

# 赵忠尧博士后面试汇报

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# 个人简历:

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- ▶ 教育经历:

- ▶ 武汉大学: 学士学位, 2011-2015, 物理学, 金融学 (辅修)
- ▶ 中国科学院大学, 高能物理研究所: 博士学位, 2015-2020, 粒子物理与原子核物理
- ▶ 南京大学: 博士后, 2020-2022, 粒子物理与原子核物理

- ▶ 科研经历综述:

- ▶ 分析部分:

- ▶ ATLAS 实验 Run-2 数据中, 多轻子末态超对称粒子的寻找 (多个子课题)
    - ▶ ATLAS 实验中, 陶子相关性能测量与校正 (多个子课题)

- ▶ 硬件部分:

- ▶ ATLAS 实验硅径迹探测器升级项目中, 外层径迹探测器的制作与测试

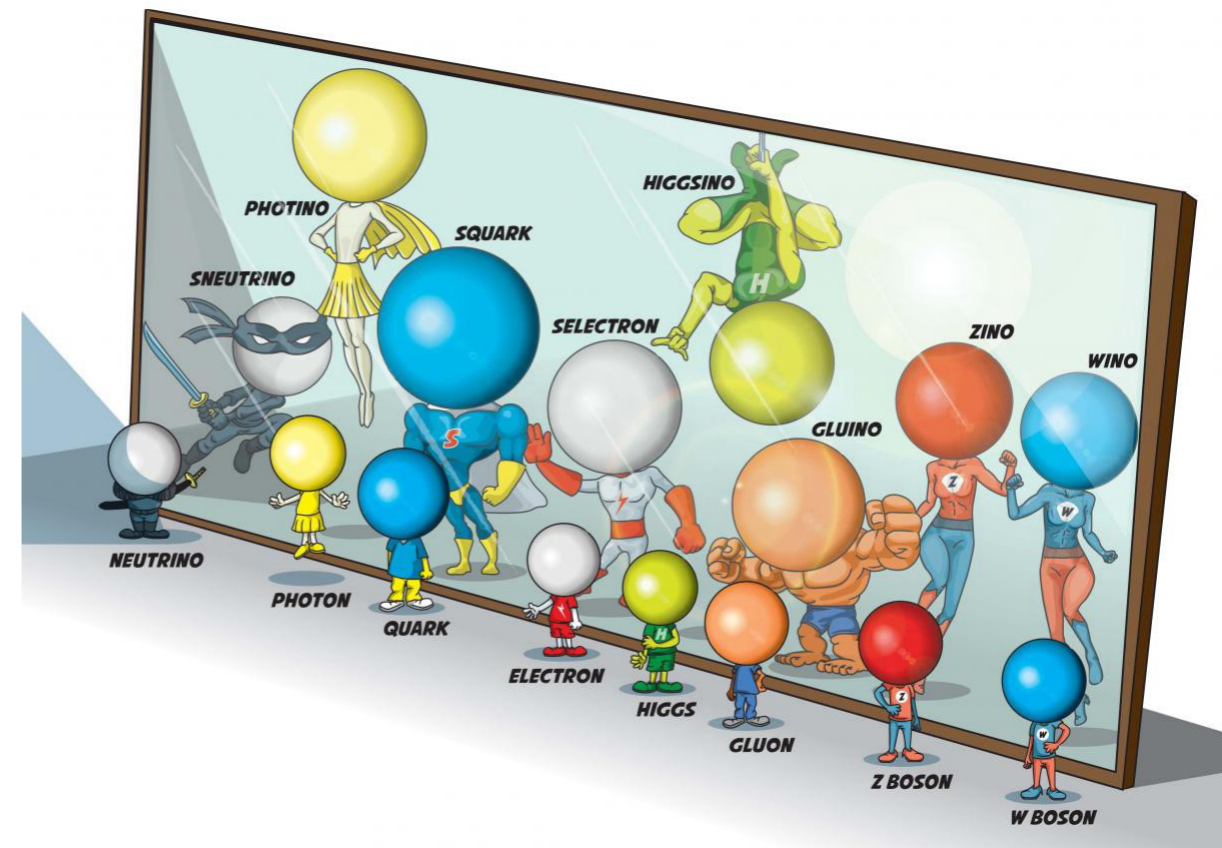
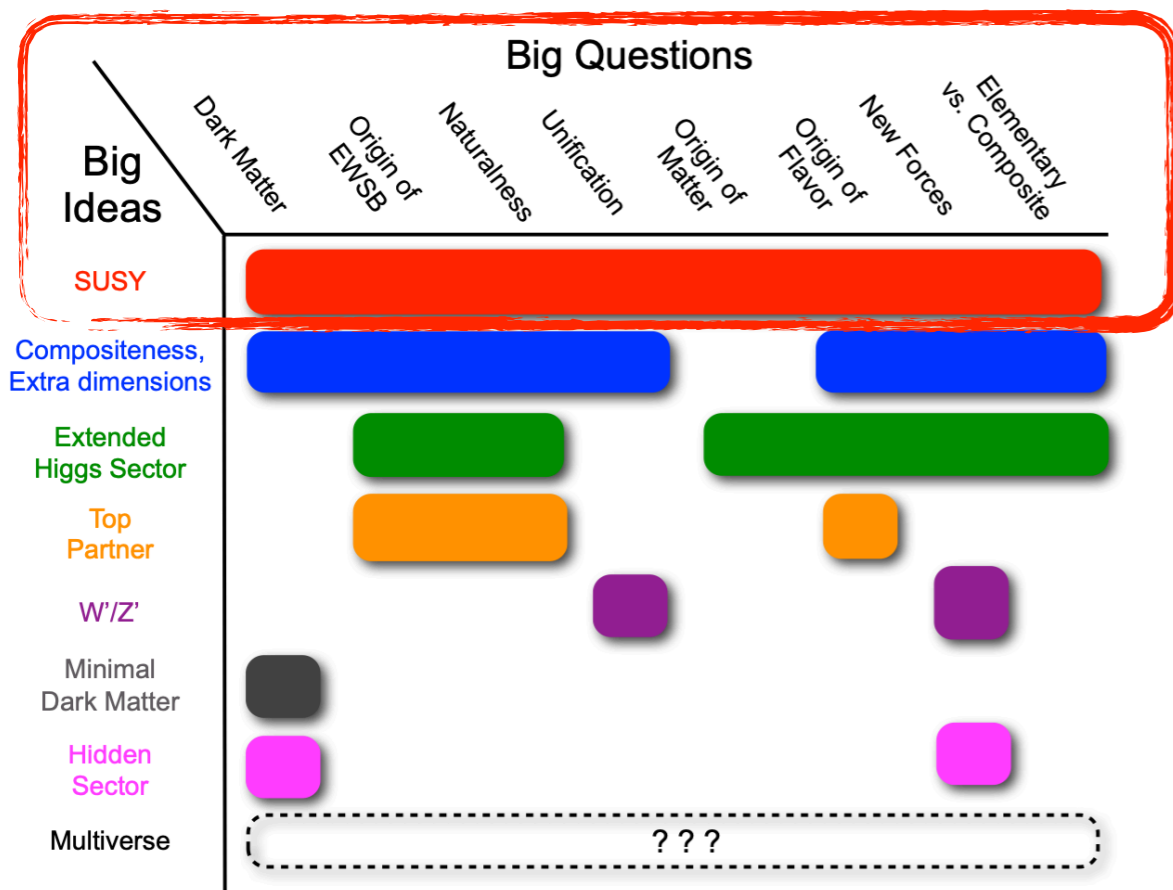
# 科研经历简介：

- ▶ 大型强子对撞机（LHC）：
  - ▶ 欧洲核子研究中心中进行的最主要的实验研究
  - ▶ 目前世界上最先进的能量最高的对撞机
- ▶ ATLAS 探测器：
  - ▶ LHC 上最大的通用探测器，实验目标包括：标准模型的精确测量、寻新物理等



# 科研经历简介:

- ▶ 超对称 (Supersymmetry/SUSY) : (LHC 实验上主要物理目标之一)
  - ▶ 将玻色子与费米子联系起来 (超多重态)
  - ▶ 解决规范等级问题、提供暗物质候选者、GUT 等
  - ▶ “软”的超对称破缺意味着超对称粒子质量在 TeV 量级, 能在 LHC 上产生



# 科研经历简介：超对称粒子的寻找

▶ 末态为同号双轻子或多轻子 (SS/3L) 的超对称粒子的寻找：(2016 - 今)，本底较低，紧致区间更好的信号显著度，覆盖较多的SUSY模型

▶ 主要贡献：该分析主要贡献人，贡献覆盖该分析每一步骤

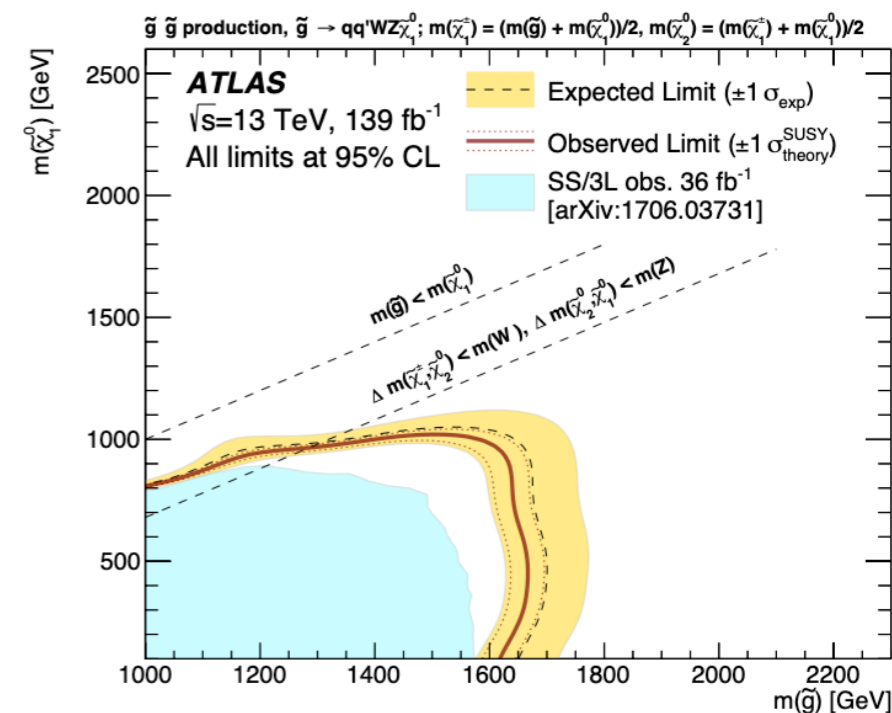
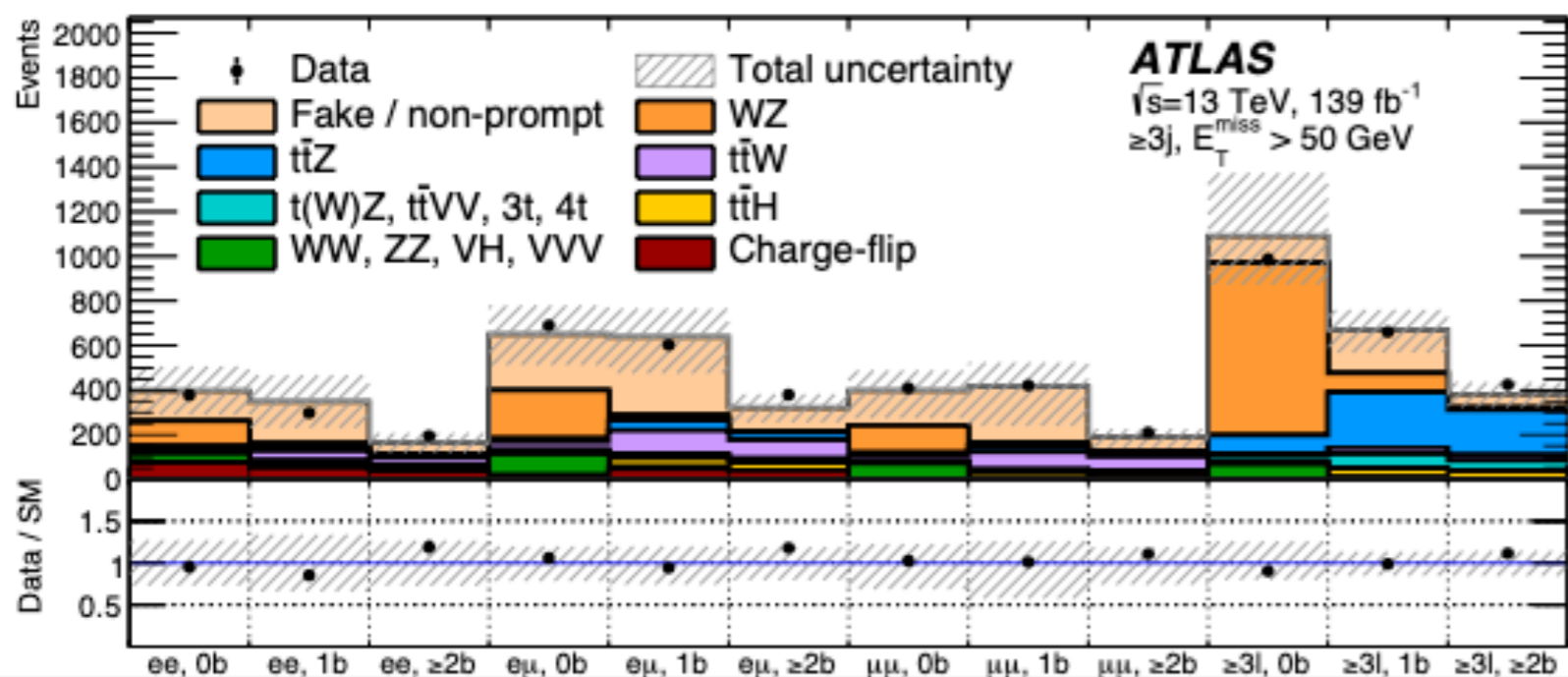
▶ 研究成果：

▶ 未发现明显的超出标准模型的信号，极大的延展了对应的超对称粒子的质量排除限

▶ **发表两篇 SCI 文章、两篇会议文章**

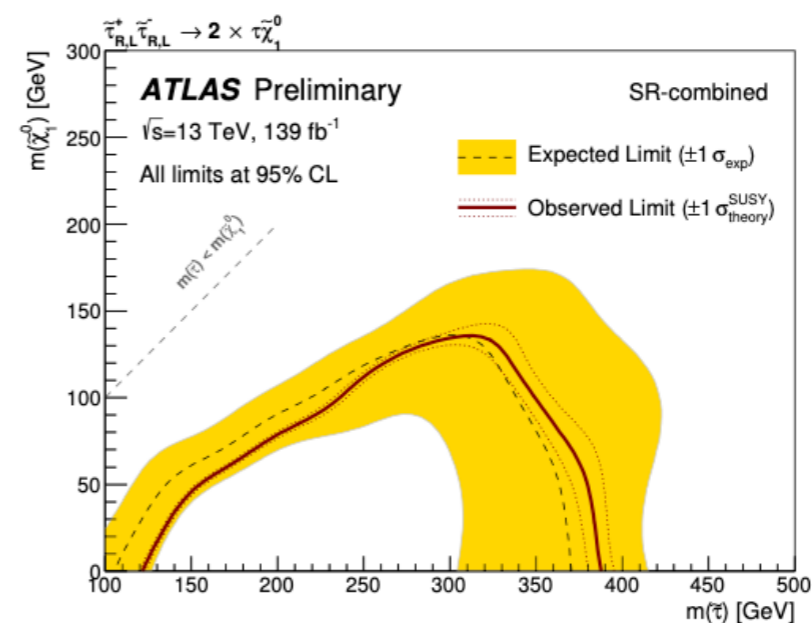
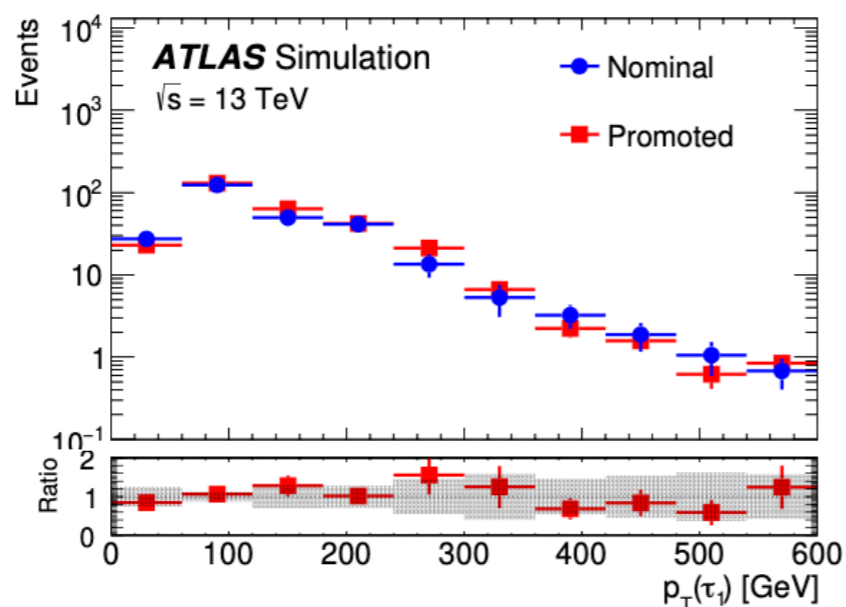
▶ 受邀做了多次批准报告以及在大会上展示海报

▶ **现担任该分析中两不同研究方向的分析联络人 (analysis contact) 主导该分析**



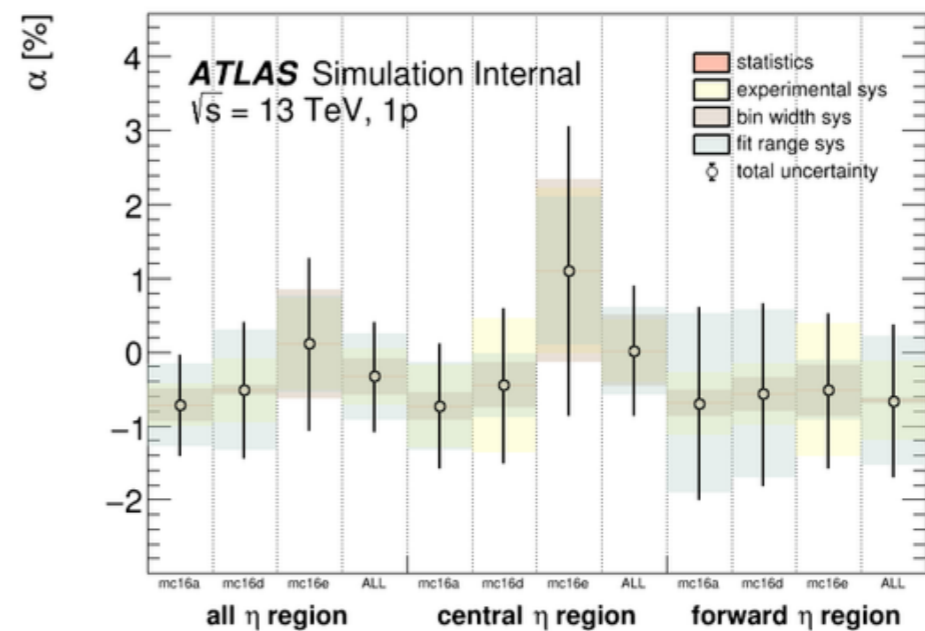
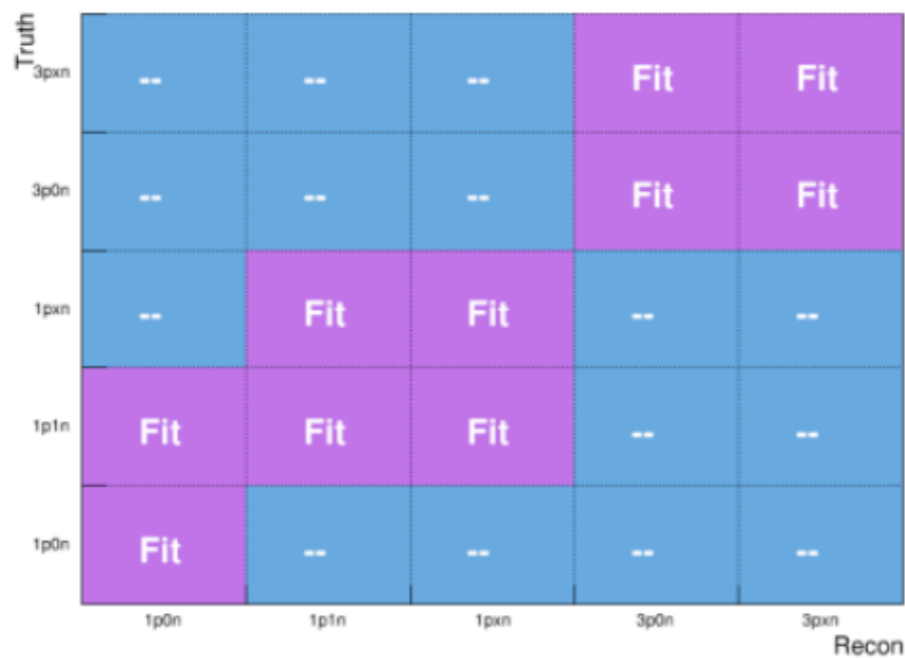
# 科研经历简介：超对称粒子的寻找

- ▶ 末态为同号双陶子 (DiTau) 的超对称粒子的寻找：(2018 - 今)，高能所原创课题，更低的本底，具有挑战性
  - ▶ 主要贡献：样本的产生、尝试新的变量以及新的方法对信号区进行优化、利用 ABCD 方法对 QCD 本底进行估计以及开发 Tau-promotion 方法提升 W+jets 本底的估计精度等
- ▶ 研究成果：
  - ▶ Tau-promotion 方法将W+jets 本底的统计误差提升 5-15 倍，极大的提高了分析结果的精确度
  - ▶ 未发现明显的超出标准模型的信号，首次在 ATLAS 实验上给出了  $\tilde{\tau}$  粒子的质量排除区间，是目前世界上最强的排除限
  - ▶ 发表了一篇 SCI 文章、一篇会议文章、一篇公共文献
  - ▶ 担任公共文献的编辑作者 (note editor) 并做了批准报告



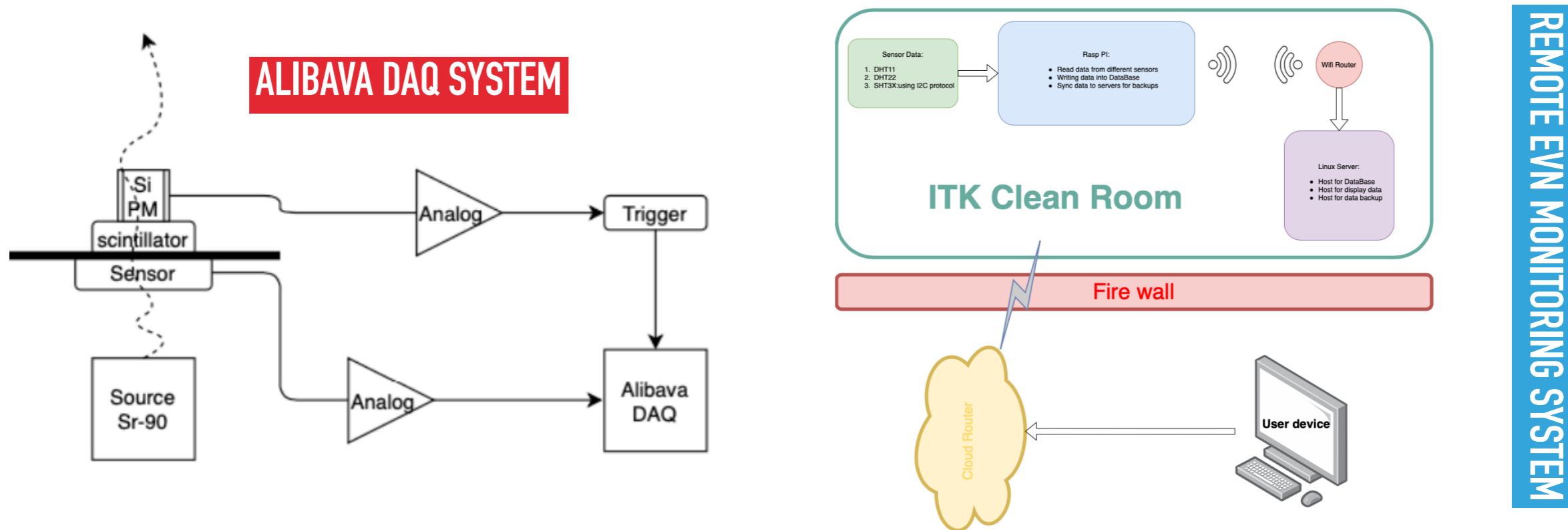
# 科研经历简介： $\tau$ 轻子性能研究

- ▶ ATLAS 实验上，陶子组开发了一系列可用于重建和识别  $\tau$  及其衰变模式的算法, 但其结果仍与实际观测有一定的偏差
- ▶ 主要贡献：
  - ▶ 基于观测数据，对  $\tau$  的衰变模式的识别效率进行修正，[ATLAS 实验上首次研究](#)，研究方法及软件框架由本人开发并维护，为后来人提供技术支持（2017 - 2018）
  - ▶ 基于观测数据，对  $\tau$  的能量刻度进行修正（in-situ TES），结果写入官方推荐包中供分析组使用（2019 - 2020）
- ▶ 研究成果：
  - ▶ 上述方法与结果正写入支持文章中，并预计发表一篇文章
  - ▶ [受邀代表陶子组在 ATLAS Overview Week 会议中做了大会报告](#)
  - ▶ [现担任超对称组与陶子组之间的联络人（CP contact）](#)



# 科研经历简介：ITK 探测模块的制作与测试

- ▶ 作为升级至 HL-LHC 的一部分，ATLAS 合作组将建造 ITK 提高带电粒子径迹探测性能，中国组紧密参与其制作与测试过程中
- ▶ 国内首次承担此类大面积抗辐照硅径迹探测器项目
- ▶ 本人主要贡献：（2020 年 6 月 - 今）
  - ▶ 利用 Alibava 取数系统研究 ATLAS 硅微条样片的性能及其微观结构，并将位移平台控制集成到数据获取系统中实现自动化
  - ▶ 利用 InfluxDB 数据库以及树莓派微型电脑对洁净间远程监控系统的开发工作，目前系统稳定运行中





# 科研经历简介：已取得的研究成果

已发表的 SCI 文章：（3 篇）

已发表的国际会议文章和公共文献：（4 篇）

ATLAS-PUB-2019-039 04 October 2019  
ATLAS-CONF-2019-018 28 May 2019  
ATLAS-CONF-2019-015 28 May 2019  
ATLAS-CONF-2017-080 09 May 2017

PHYSICAL REVIEW D **101**, 032009 (2020)

**Search for squarks and gluinos in final states with same-sign leptons and jets using  $139 \text{ fb}^{-1}$  of data collected with the ATLAS detector**

HEP PUBLISHED FOR SISSA BY SPRINGER  
RECEIVED: September 19, 2019  
REVISED: April 2, 2020  
ACCEPTED: May 11, 2020  
PUBLISHED: June 4, 2020

**The ATLAS collaboration**  
E-mail: [atlas\\_publications@cern.ch](mailto:atlas_publications@cern.ch)

ABSTRACT: A search for supersymmetric partners of gluons and quarks is presented, involving signatures with jets and either two isolated leptons (electrons or muons) with the same electric charge, or at least three isolated leptons. A data sample of proton-proton collisions at  $\sqrt{s} = 13 \text{ TeV}$  recorded with the ATLAS detector at the Large Hadron Collider between 2015 and 2018, corresponding to a total integrated luminosity of  $139 \text{ fb}^{-1}$ , is used for the search. No significant excess over the Standard Model expectation is observed. The results are interpreted in simplified supersymmetric models featuring both  $R$ -parity conservation and  $R$ -parity violation, raising the exclusion limits beyond those of previous ATLAS searches to 1600 GeV for gluino masses and 750 GeV for bottom and top squark masses in these scenarios.

KEYWORDS: Hadron-Hadron scattering (experiments), Supersymmetry

ARXIV EPRINT: [1909.08457](https://arxiv.org/abs/1909.08457)

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for the benefit of the ATLAS Collaboration.  
Article funded by SCOAP<sup>3</sup>.  
[https://doi.org/10.1007/JHEP06\(2020\)046](https://doi.org/10.1007/JHEP06(2020)046)

JHEP06(2020)046

**Improved description of the di-tau final state in events with associated production of a  $W$  boson and jets in the ATLAS detector using the tau-promotion method**

ATLAS EXPERIMENT

**Searches for supersymmetry in resonance production,  $R$ -parity violating signatures and events with long-lived particles with the ATLAS detector**

Yang Liu  
— On behalf of the ATLAS Collaboration  
Institute of High Energy Physics Chinese Academy of Science, CAS

**Introduction**

- SUSY relates fermionic and bosonic degrees of freedom. In the generic superpotential, Yukawa couplings can lead to baryon and lepton number violation:  $W_{\text{RPV}} = \lambda_{ijk} L_i L_j E_k + \lambda'_{ijk} L_i Q_j D_k + \lambda''_{ijk} U_i D_j D_k + \kappa_i L_i H_u$  which can be called  $R$ -parity violating (RPV) couplings. This family of models leads to unique collider signatures which would elude conventional searches for  $R$ -parity conserving SUSY.
- Other complementary searches for SUSY will be the long-lived particles since lots of BSM models have predicted their existence. Decades of searches for SUSY have set severe constraints on the masses of promptly decaying particles. Searches targeting the more challenging experimental signatures of new long-lived particles (LLPs) have therefore become increasingly important and must be pursued at the LHC.

**Stop B-L**

**RPV 1 Lepton + Multijet**

Signal Regions:

ATLAS EXPERIMENT

**Searches for strong production of supersymmetric particles with the ATLAS detector**

Yang Liu On behalf of the ATLAS Collaboration  
Nanjing University & Institute of High Energy Physics  
[yang.l@cern.ch](mailto:yang.l@cern.ch)  
May 26 2021

ATLAS EXPERIMENT

国际会议报告：（5 次）

海报：（3 篇）

# 科研经历简介： 已取得的研究成果

## 已发表的 SCI 文章： (3 篇)

- ▶ “Search for supersymmetry in final states with two same-sign or three leptons and jets using 36 fb<sup>-1</sup> of  $\sqrt{s} = 13$  TeV  $pp$  collision data with the ATLAS detector”, The ATLAS collaboration, [J. High Energ. Phys. \(2017\) 09 084](#).
- ▶ “Search for squarks and gluinos in final states with same-sign leptons and jets using 139 fb<sup>-1</sup> of data collected with the ATLAS detector”, The ATLAS collaboration, [J.High Energ. Phys. \(2020\) 06 046](#)
- ▶ “Search for direct stau production in events with two hadronic  $\tau$ -leptons in  $\sqrt{s} = 13$  TeV  $pp$  collisions with the ATLAS detector”, The ATLAS collaboration, [Phys. Rev. D101 \(2020\) 3. 032009](#)

## 已发表的国际会议文章和公共文献： (4 篇)

- ▶ “Search for supersymmetry in final states with two same-sign or three leptons and jets using 36 fb<sup>-1</sup> of  $\sqrt{s} = 13$  TeV  $pp$  collision data with the ATLAS detector”, [ATLAS-CONF-2017-030](#)
- ▶ “Search for squarks and gluinos in final states with same-sign leptons and jets using 139 fb<sup>-1</sup> of data collected with the ATLAS detector”, [ATLAS-CONF-2019- 015](#)
- ▶ “Search for direct stau production in events with two hadronic tau leptons in  $\sqrt{s} = 13$  TeV  $pp$  collisions with the ATLAS detector”, [ATLAS-CONF-2019-018](#)
- ▶ “Improved description of the di-tau final state in events with associated production of a W boson and jets in the ATLAS detector using the tau-promotion method”, [ATL-PHYS-PUB-2019-039](#)

# 科研经历简介： 已取得的研究成果

## 国际会议报告： (5次)

- ▶ ATLAS TauWorkShop: "[Substructure T&P Measurement](#)", Max-Planck-Institut für Physik, 2017 Oct
- ▶ ATLAS Overview week: "[Tau performance report](#)", Waseda University, 2018 June
- ▶ The 4th China LHC Physics Workshop: "[inclusive and electroweakino SUSY search with leptons](#)", Central China Normal University, 2018 Dec
- ▶ The 5th China LHC Physics Workshop: "[inclusive SUSY search with SS leptons at ATLAS](#)", Dalian University of Technology, 2019 Oct
- ▶ Phenomenology 2021 Symposium: "[Searches for strong production of supersymmetric particles with the ATLAS detector](#)", University of Pittsburgh, 2021 May

## 海报： (3 篇)

- ▶ The 5th Annual Large Hadron Collider Physics conference: "Search for squarks and gluinos in final states with two same-sign or three leptons at ATLAS", Shanghai, 2017 May
- ▶ Particles and Nuclei International Conference 2017: "Searches for supersymmetry in resonance production, R-parity violating signatures and events with long-lived particles with the ATLAS detector", IHEP, 2017 Sep
- ▶ The 5th China LHC Physics Workshop: "Improved description of the di-tau final state in events with associated production of a W boson and Jets in the ATLAS detector using the Tau-promotion method", Dalian University of Technology, 2019 Oct

# 未来工作计划:

- 分析部分:
  - 超对称粒子的寻找: (**预计2年时间内, 发表四篇 SCI 文章**)
    - 继续进行末态为 SS/3L 的超对称粒子的寻找:
      - 现分为两个独立的分析组分别对不同类型的超对称粒子进行寻找, 本人同时**担任两分析组联络人 (analysis contact)** 主导以上两分析
      - 预计于今年秋季 (**担任文章编辑**) 以及明年年初分别发表一篇 SCI 文章, 共两篇文章
    - 进行 Run-2 阶段下, 对超对称粒子不同末态下的联合寻找: 预计工作期间发表一篇 SCI 文章
    - 进行 Run-2 阶段下, 对 pMSSM 理论中相关参数的联合扫描: 预计工作期间发表一篇 SCI 文章
  - 陶子性能研究: 着重于低能动量陶轻子的重建效率、鉴别效率以及能量校正等的测量以及修正
- 硬件部分:
  - 对 REMS 系统进行升级、维护
  - 熟练掌握 ITK 探测模组的生产以及测试全过程并积极参与批量产生中

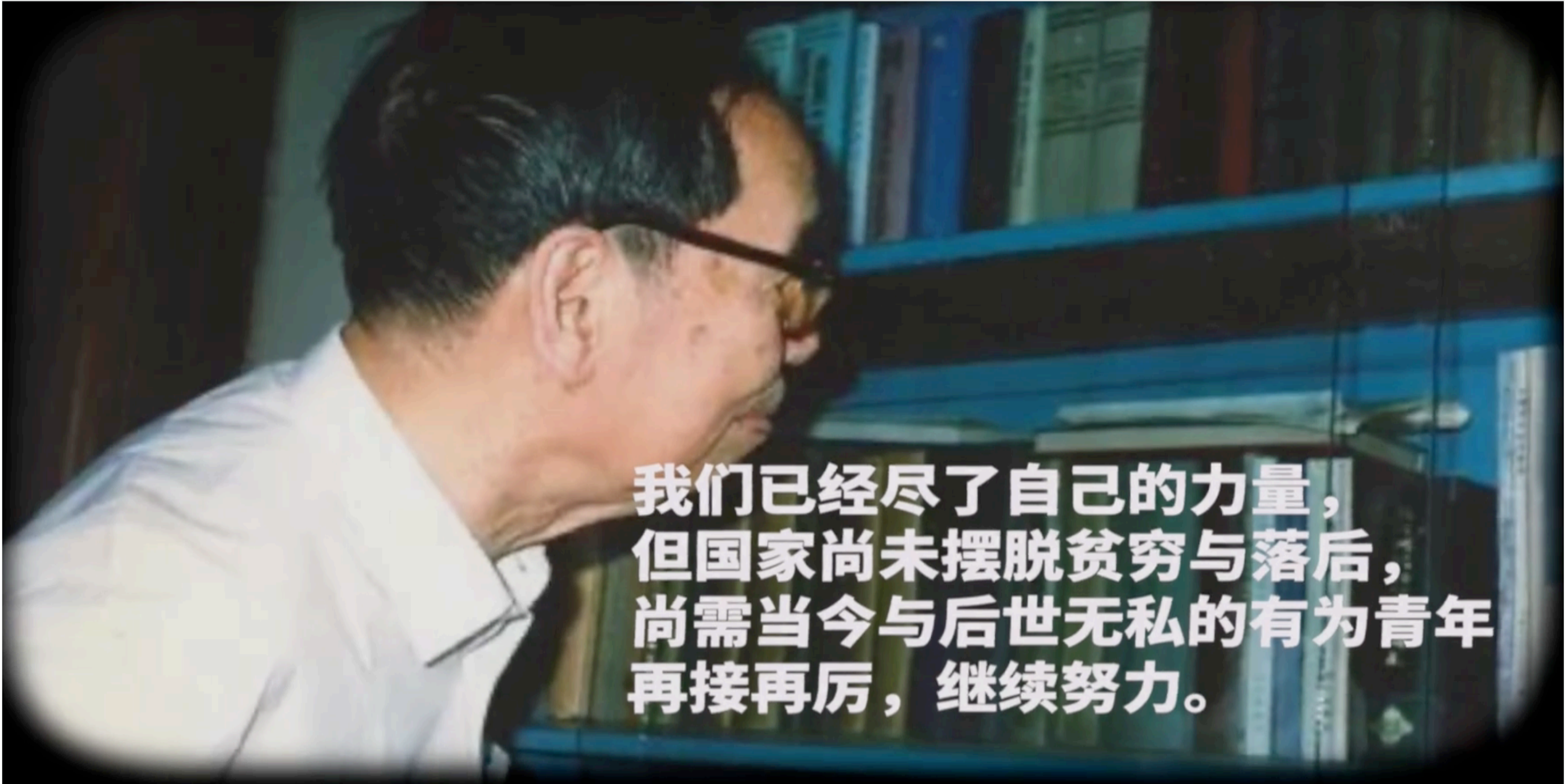
## Ongoing Analyses

search... 10 results per page showing 1 to 5 of 5 entries FIRST PREVIOUS 1/1 NEXT LAST

Ref Code	Title	Contributions
<b>ANA-SUSY-2019-17</b> 2019-07-10	SUSY Staus 2nd Wave	Analysis Team - Member
<b>ANA-SUSY-2019-22</b> 2019-10-17	SUSY EWK. SS/3L	Analysis Team - Contact Editor Analysis Contact
<b>ANA-SUSY-2020-27</b> 2020-10-26	SUSY Strong SS/3L 2nd wave	Analysis Team - Member Analysis Contact
<b>ANA-SUSY-2020-14</b> 2020-06-18	SUSY grand pMSSM scan (pMSSM-19)	Analysis Team - Member
<b>ANA-TAUP-2018-01</b> 2019-01-17	Run 2 Tau Performance	Analysis Team - Member

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BACK UP



**我们已经尽了自己的力量，  
但国家尚未摆脱贫穷与落后，  
尚需当今与后世无私的有为青年  
再接再厉，继续努力。**

回想自己一生，经历许多坎坷，唯一希望的就是祖国繁荣昌盛，科学发达

——赵忠尧

# Interesting readings for Chung-Yao Chao:

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《我的回忆》

《核物理学家赵忠尧杰出的人生》

《赵忠尧论文选集》序言

Zhao Zhongyao

《为了可爱的中国》第二集《归国》

《大揭秘》物理学大师赵忠尧

他曾是邓稼先、杨振宁老师，回国无比艰难，美国曾连发三道命令拦截【华夏传奇】

【天才简史-赵忠尧】

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THE END