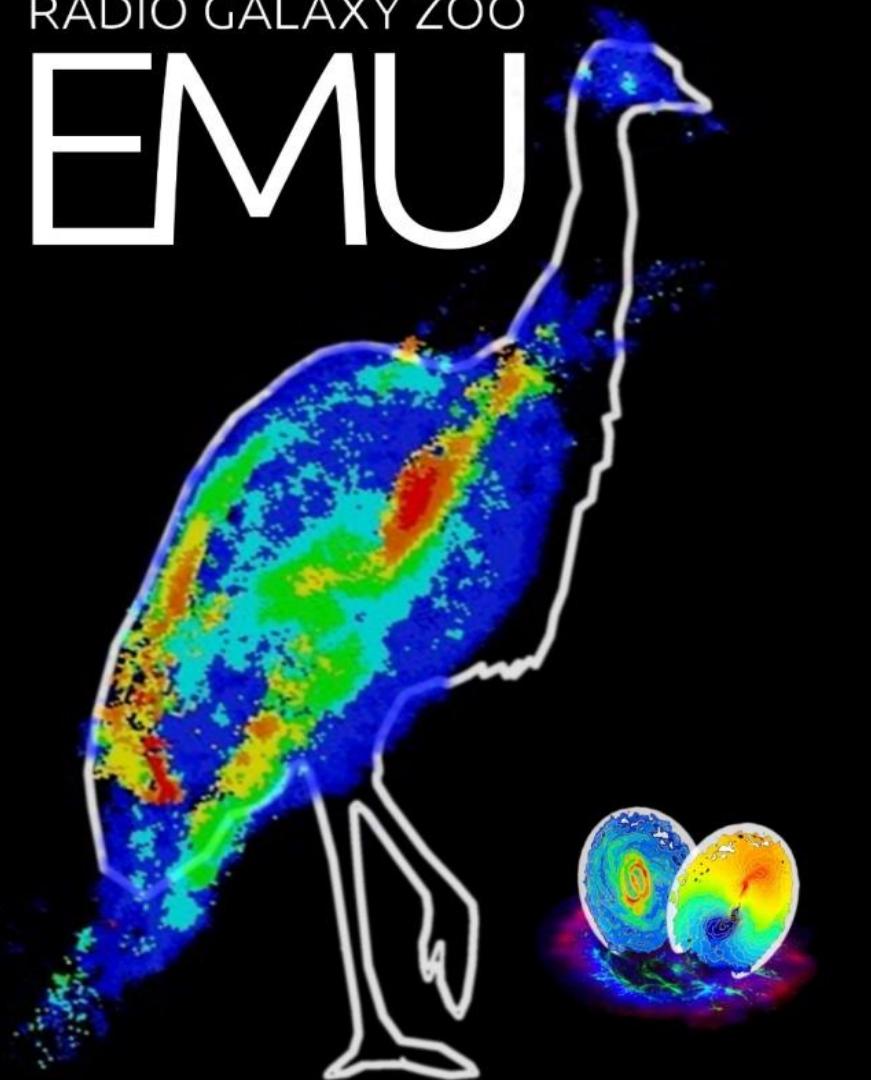


RADIO GALAXY ZOO

EMU



EVOLUTIONARY MAP OF
THE UNIVERSE

射电星系动物园-宇宙演化路径图

唐弘铭
西安交通-利物浦大学 物理系

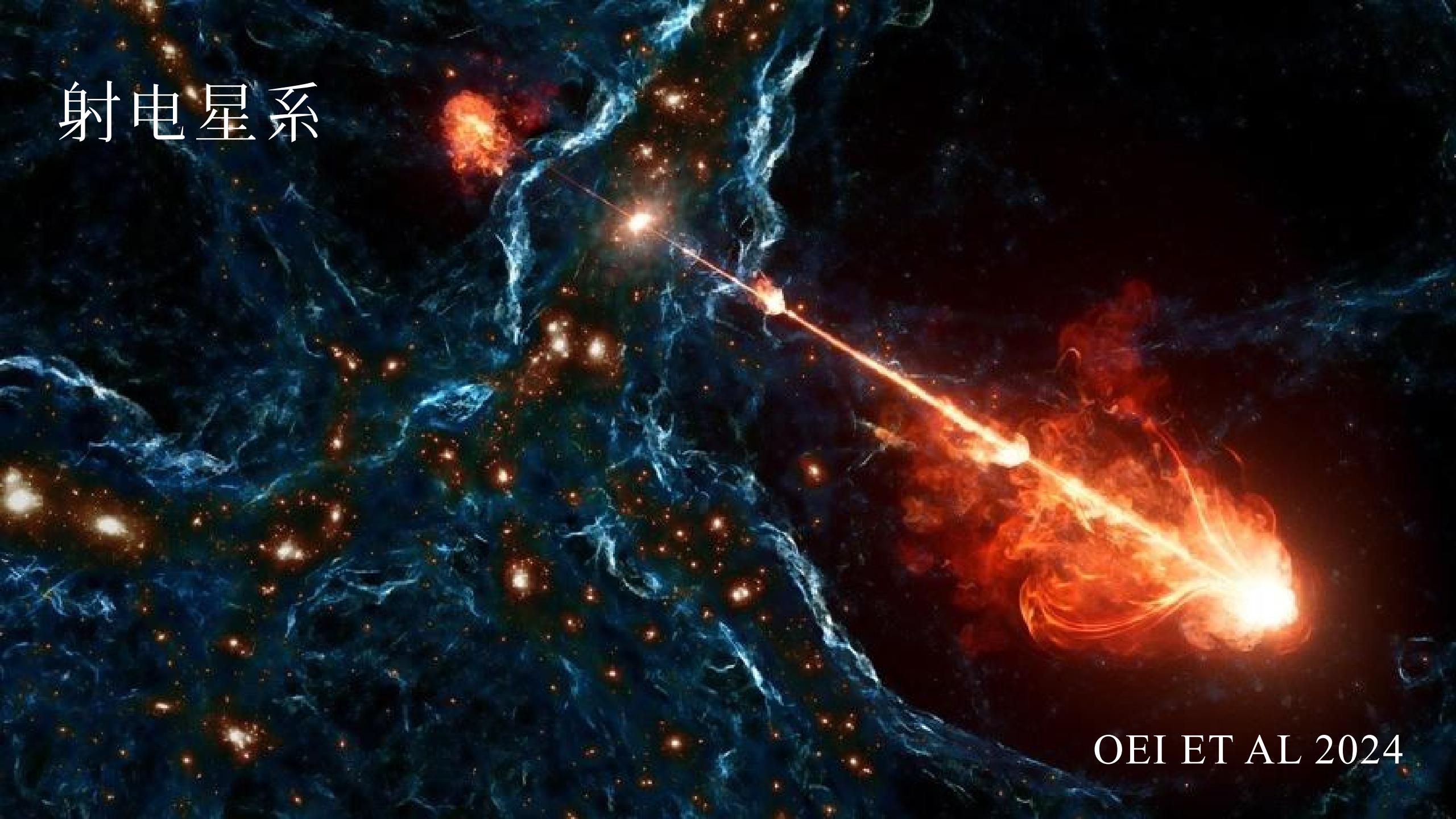
项目共同PI: *Eleni Vardoulaki*

团队中方成员/合作者 (A-Z; 暂) : 曹晨、陈若颖、樊东卫、郭
铨、贾鹏、李楠、李瑞、李雨珊、骆彦、梁志成、欧阳希昶、盛
馨月、施韡、隋元、于斌、杨小龙、喻业钊

Email: Hongming.Tang@xjtlu.edu.cn



射电星系



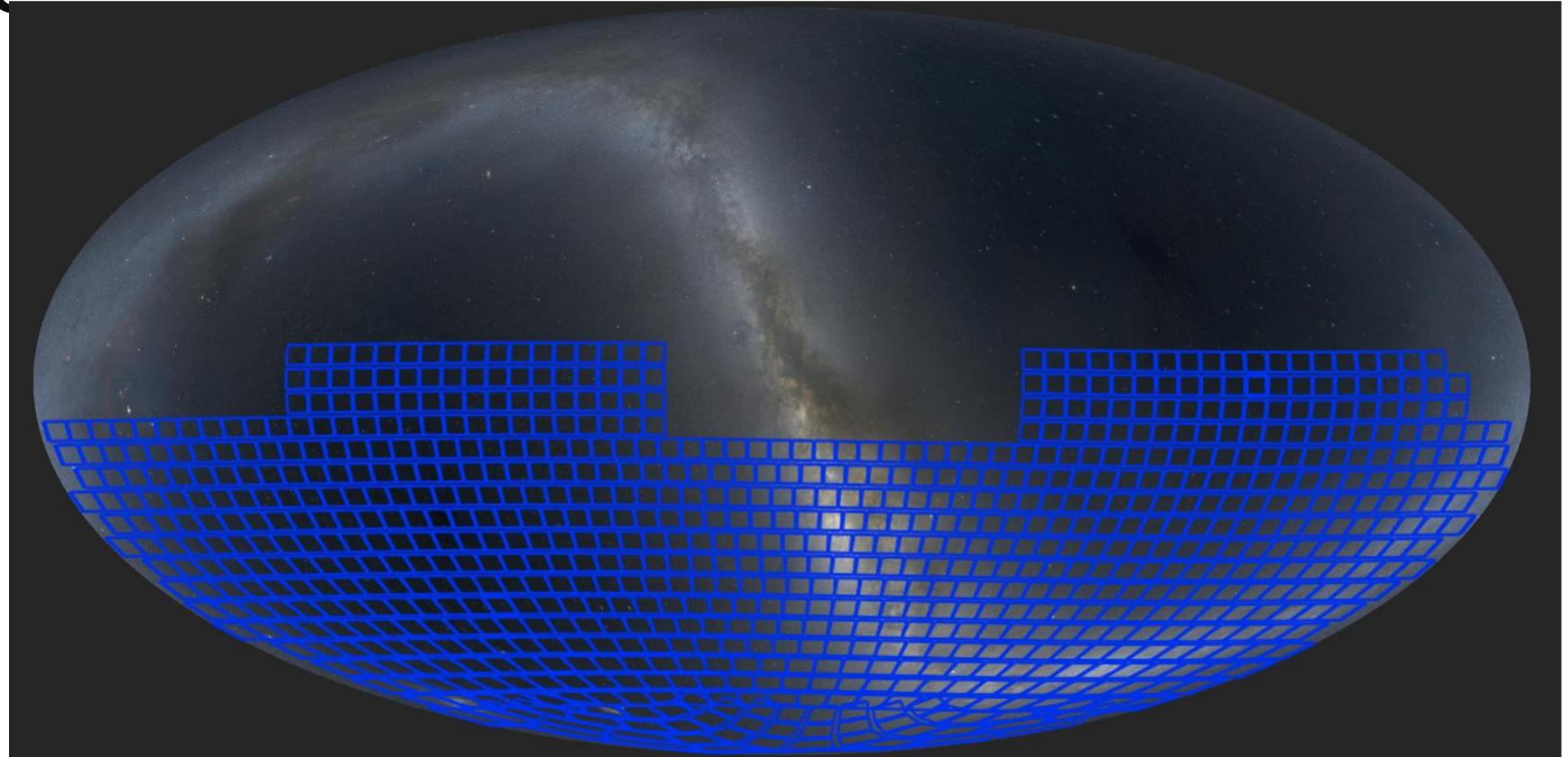
OEI ET AL 2024

宇宙演化路 径图(EMU)

新一代全南天
射电连续谱巡天

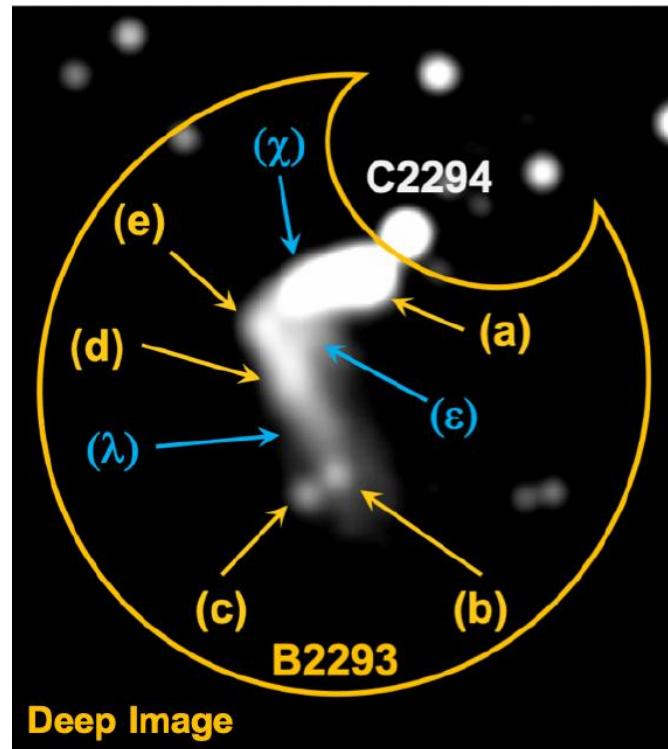
由澳大利亚平
方公里阵探路者
望远镜开展

预计到2028年
完成观测

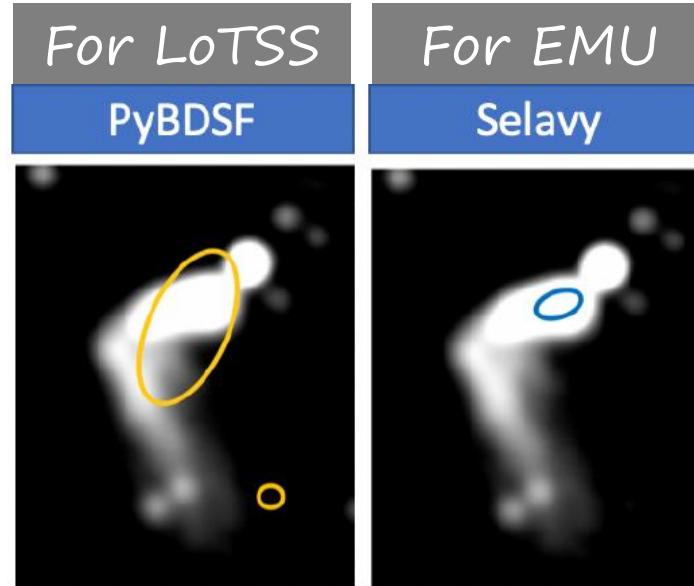


Hopkins et al. 2025

公众科学：巡天科学的需求



Boyce et al. 2023a,b



一般来说，射电连续谱巡天中 $5-20\%$ 的目标无法通过上述简单的多椭圆高斯拟合完成搜寻

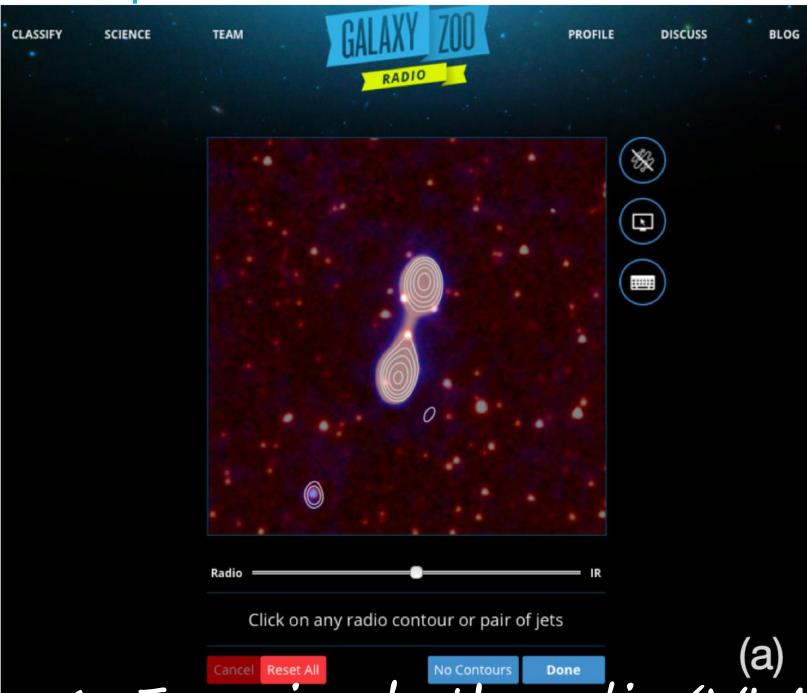
对于 *EMU* 巡天，这意味着 200 万个天体需要目视检验

解决方案之一>公众科学

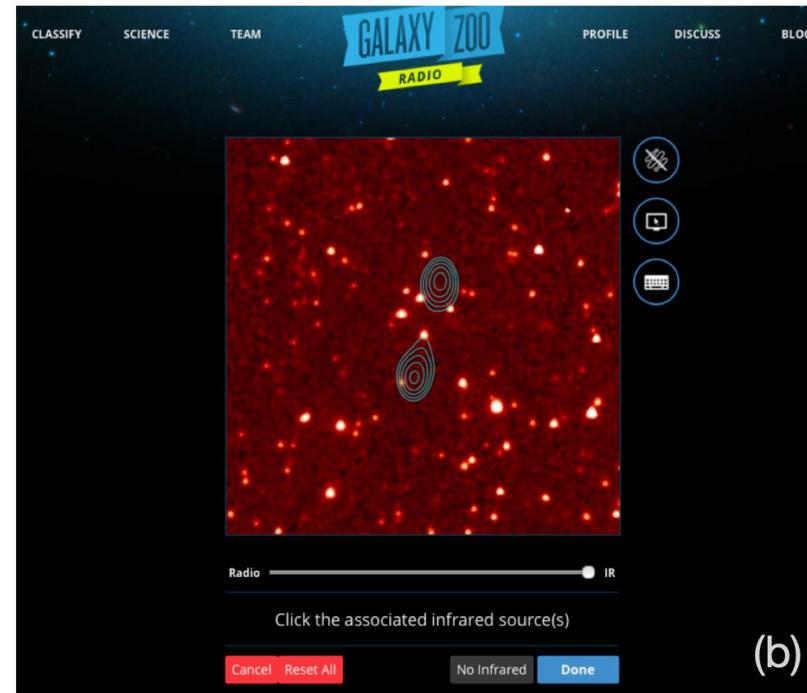
初代 RGZ 流程

2. Mark radio emission regions that are interconnected to the same hosting galaxy

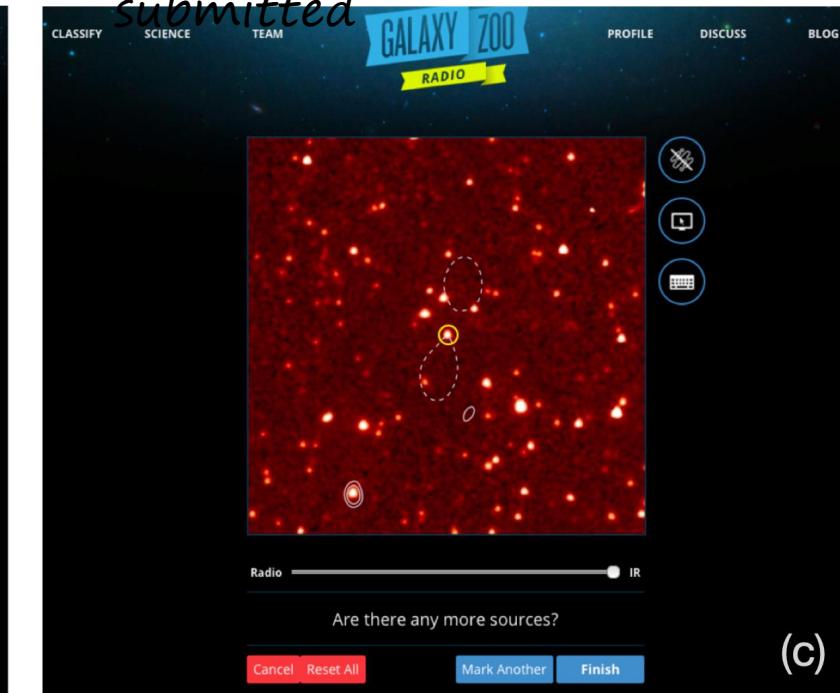
Banfield+2015; Wong et al.
submitted



1. Examine both radio (VLA FIRST) and IR (WISE) identity location of radio emission regions w.r.t. aalaxy



(a)



(b)

3. Identify its infrared hosting galaxy

yes

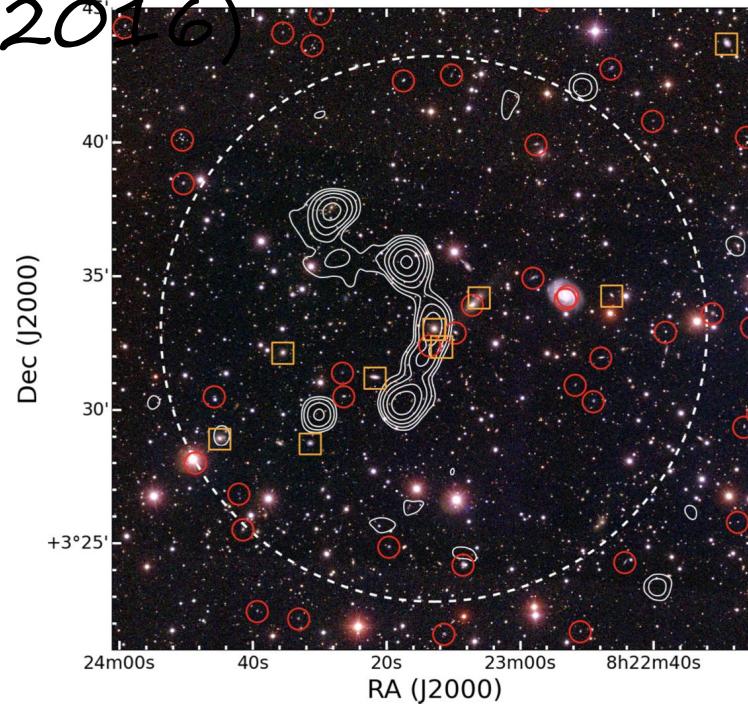
4. More radio galaxy?

Optional: Comment/Discuss

11年, 100,586 个确认目标
7 篇科学文章 + 10 篇ML应用文章

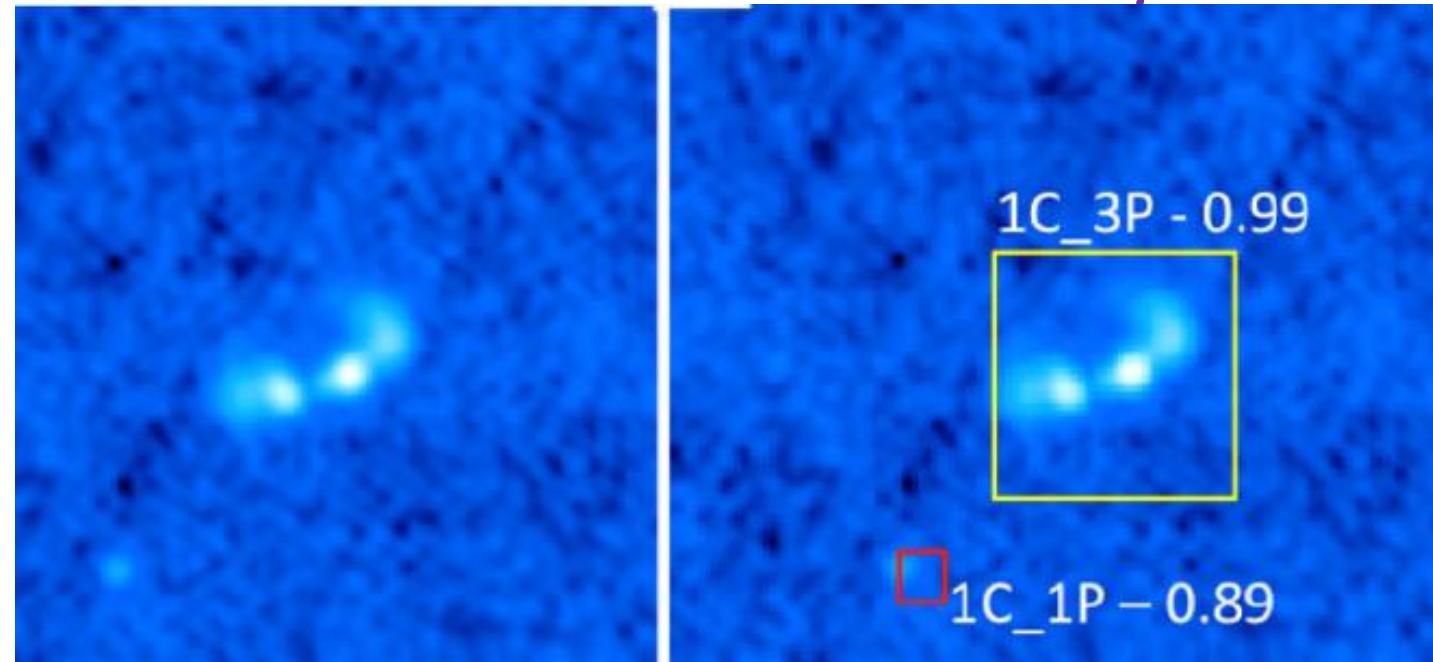
稀有形态/性质天体识别

(*i.e.*, Banfield *et al.*
2016)



射电辐射区+宿主星系识别

(*i.e.*, Wu *et al.* 19)



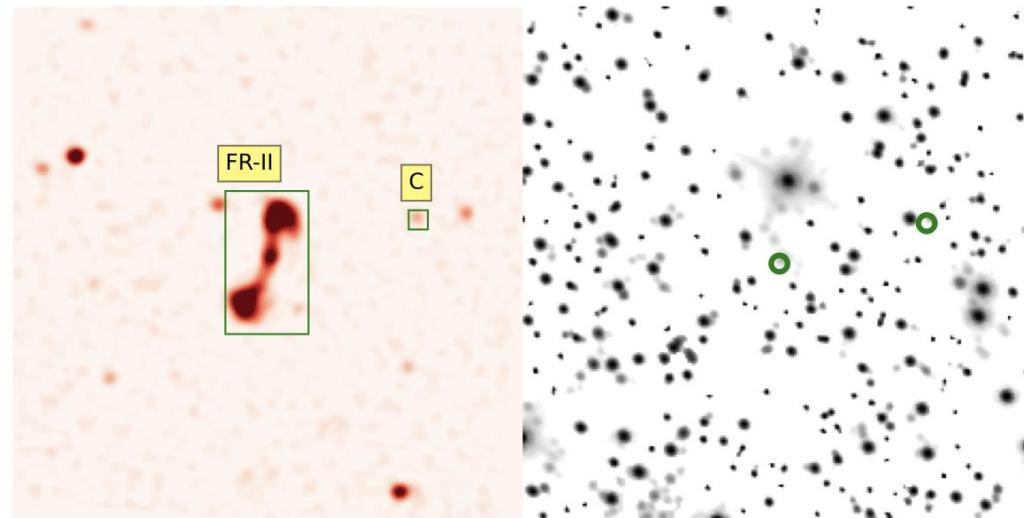
RGZ DR1: Wong *et al.*, 2025



Publication

EMU先导巡天目前技术路线

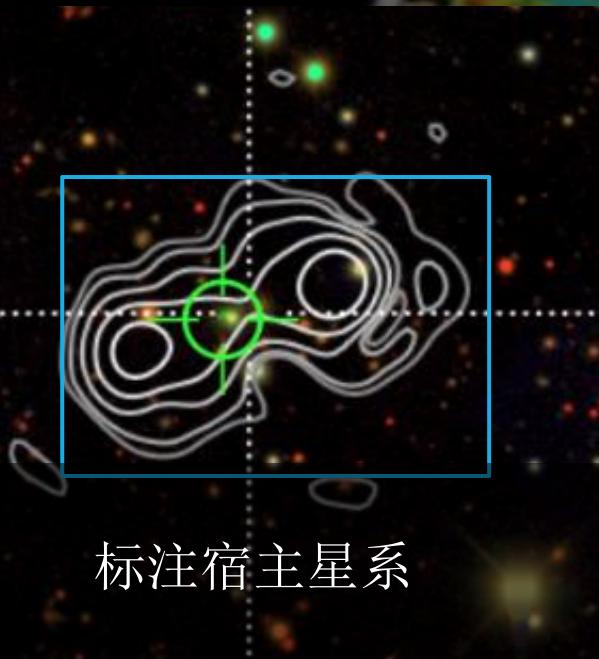
1. 公众科学提供初步射电星系样本
2. 专家目视检验高价值目标提供对比样本
3. 通过对比样本检验的射电星系样本
供应机器学习算法开发，迭代，优化
4. 生成高科学价值的巡天星表 (*EMUCAT+*)



Credit: Gupta et al. 2024



Hunt supermassive black holes,
star forming galaxies, and
discover the unknown!

[Learn more](#)

Radio Optical Infrared

amorphous
bent
bridge
core
hourglass
jet
lobe
merger
plume (feather like)
tail

NEED SOME HELP WITH THIS TASK?

Done

描述射电星系形态

Comment with your own tags!

This is a discussion board if you see any object with unusual radio morphology or physical properties. Let's make discovery together!

Subscribe: Subscribe to receive notifications for new discussions in this board (daily email)

Moderator Controls

New Discussion

Peculiar Radio Source (#peculiar)

Triple radio source (#triple)

blended (#blended)

Core jet Structure (#core-jet)

Radio emission from normal galaxies (#traces_host_galaxy)

Wide/Narrow Angle Tailed (#wat_nat)

Double-Double radio galaxy (#double-double)

Spiral host DRAGN (#spiral_host_dragn)

Odd Radio Circles (#

Recent Comments

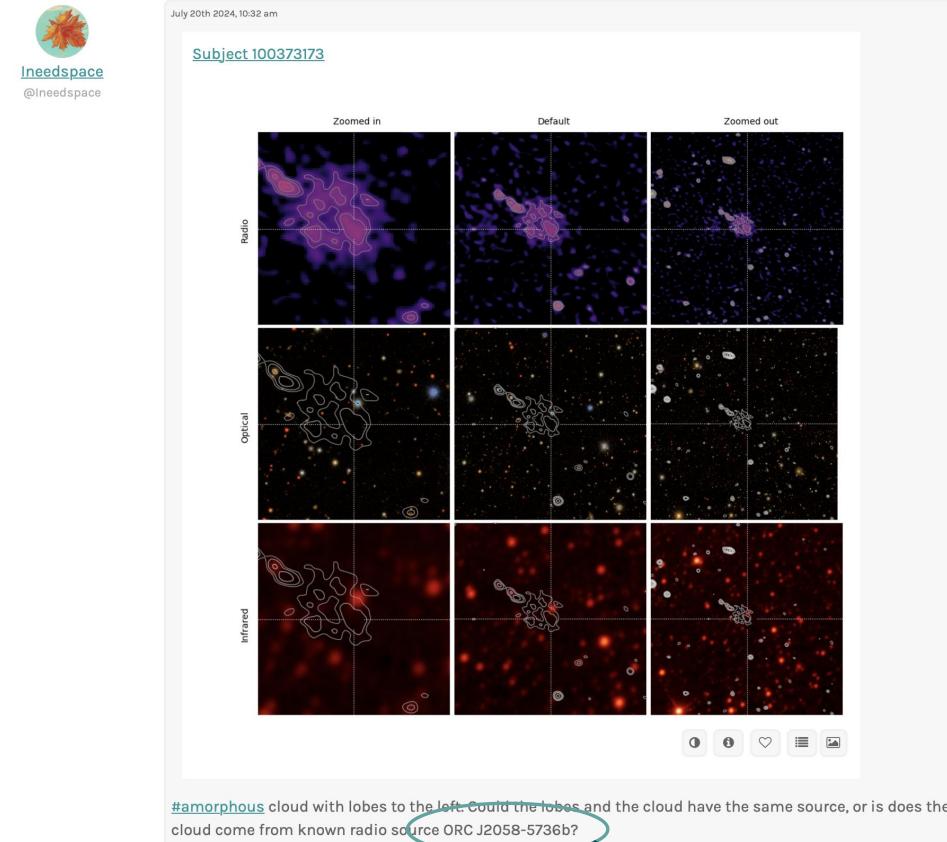
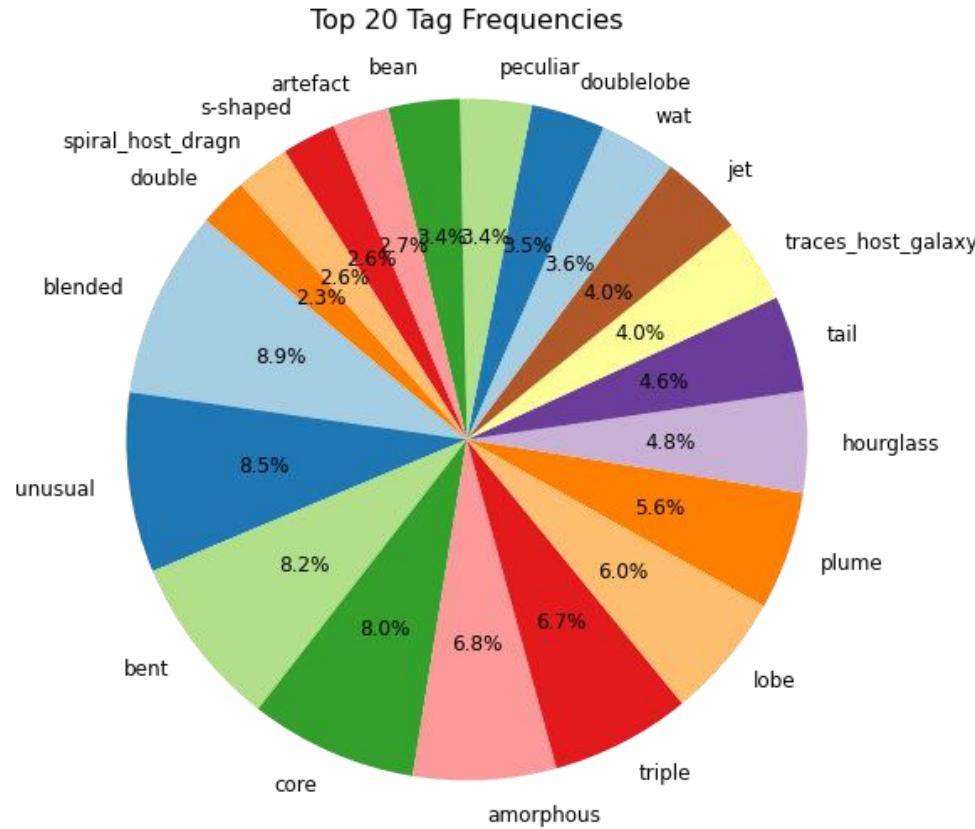
Popular Tags:

Recent Participants:

Projects:

和团队成员讨论你的发现

标注结果与罕见天体发现



已发现的一个奇异射电圈

“引进来，走出去”

其他项目 Other Project

射电星系动物园
Radio Galaxy Zoo: EMU

项目状态：运行中 上线时间：2024年11月6日

项目简介：射电星系动物园：宇宙演化路径图（RGZ EMU）是一个新兴的全民科学项目，专注于研究强射电发射星系。它基于世界知名的全民科学平台Zooniverse，且由中国首次作为共同牵头方参与。RGZ EMU由瑞典国家天文台和清华大学的研究人员联合领导，由全球十多位天体物理学家、数据科学家和人工智能专家，以及虚拟天文台学者共同开发。

立即参与

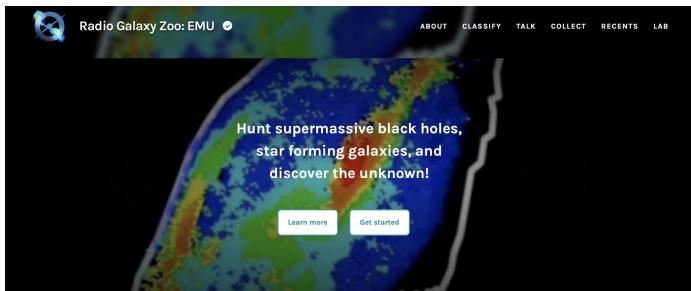
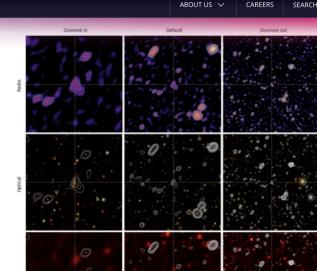
SKA OBSERVATORY

Radio Galaxy Zoo: EMU

Help astronomers locate and identify supermassive black holes, star-forming galaxies, and maybe discover something completely unknown with an SKA pathfinder telescope!

Following the original, very productive Radio Galaxy Zoo, the team behind it is asking for your help to work with radio emission images from the Evolutionary Map of the Universe (EMU) Survey from the Australian Square Kilometre Array Pathfinder (ASKAP). The project offers a chance to take on the challenging task of describing what each radio source looks like, using a preselected list of descriptors. Your work will help researchers understand which patches of radio emission belong together and which optical or infrared galaxies are home to supermassive black holes.

Start now by clicking here



GALAXY CRUISE NAOJ
@Galaxy_Cruise_e

Here comes the new “Citizen Astronomy” project!

Galaxies shine not only in visible light, but also in radio waves. Which of them holds the supermassive black holes that eject powerful jets? “Radio Galaxy Zoo: EMU” starts language support in Japanese.



zooniverse.org
Zooniverse
The Zooniverse is the world’s largest and most popular platform for people-powered research.

2,295

Volunteers

91,529

Classifications

* C I T I Z E N S C I E N C E

R A D I O G A L A X Y Z O O

E M U

AVAILABLE IN

ENGLISH GREEK CHINESE URDU

AND

JAPANESE

Z O O N I V E R S E . O R G 我的小红书号:



科学之外：联合国可持续发展目标

1 NO
POVERTY



2 ZERO
HUNGER



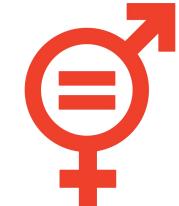
3 GOOD HEALTH
AND WELL-BEING



4 QUALITY
EDUCATION



5 GENDER
EQUALITY



6 CLEAN WATER
AND SANITATION



7 AFFORDABLE AND
CLEAN ENERGY



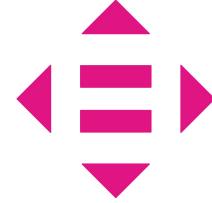
8 DECENT WORK AND
ECONOMIC GROWTH



9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE



10 REDUCED
INEQUALITIES



11 SUSTAINABLE CITIES
AND COMMUNITIES



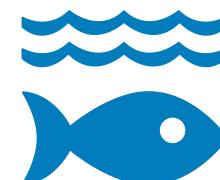
12 RESPONSIBLE
CONSUMPTION
AND PRODUCTION



13 CLIMATE
ACTION



14 LIFE
BELOW WATER



15 LIFE
ON LAND



16 PEACE, JUSTICE
AND STRONG
INSTITUTIONS



17 PARTNERSHIPS
FOR THE GOALS



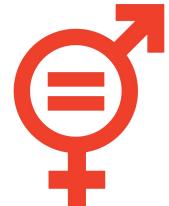
IAU OAD 2023 推荐



1. 国际 天文-机器学习 讲习班

↑巴基斯坦，卡拉奇

↑吸引来自六大洲的超过150名本科生/研究生参加



IAU OAD 2023 推荐

2. 科研实习指导

向女性本科生倾斜的暑期实习项目；向女性高中生倾斜的项目式学习项目 (i.e. 广州市执信中学-许可馨，中山大学录取)

3. 职业规划咨询

与妍星计划合作，为中学-研究生阶段的女性学生提供线上职业咨询。已覆盖 > 100 人



越诗瑜
(香港中文)



骆彦
(北大天文系)



韦乐瑶
(清华天文系)

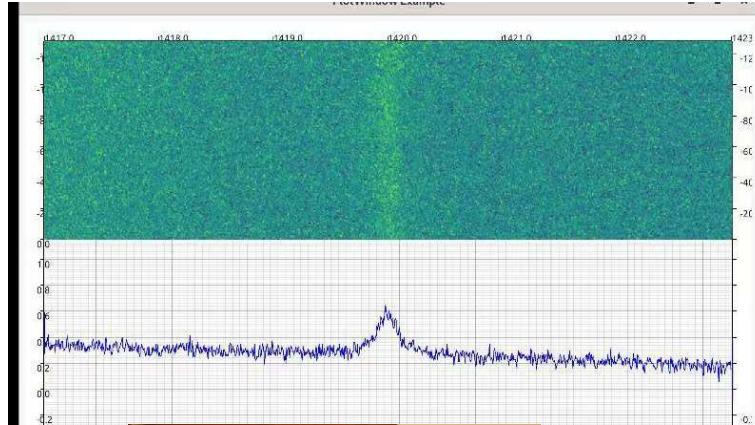


梁楚霓
(东京大学)

RADIIO: IAU OAD 2025



4 QUALITY EDUCATION



Radio Galaxy Zoo: EMU

Hunting supermassive blackholes, star forming galaxies and discover the unknowns!

Learn more

This project has been built using the Zooniverse Project Builder but is not yet an official Zooniverse project. Queries and issues relating to this project directed at the Zooniverse Team may not receive any response.

Get started

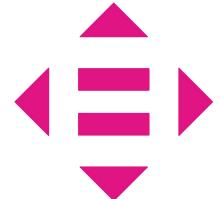
The workflow is to cross-match infrared galaxy candidates and the radio lobes associated with them

Host identification and radio galaxy assembly Radio Galaxy Classification

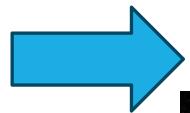
❖ 面向中国，巴基斯坦，希腊三国中小学学生/教师

❖ 接触公众科学，提升科学素养及科学数据素养

❖ 中方合作单位（暂）：上海天文馆、上海天文台、上海诺美高级中学，广州市执信中学、东莞松山湖未来学校，孙吉元宏博学校（乡村培训试点学校）

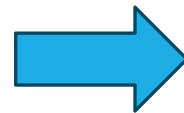


消除不平等：先把价格打下来



->

104



Introduction

1. Radio Astronomy

Radio astronomy explores cosmic whispers - radio waves emitted by celestial objects through radio telescopes. These signals provide us with radio telescopes used worldwide: the birthplace of the first radio telescope, the dawn of space exploration, and the windows opened to us.

Background

Our society champions a better world: renewing the ancient Silk Road as a platform for scientific unity. The RADIO is the driving force behind empowering Chinese youth to collaborate with peers in Pakistan and Greece, transforming radio astronomy into a universal language.

Education Framework

1. Data skills workshop

- Real Astronomical Data: Students practice authentic radio observations in Jupyter notebooks.
- Spectral Analysis: Identify patterns in radio波谱. They analyze radio波谱 patterns to identify hydrogen gas in radio波谱氢气波谱.
- Collaborative Problem-Solving: Team work on data challenges.

2. Citizen Science

Citizen Science fosters global citizen science projects. In 2020, they organized radio波谱 citizen science projects to engage young people with science.

3. Hands-On Engineering

- Low-Cost Design: Build functional telescopes using recycled materials & off-the-shelf components.
- Three-Stage Process: - Component Sourcing - Precision assembly - System Calibration

Observation Experience

- Telescopes aligned, calibrated, and ready for use.
- Data recording with Python scripts.
- Interactive visualization.
- Scientific documentation.
- Visual design at exhibition booths.

未来的改进

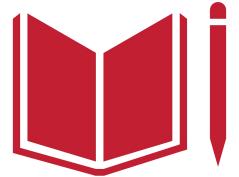
从数据处理到模型预测，我们希望未来能够实现部分特征之间的关系。我们希望识别出哪些数据是相关的，这可能是因为它们在某些方面具有相似性。因此，我们希望改进数据挖掘和机器学习算法，以便更好地识别这些相关性。此外，我们希望改进我们的模型，使其更准确地预测结果。在未来，我们将继续努力，通过技术创新和合作，为我们客户提供更好的解决方案。

102

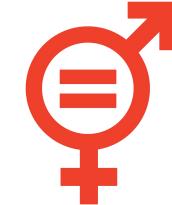
->

我们期望

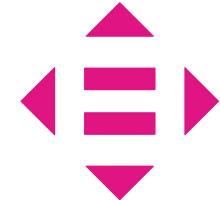
4 QUALITY EDUCATION



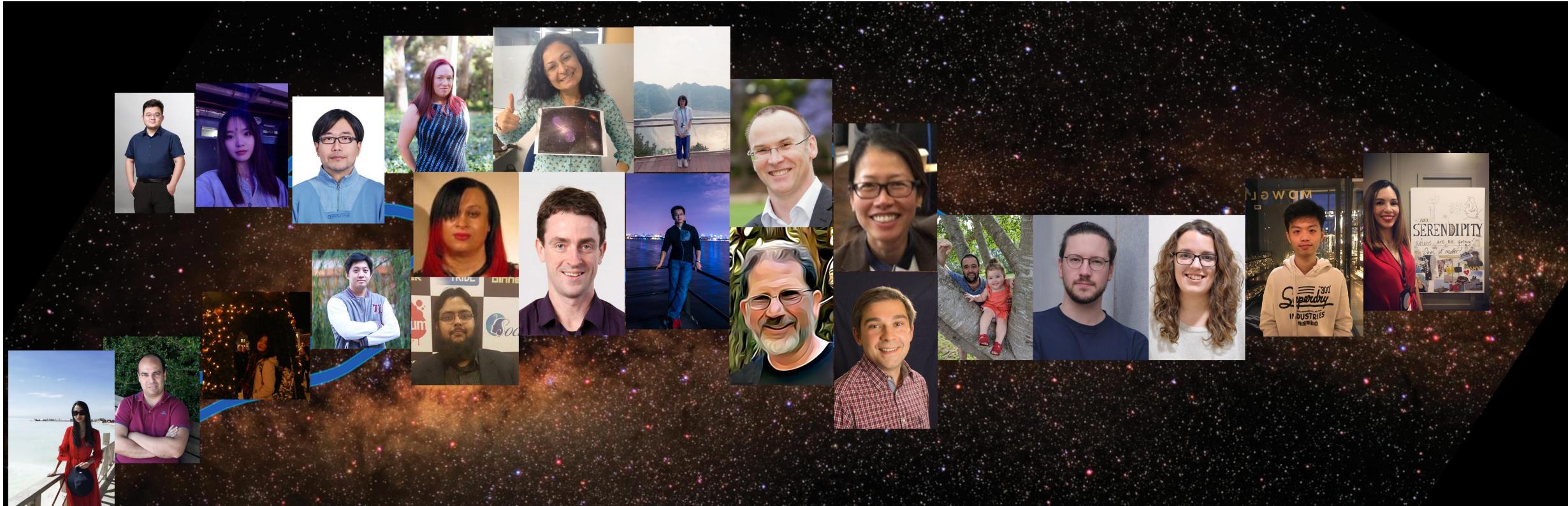
5 GENDER EQUALITY



10 REDUCED INEQUALITIES



1. 和职业天文学家，公众科学家，教育工作者，科普工作者一道，推动更多公众科学项目引进来，走出去
2. 让基于公众科学的科普，教育活动既有深度，也有宽度
3. 通过长期努力，为实现可持续发展目标作出微小的贡献



谢谢大家
射电星系动物园期待您的到来！