural Design Institute is currently reviewing the detailed architectural design of the main telescope building (base pier and tower).

图 3.4：地勘钻孔位置分布

Geological drilling for the telescope main building

图 3.5：地勘钻孔结果

Rocks from the drilling

截至目前，1.6 米多通道测光巡天望远镜台址监测系统（包括全自动大气视宁度监测仪、气象站、云量计、天光背景计和全天相机）已顺利运行超过 1 年，正在持续积累台址监测数据。该数据已用于考察和分析高美古址点的夜天文观测条件，并为 Mephisto 巡天策略的制订提供重要依据。

Hitherto, a site monitoring system for Mephisto (including an ADIMM, a meteorological station, a nephometer, a skylight background meter, and an all-sky camera) has been running smoothly and accumulating data continuously for more than a year. The data have been used to characterize the night

astronomical observational conditions of the Gaomeigu site. The results will serve as a vital input of the Mephisto Survey strategy.

- ## 圆顶、数据中心及其他附属设施 Dome, Data Centre and Auxiliary Facilities

南京天文仪器有限公司完成 1.6 米多通道测光巡天望远镜穹顶详细设计方案（该公司去年年底中标）。方案 4 月 2 日通过专家组评审。

The dome for Mephisto was designed by Nanjing Astronomical Instrument Co., Ltd. of CAS (the company won the public bidding end of last year). The design was reviewed and accepted by an evaluation panel on April 2.

完成了数据中心和风机房等附属设施的建筑设计方案。

Architectural designs of the Data Centre and auxiliary facilities (e.g., Ventilator and Power Rooms) are completed.

图 3.6：数据中心效果图 Design sketch of the data centre

- ## CCD 相机研制

CCD Camera Development

2020 年 2 月 12 日，研究所与国家天文台正式签署《云南大学 1.6 米多通道测光巡天望远镜（Mephisto）CCD 拼接相机预研制合作协议》。作为技术验证，国家天文台两个实验室将分别独立为 Mephisto 项目研制基于 e2v CCD 290-99 探测器的单芯片以及拼接 CCD 测试相机。

On February 12, 2020, SWIFAR signed an agreement with the National Astronomical Observatories, CAS. Two laboratories of NAOC shall develop, independently, single-sensor and mosaic CCD test cameras for Mephisto based on e2v CCD 290-99 sensors, for the purpose of technology verification.

2020 年 3 月 2 日，第二片 CCD 工程片到货入库。

On March 2, 2020, the second piece of e2v CCD 290-99 sensor of engineering-grade arrived and stored.

- Mephisto 软件与科学 Mephisto Software and Science

2020 年 3 月 6 日和 20 日， Mephisto 软件与科学双周系列讨论会举办。项目科学组、时域组、巡天策略组以及数据处理组分别介绍了进展。

On March 6 and 20, 2020, two of the biweekly series of Mephisto Software and Science Meetings were held. The teams on Mephisto science, time-domain astronomy, survey strategy, and data processing introduced their respective progress.

云南大学五十公分望远镜阵列项目 The 50cm Telescope Array Project:

2020 年 1 月，云南大学五十公分望远镜阵列项目首台五十公分望远镜在西藏阿里观测站进行安装和初步调试。预计今年五六月份投入测试观测（视疫情发展），后续两台望远镜也将在条件成熟时运往阿里。

In January 2020, the first 50cm telescope of Yunnan University 50cm Telescope Array Project was installed and preliminarily commissioned at the Ali Observatory in Tibet. Test observations are expected in May/June this year (depending on the situation of the Covid-19 pandemic). The other two telescopes of the array will be transported to Ali, Tibet, when conditions allow.

图 3.7：五十公分望远镜 50cm Telescope

四、 学生培养 Teaching and Training

教学 Teaching & Learning:

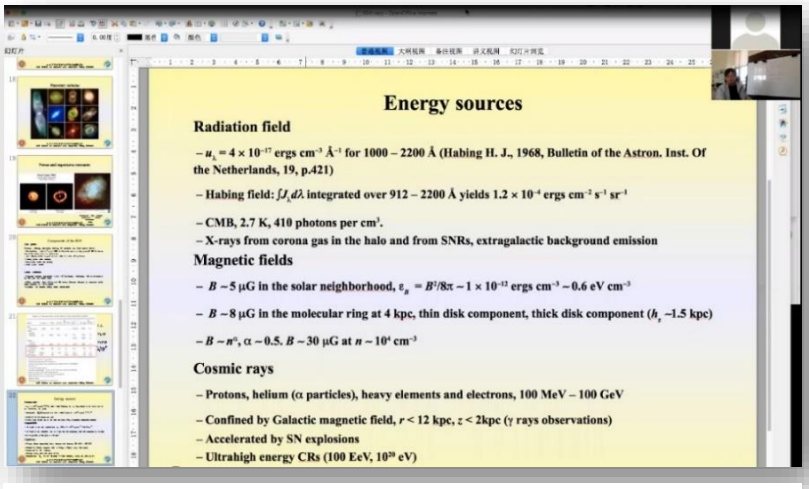

图 4.1: 刘晓为老师给研究生上气体星云天体物理学课程 Prof. Xiaowei Liu lecturing postgraduate course *Astrophysics of Gaseous Nebulae*

2020 年春季学期，中国西南天文研究所教师共开设 4 门课程，包括两门研究生课程："气体星云天体物理学"（刘晓为），"星系宇宙学"（范祖辉），和两门本科生课程："天体光谱学"（刘晓为），"普通天文学"（刘项琨，尔欣中）。所有课程已从 3 月 9 日起开始网上教学。

In the 2020 spring semester, four courses are being lectured by the faculty members of SWIFAR, including two for postgraduates and two for undergraduates. They are *Astrophysics of Gaseous Nebulae* (by Prof. Xiaowei Liu for postgraduates), *Cosmology and Structure Formation* (by Prof. Zuhui Fan for postgraduates), *Astronomical Spectroscopy* (by Prof. Xiaowei Liu for undergraduates), and *Fundamental Astronomy* (by Associate Profs. Xiangkun Liu and Xinzhong Er). From March 9, 2020, all courses are being taught online.

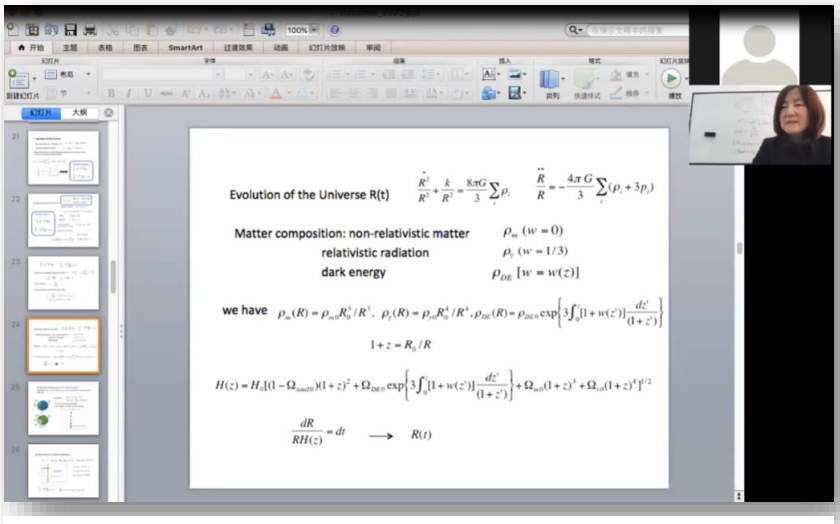

图 4.2：范祖辉老师给研究生上星系宇宙学课程 Prof. Zuhui Fan lecturing postgraduate course *Cosmology and Structure Formation*

研究生培养 Postgraduate Training:

- **2017 级硕士生李梓炜谈在中国西南天文研究所学习感悟：**

"在过去的两年半时间里，随着云南大学中国西南天文研究所（SWIFAR）的发展，我自身也取得了很大进步。研究所初建之时，第一批教职工和我们第一批学生在格物楼的临时办公室里一起工作、学习。从那时起，SWIFAR 就积极组织各类学术活动 (如午餐讨论会和学术报告等)。我也因此过上了忙碌而充实的研究生生活。这些学术活动使我能够有机会和全国、全世界的优秀天文学者交流，了解天文学各领域的最新研究动态。随着天文楼的建成，我们搬迁至新办公室，

有了更好的科研、学习条件。从个人的办公桌、办公用品，到团队的服务器计算资源，各项设备日臻完善。SWIFAR 是一个年轻、充满活力，同时又兼具专业、团队协作与国际视野的科研教学机构。对我来说，在自己的研究领域，我得到了耐心、专业的指导，而对于天文学其他领域，各位教职工、博士后也乐于与我进行交流，分享他们的成果与经验。

对于 SWIFAR 和我自身未来的进步与发展，我充满期待。对我自身而言，我将由一名硕士研究生转为博士研究生，继续在 SWIFAR 进行研究和学习。期待着能使自己在自身的研究领域更为专业的同时具有较为宽阔的科研视野，能够培养起独立地发现科学问题、解决问题的能力。对于 SWIFAR，我亲身经历了其在发展过程中的快速进步，来自国外的教职工和博士后的加入使得整个团队更加国际化，期待在未来能有更多的交流与合作。对于我们学生，也期待着未来我们能更加有效地相互学习与交流，包括不同的研究方向之间，以及具体地解决实际问题的方法等。”

- **Ziwei LI, M.Sc candidate of grade 2017, talks about his learning experience at SWIFAR:**

“In the last two and a half years, as the South-Western Institute for Astronomy Research (SWIFAR) of Yunnan University develops, I have also made a lot of progress. In the early days of the Institute, we students studied and worked together with the first few SWIFAR faculty members in temporary offices in the Gewu building. Since then, academic activities have been actively organized (e.g., Lunch Talks and Colloquia, etc.). As a result, I have a busy and fulfilling postgraduate life. Those academic activities provide me with opportunities to communicate with outstanding astronomers in China and around the world, and to learn about the latest research developments in the various fields of astronomy. With the completion of the new Astronomy Building, we moved to new offices with better study and research conditions. Not only the personal desk, office supplies, but also the team's computing resources have been much improved. As the Institute expands, with new students, postdocs, and faculty members arrive, newly recruited administrative staffs provide efficient support and convenience for everyone's study and scientific research. The research fields of the Institute also expand. SWIFAR is a young and dynamic research Institution that combines professionalism, teamwork spirit, and international perspectives. In my own field of research, I receive patient and professional guidance. While in other areas of astronomy, faculty members and postdocs are also willing to communicate with me and share their achievements and experiences.

I am looking forward to the future progress and development of SWIFAR, as well as of myself. For me, I will move from a master’s degree candidate to a Ph.D. candidate, and continue my study and research in this Institute. I hope to make myself more professional in my own research field, but also have a broader scientific research vision, so as to cultivate my ability to find and solve scientific problems independently. For SWIFAR, I have personally experienced its rapid development and progress. The arrival of foreign faculty members and postdocs has made the Institute quite international, and I expect a lot more communication and cooperation in the future. For us students, I also hope that we can communicate more effectively in the future, especially amongst students of different research directions, and learn from each other how to solve specific scientific problems.”

图 4.3：李梓炜同学、范祖辉老师与意大利访问学者 Giovanni Covone 合影

Mr. Ziwei Li, Prof. Zuhui Fan and Italian visiting fellow Dr. Giovanni Covone

五、 教师风采 Faculty Profile

岛袋隼士，1987 年出生于日本冲绳，现在云南大学中国西南天文研究所（SWIFAR）任助理教授，主要研究领域为再电离时期和 21 厘米宇宙学。

Born in Okinawa, Japan in 1987, Hayato Shimabukuro is an assistant professor of the South-Western Institute For Astronomy Research (SWIFAR) of Yunnan University (YNU). His main research field is 21cm cosmology and the epoch of reionization.

可以简单介绍一下您的学术经历吗？

我 2011 年毕业于日本东北大学，之后去了名古屋大学，并于 2016 年获得了天体物理学博士学位。2016 年至 2018 年，我作为巴黎天文台的博士后去了法国。在巴黎期间，我每个月都会去一次卢浮宫、奥赛等博物馆，因为我很喜欢艺术，尤其是印象派的艺术。我去博物馆的次数已经多到可以和蒙娜丽莎称兄道“妹”了！2018 年 4 月，我来到北京，在清华大学度过了一年零一个月。2019 年 12 月，我正式成为了 SWIFAR 的一名助理教授。

Could you briefly introduce your academic experience?

I graduated from Tohoku University in 2011. After that, I moved to Nagoya University and got my PhD of astrophysics in 2016. From 2016 to 2018, I moved to France and became a postdoctoral researcher at the Paris Observatory. During my stay in Paris, I went to museums such as Le Louvre or Le Musée d'Orsay once per month because I adore art, especially impressionism. As a matter of fact, I went to the museums so often that I felt like Mona Lisa was a friend! In April 2018, I went to Beijing and spent one year and a month at Tsinghua University, and I became a faculty member here at SWIFAR in December 2019.

图 5.1：岛袋隼士办公室里收藏的博物馆纪念品 Souvenirs bought from different museums in Hayato’s office

当初为何选择天文学作为您的专业？

在我还念初中的时候就读了一些关于爱因斯坦创立的相对论的书，当时对这个理论印象深刻，并对宇宙产生了浓厚的兴趣，于是决定将来读大学时把物理和天文学作为自己的专业。

Why did you choose astronomy as your major?

When I was a junior high school student, I read some books about the Theory of Relativity developed by Albert Einstein. I was deeply impressed by the theory and so intrigued by the universe that I decided to study Physics and Astronomy as my major in university.

您在 SWIFAR 有哪些研究计划？

我在 SWIFAR 的研究领域是宇宙学，这是一个关于整个宇宙的历史和演化的学科。我的主要研究课题是再电离时期(EoR)，即宇宙历史上第一代恒星和星系形成的时期。为了研究 EoR，我重点关注的是中性氢原子发出的 21 厘米信号，该信号对研究 EoR 非常有用。此外，我还参与了一个名为 SKA 的大型射电望远镜项目，而中国是该项目的重要参与者。

What are your research projects here at SWIFAR?

My field of study at SWIFAR is cosmology, which is a subject about the history and evolution of the whole universe. My main research topic is the Epoch of Reionization (EoR), which refers to the period in the history of the universe during which the first generation of stars and galaxies had formed. To study the EoR, I'm focusing on the 21cm signal emitted by neutral hydrogen atoms. The 21cm signal is very useful in studying the EoR. Besides, I'm also involved with a huge radio telescope project called SKA, in which China is a prominent participant.

您的研究计划目前有哪些进展？

从我来这里到现在其实只有 3 个月，所以我的研究计划才刚刚起步。尽管如此，在这短短的时间里，我已经在国际期刊 *MNRAS* 上提交了一篇论文，而我的另一篇关于宇宙学和粒子物理学的论文也在《物理评论 D》（*PRD*）上发表了。由于机器学习是我的专长之一，我尝试将机器学习技术应用于宇宙学，目前也继续在用机器学习的方法在宇宙学领域进行研究。作为一个充满好奇心的人，除了眼前的项目外，我还期待着开展其他新的项目！

图 5.2：島袋隼士与他在巴黎的导师

Hayato with his supervisor in Paris

Have you made any progress on these projects?

Because I have been here for only three months, I'm just getting started with my projects. Nevertheless, in this short period of time I have already submitted a paper to *MNRAS*, which is an international journal, and another of my papers was published in the *Physical Review D* (*PRD*), in which I studied cosmology and particle physics. As machine learning is one of my specialities, I have also developed machine learning techniques applicable to cosmology. I'm currently continuing my cosmology research with a machine learning approach. As a curious person, I'm interested in starting new projects in addition to the previous ones!

是什么原因促使您从日本来到中国？为什么选择在 SWIFAR 任教？

您可能也知道，在世界其他国家，尤其在日本，要想找到一个教员的职位绝非易事，而中国正在为来自世界各地的年轻学者提供机会和资源，让他们实现自己的目标。同时，SWIFAR 成立才两年，还很年轻，还在不断地发展，这让我觉得自己可以与研究所一起成长，而这也是我选择 SWIFAR 而不是其他研究所的原因。

What motivated you to move from Japan to China, and why did you choose to teach at SWIFAR?

As you may know, it is very difficult to find a faculty position in other countries in the world, especially in Japan, while China is offering young scholars from all over the world the opportunities and resources to achieve their goals. Meanwhile, SWIFAR was founded only two years ago. It is young and still developing, so I have the feeling that I can get in on the ground floor and grow with this Institute, and that's the reason why I chose SWIFAR instead of other institutes.

您觉得在昆明的生活怎么样？作为一个外国人，有没有遇到过什么困难？

我在昆明的生活十分惬意。我现在住的房子很宽敞，房租价格也很合理。我一个单身汉却住着 3 间卧室，您想想看！最近，我又添置了一台家庭影院投影屏幕，我现在在家就可以看大屏幕电影了。比如这周末我就看了一部日本导演宫崎骏指导的动画片。我也很喜欢新海诚导演的电影。

我认为对于生活在中国的外国人来说，最有挑战性的还是语言。不过最近我开始自学中文，我觉得我的中文水平在一步步提高。此外，我觉得在小区周围很难买到肉和鱼，尤其是黄油，因为我喜欢自己做饭，而日料、法餐和世界各地的很多美食都离不开黄油！

How do you like the life in Kunming? Have you encountered any difficulties as a foreigner?

Life in Kunming is very comfortable. The apartment I'm currently living in is very spacious, and the rent is at a very reasonable price. I have 3 bedrooms while I'm still single, imagine that! Recently, I have acquired a home cinema projection screen and I'm now able to watch big-screen movies at home. This weekend, for example, I have watched an animated film by the Japanese director Hayao Miyazaki. I also like films directed by Makoto Shinkai.

图 5.3：島袋隼士租住的公寓一角

A cozy corner in Hayato's apartment

To me, the most challenging thing for foreigners living in China is the language. Still, recently I began to learn Chinese by myself, and I think my Chinese is improving step by step. Also, I find it a little bit difficult to get meat, fish and especially butter around here, because I love cooking for myself, and Japanese cuisine, along with French cuisine and many other cuisines around the world, cannot go without butter!

您刚才有提到说您最近一直在学习中文。那么作为 SWIFAR 第一个接受采访的外教，能不能用您学到的一个中文词语，或者日语里的汉字也可以，作为对 SWIFAR 简报创刊的寄语呢？

噢，这个问题可有点儿难！我还是想选一个中文……（沉吟片刻）—— 希望。 “希望”不仅是我对 SWIFAR 简报的寄语，也是对整个研究所的寄语，是对 SWIFAR 全体教职工、博士后和学生们的寄语；这也是对我自己的寄语，因为我衷心希望能够为 SWIFAR 以及中国科学界作出贡献。的确，这是我人生的一个新阶段，充满了无限的可能性和希望，正如 SWIFAR 的未来一样。

You just mentioned that you've been learning Chinese recently. As the first faculty member to be interviewed, which Chinese word (or Japanese Kanji) would you use to represent your good wishes to the launch of SWIFAR Newsletter?

Oh, this is a tricky question! So I'm going to pick a Chinese one... (thinking for a while) "Xiwang". It means hope, not only for the Newsletter but also for the Institute, for its faculty members, postdoc fellows and students; and for myself, because I hope to contribute to SWIFAR as well as the Chinese science community. Indeed, this is a new stage of my life, and I think it is full of hope and promise, just as the future of SWIFAR.

六、 工作环境 Work Environment

为满足新冠疫情发生后急剧增长的对视频会议服务的需求，研究所近期在 1 楼会议室搭建了一套小鱼易连视频会议系统，助力教学科研活动。

To meet the rapidly rising demand for teleconferencing service, a new conference video system XiaoYuYiLian was recently set up in the 1st floor meeting room to facilitate the teaching and research activities of the Institute.

图 6.1：小鱼易连视频会议系统 SWIFAR's brand new conference video system: XiaoYuYiLian