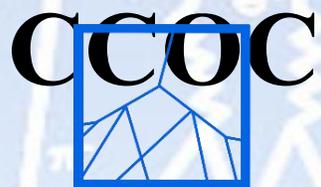


校园宇宙线观测联盟

Campus Cosmic-ray Observation Collaboration,



张闯

中国科学院高能物理研究所

首届全国天文公众科学大会

2025年7月31日-8月1日 ◦ 辽宁师范大学



2018年全国物理科普大会

中国物理学会、南开大学、中国科学院大学和中国科学院高能物理研究所联合主办，南开大学物理科学学院、天津市物理学会、《现代物理知识》编辑部承办，2018年9月17-18日在南开大学召开，200余名代表出席。



2018.9.17

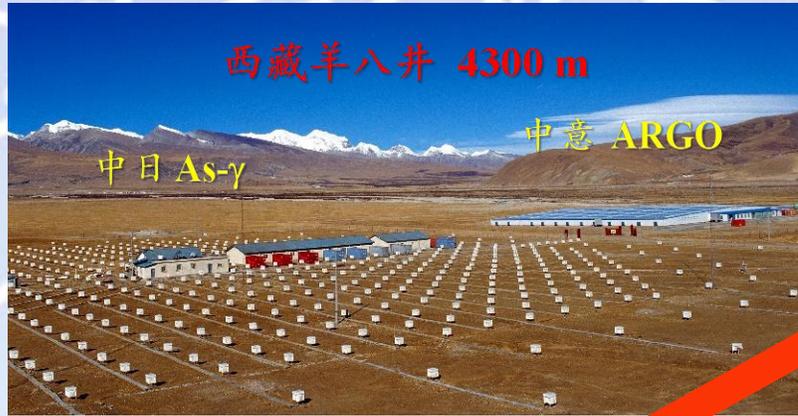
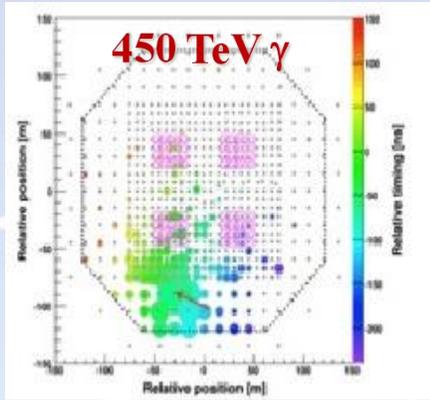
校园宇宙线观测联盟

- 缘起和成立
- 联盟的活动
- 学习和思考

高山宇宙线观测：落雪山-羊八井-海子山

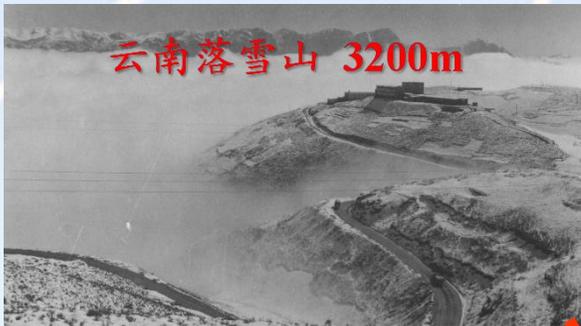
重大科学前沿问题：宇宙线的成分、起源、加速和传播机制，与天体形成和演化密切相关

2020

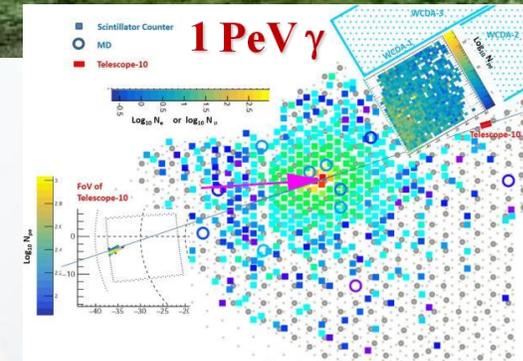
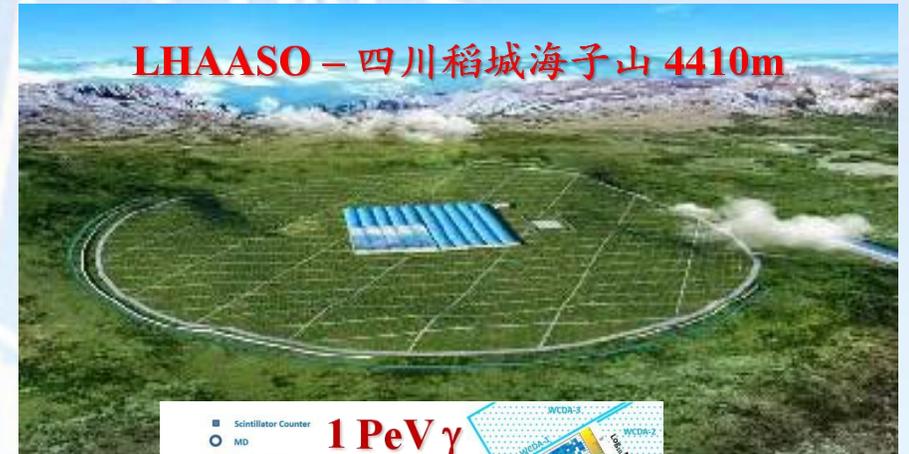


2010

2000



1990

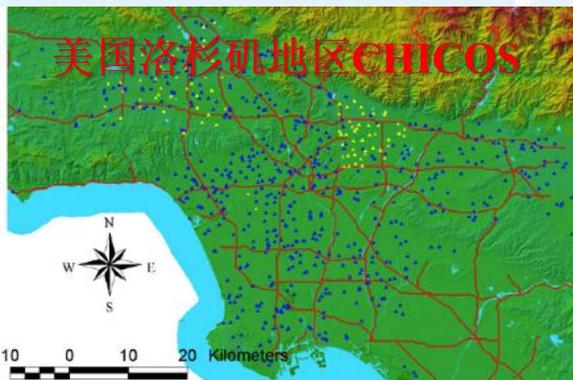


1950



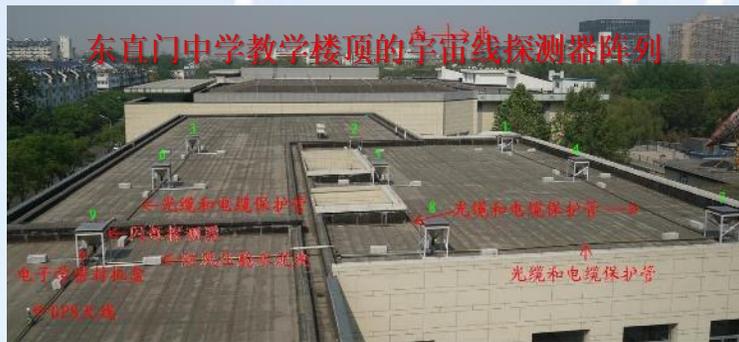
宇宙线观测走进校园

- 宇宙线是天然易得的研究样品，是“天上掉下来的馅饼”。
- 每时每刻都有宇宙线（次级）粒子通过人体，但不知不觉不可见。
- 采用粒子物理研究的探测器仪器进行观测，设备和方法成熟、技术可行。
- 高能物理研究所长期在云南落雪山、西藏羊八井开展高山宇宙线研究，并在四川稻城建成大型高海拔宇宙线观测站，可以提供科技指导。
- 经过培训，物理教师可以掌握基础知识和实验技术，学生可以在宇宙线课外小组制作设备、开展实验；
- 世界上已有十几个国家在几百个中学和大学开展宇宙线研究，有成功的经验。



一、缘起和成立

在北京市“翱翔计划”的支持下，高能所专家指导东直门中学，2016年建成了我国第一座校园宇宙线探测站，学生在真实的科学研究中培养创新精神和团队意识。沈长铨老师在2018年物理科普大会上报告了情况，引起热烈的支持和反响。



全国物理科普大会

2018.9.17-19 · 天津 · 南开大学

南开大学 Nankai University
2018年全国物理科普大会
物理前沿 精彩呈献

首页 会议信息 会议日程 注册信息 报告信息 住宿信息 交通信息

 王景林 南京物理研究所	 王成 中国科学院上海技术物理研究所	 刘杰 清华大学	 刘杰 清华大学	 刘杰 清华大学
 王景林 南京物理研究所	 刘杰 清华大学	 刘杰 清华大学	 刘杰 清华大学	 刘杰 清华大学



2018 全国物理科普大会

会议日期: 2018年9月14日报到, 9月15-17日召开研讨会

会议地点: 南开大学

参会人员: 物理教师和教育工作者; 教育科研机构研究人员和行政管理人员; 科普工作者等。

指导委员会: 主任: 王贻芳 委员: 葛墨林, 陈阳坤, 汪卫华, 吴岳良, 赵光达, 朱邦芬
组织委员会: 主任: 罗晓冬 委员: 李学潜, 刘长兵, 乔从丰, 乔宗福, 朱祥, 张闻, 郑文柯

特邀报告人: 葛墨林, 陈阳坤, 王贻芳, 武向东, 吴岳良, 薛其坤, 张双南

会议日程: 详见大会官网 KEPU.NANKAI.EDU.CN

主办单位: 中国物理学会, 南开大学, 中国科学院高能物理研究所
承办单位: 南开大学物理科学学院, 天津市物理学会, 《现代物理知识》编辑部
协办单位: 中国物理学会科普教育专业委员会, 北京人民广播电台, 山东人民广播电台
支持单位: 天津市物理学会委员会, 天津物理学会, 天津物理学会

物理科普与教学沙龙

想了解未来中国需要什么样的物理人才吗?
想倾听中国物理科普与教育的高知见解吗?
9月17日邀请和专家面对面

主持人: 乔从丰
中国科学院大学, 物理学部副部长

受邀嘉宾的老师有:
康原: 中国科学院大学, 副校长(院士)
王贵强: 中国科学院物理研究所(院士)
刘玉建: 南开大学, 研究生院常务副院长
宋城: 南开大学, 物理学院物理实验教学中心主任
张闻: 中科院高能所, 量子天体物理中心主任
魏巍: 南开大学副校长
时间: 中国物理学会科普工作委员会主任

0917
19:30-21:00
地点: 南开大学体育馆



在中学开展宇宙线研究研讨会

(2019年1月10日)



校园宇宙线观测联盟成立大会

2020.9.28. 北京



校园宇宙线观测联盟

- **目的：**为了推进我国校园宇宙线观测网建设，普及宇宙线知识，开展宇宙线科学研究，加强相关国际交流，**促进创新型人才培养**，成立校园宇宙线观测联盟。
- **性质：**校园宇宙线观测联盟是以推进学校开展校园宇宙线观测和研究、培养创新型人才为目标，科学普及、人才培养和科学研究三位一体，由成员自愿组成的、**非盈利性的非法人协作单元**。
- **职能：**1、推进校园宇宙线观测站的建立，开展宇宙线观测与相关研究。2、推动宇宙线观测仪器设备的开发和数据采集与处理软件等方面的合作。3、促进联盟成员在宇宙线观测和研究方面的合作，建立宇宙线观测数据库，实现数据共享。4、组织培训班、研讨会，开展宇宙线观测研究的交流。5、加强校园宇宙线国际交流与合作，协调参与“国际宇宙线日”活动。6、基于宇宙线探测和研究，促进物理教师科研能力提升和学生中的创新型人才培养。

摘自：《校园宇宙线观测联盟章程》

校园宇宙线观测联盟成员

33个团队，其中中学17个、大学12个、小学1个，研究所等4个
6位个人

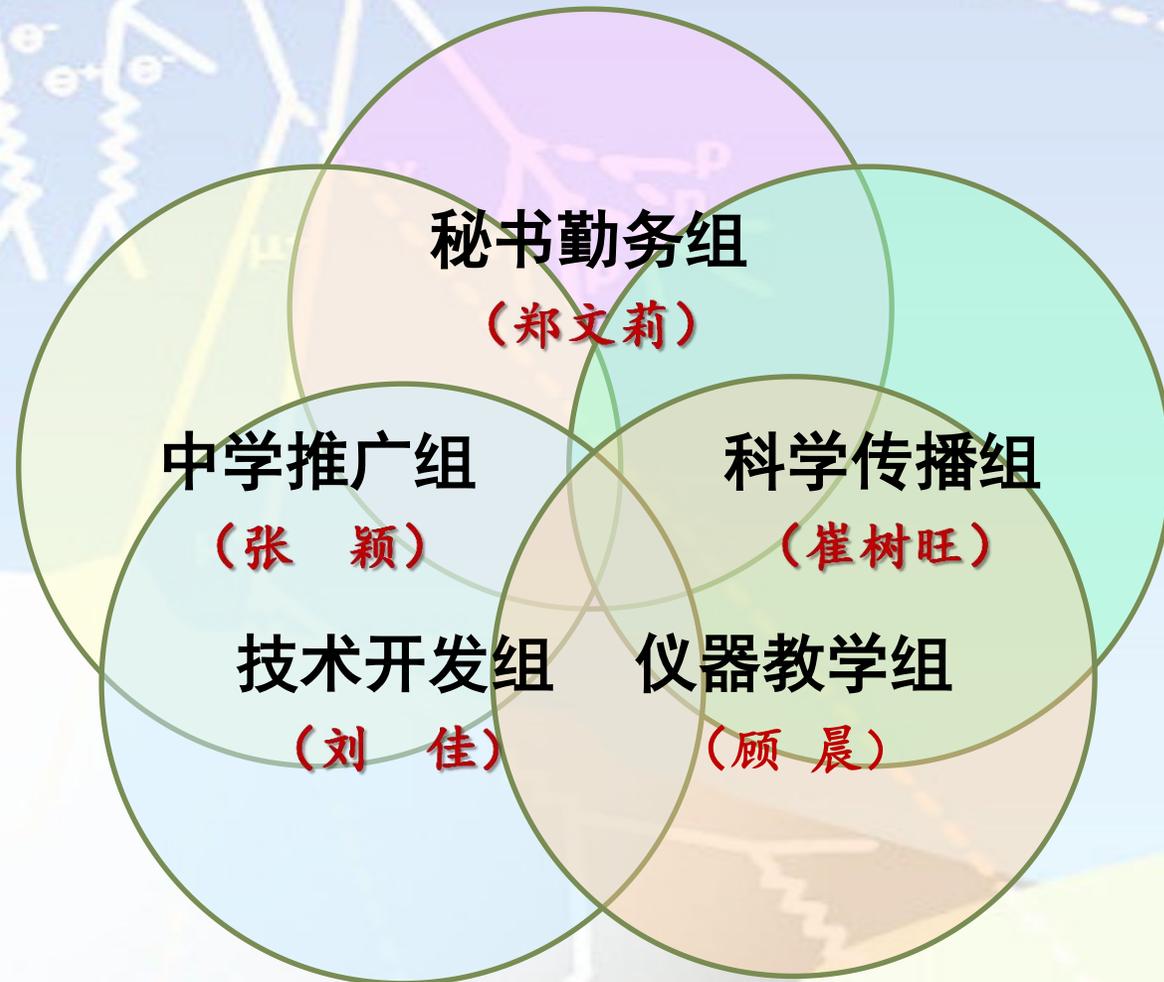
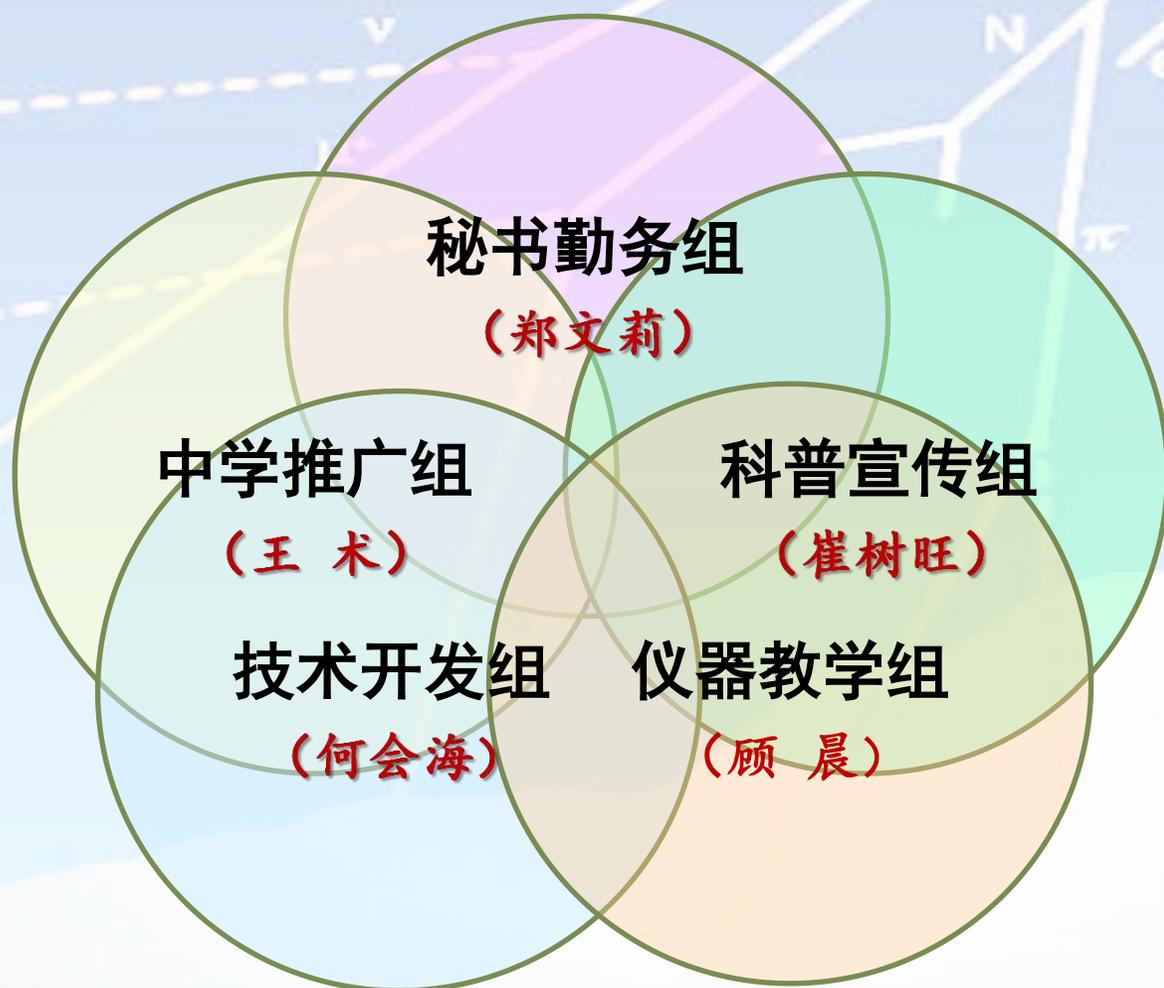


校园宇宙线观测联盟 理事会和工作组

理事长：张闯；副理事长：崔树旺、陈冬、王术（张颖）；秘书长：郑文莉；顾问：沈长铨、张卫强

第一届理事会20人（2020 - 2024）

第二届理事会23人（2024 - ）



建立宇宙线科学教育基地

中国科学院大学关心下一代工作委员会
高能物理研究所二级委员会“宇宙线科学教育基地”

揭牌仪式



二、联盟的活动

- 推进校园宇宙线观测站建设
- 共享校园宇宙线观测的数据
- 举办宇宙线培训和暑期学校
- 参加国际宇宙日等交流活动

1、推进校园宇宙线观测站的建设

- 西南交通大学和石家庄一中-河北师大基于LHAASO技术建设了宇宙线观测站；
- 江苏省姜堰中学校园宇宙线观测站于2022年7月安装建成，开展科学教育活动；
- 江苏省兴化中学校园宇宙线观测站于2023年10月安装建成，开始宇宙线观测；
- 江苏省王淦昌中学宇宙线观测站于2024年10月安装建成，开始宇宙线观测；
- 西藏大学、中山大学也已经完成校园宇宙线观测站建设，将发挥带动作用。



江苏省姜堰中学



江苏省兴化中学



江苏省王淦昌中学



校园宇宙线探测器研制

两种校园宇宙线探测器

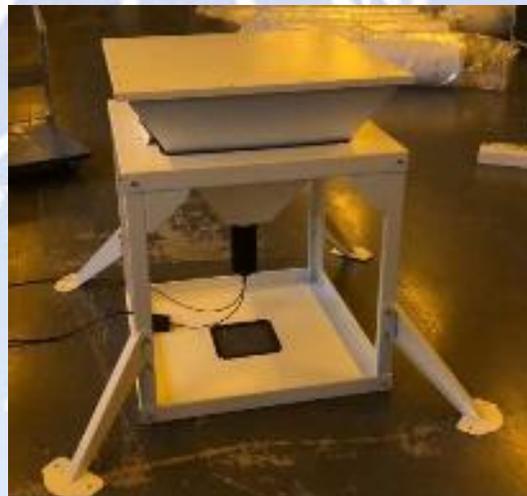
- 空气光导探测器
- 缪子望远镜



高压模块



低压模块



空气光导探测器



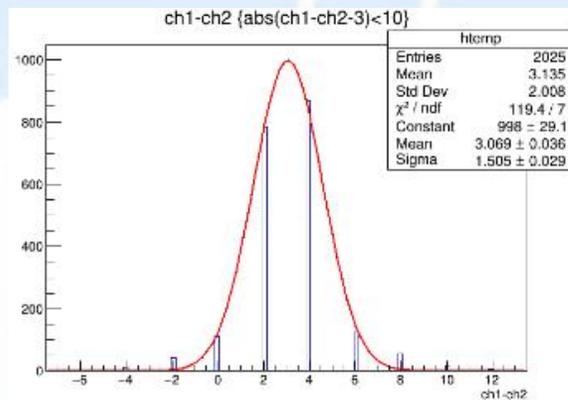
缪子望远镜



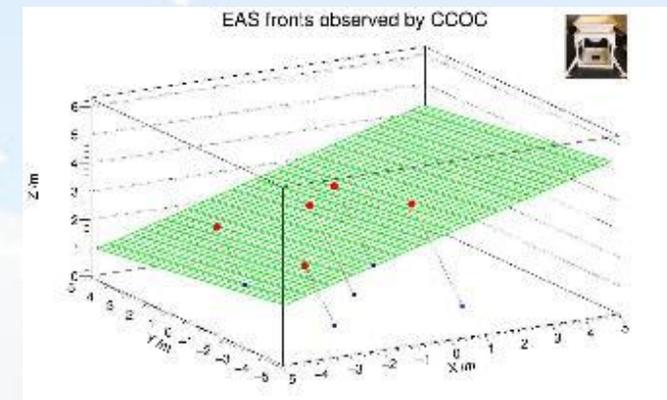
数据获取软件



电子学板

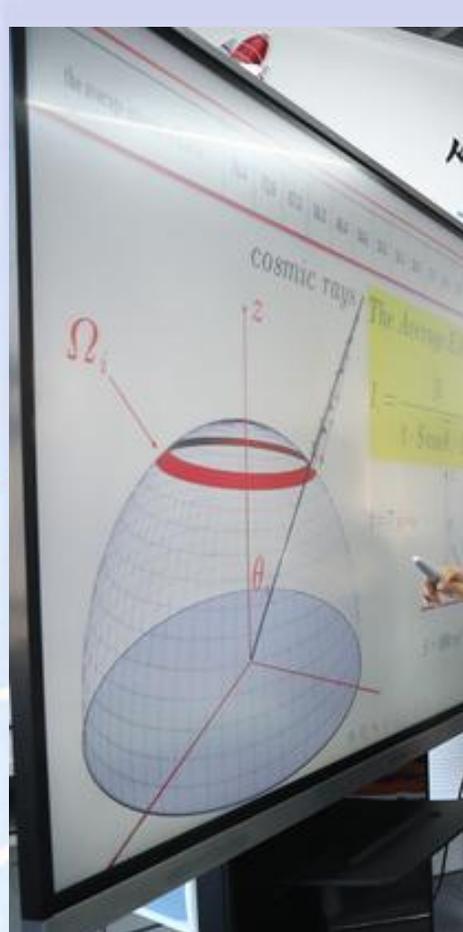


缪子望远镜探头时间差分布



宇宙线阵列重建事例

丰富多彩的宇宙线社团活动



3班 刘宇轩
请于今日交至高三物

3班 孙易怡
请于今日交至高三物理组刘春晖老师 2#一楼或高一物理组冯艳秋老师 3#一楼

《宇宙线社团活动心得》

通过
在一系列
讲座中，
基础知识
我回顾
到了生
从计
也学
益

在社团中活动的这段时间，我们体验了作为宇宙线研究的机器的游览，也亲自操作了电脑上的筛选数据的步骤。在这些亲身经历中，我一步一步地走近了原先我心目中蒙着面纱的宇宙线，更加吸引着我进一步地探索。虽然它与我原先心中所想的宇宙线有所不同，但它是如此有生命力，有趣，有着令人着迷的魅力。在他的吸引下，我知道了更多物理探究的方法，更多机器运行的原理，激发着我物理探究的精神。

还有就是，我认为它也开拓了我的眼界。在国际宇宙线日中，我们汇报了我们的活动成果，也见识了更多样的宇宙线知识。在逐渐地了解中，它令我感到这世界有那么多未知，那么多神秘的东西，需要我们去学习更多去了解它。

通过宇宙线社团活动，我真的学到很多，希望我能向这些知识，献学的更深处探索。



2、共享校园宇宙线数据

校园宇宙线观测联盟数据开放和使用办法

- 一、为了更好规范校园宇宙线观测联盟（以下简称联盟）各成员运行的宇宙线观测实验数据的开放共享，明确各方权利义务，依照**联盟章程第二章第五条第二款第5项**，制定本办法。
- 二、**联盟成员运行的宇宙线观测实验所产生的数据应当在整个联盟内共享。数据也应该向公众用户开放。**具体开放的数据范围可由成员和联盟协商确定。
- 三、**本办法适用于联盟成员运行的宇宙线阵列产生的数据以联盟的名义进行开放共享，包括但不限于原始数据、衍生数据等。也包括数据处理所需要的软件、算法等。**
- 四、为了提供统一和高效的服务，由成员学校提供原始数据，而联盟委托中科院高能物理研究所宇宙线工作组代表联盟统一进行数据的**预处理和开放共享**，并统计数据下载情况。为了方便公众的学习和使用，开放的数据为预处理以后的数据，其数据格式和数据量均经过优化。
- 五、**汇交到联盟的数据归数据提供者及联盟共同所有，联盟有权根据需要进行数据产品的再加工、公开共享。**
- 六、用户在使用开放的数据时，**应遵守以下使用条款，特别是需要注明数据的来源。**

.....

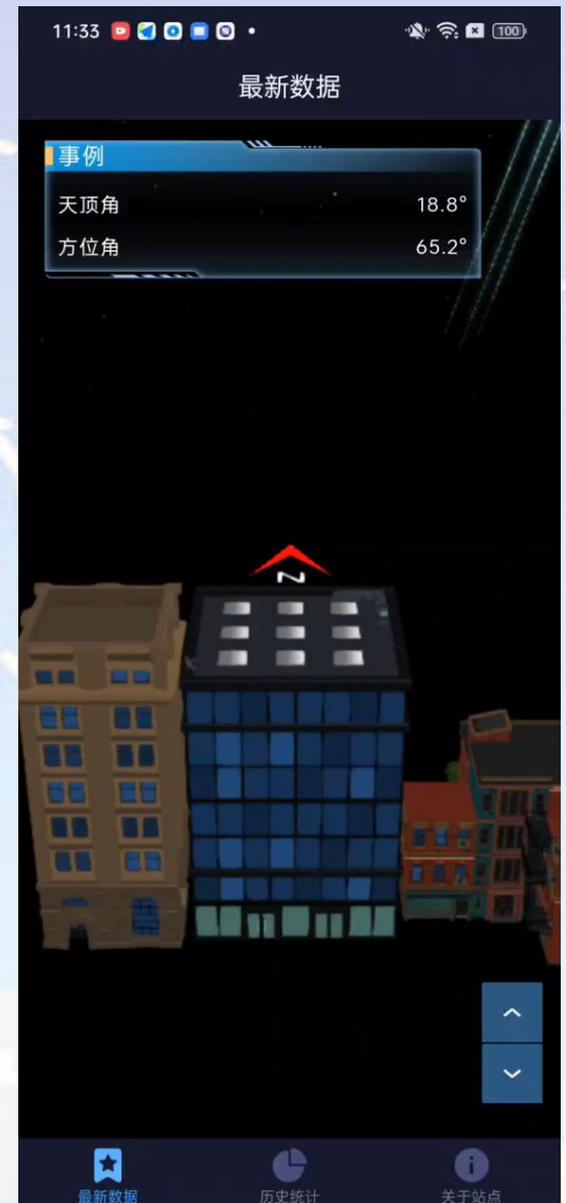
联盟网站数据中心

<http://ccoc.ihep.ac.cn/datacenter/>

- 提供联盟内校园站点的数据共享，数据可视化，以及站点情况、数据使用的介绍等
- 目前提供东直门中学2018以来的数据，并继续加入新站点的数据
- 联盟成员可以直接下载，公众提交下载请求经审核后可以下载
- 在联盟的历次培训和活动中为参加学校提供了数据下载
- 为校园宇宙线观测App提供数据源

校园宇宙线观测App

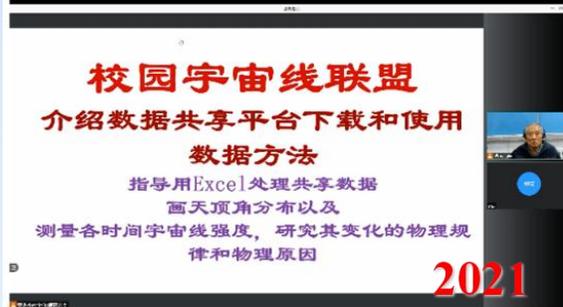
- 虚拟宇宙线观测站：宇宙线观测装置的“数字孪生”
- 融合宇宙线的知识，内容丰富，让用户不断探索，以增加用户粘性
- 英文名暂定：COSLink，中文名暂定“宇联”
- 主要功能：各个站点地图展示，实时事例数据可视化，历史统计信息的可视化（天顶角、方位角、能量、探测器、事例数、来向分析等），站点运行质量排序……



3、校园宇宙线培训和暑期学校



CCOC 国际宇宙日培训会



2021年暑期交流培训会



2022年校园宇宙线观测暑期学校

线上地址: <https://meeting.tencent.com/s/YEcnaxYqH75F> 腾讯会议 ID: 272 908 922

时 间
09:00 - 09:15
09:15 - 09:30
09:30 - 10:10
10:10 - 10:20
10:20 - 10:35
10:35 - 10:45
10:45 - 10:55
10:55 - 11:35
11:35 - 12:05
12:05 - 13:30
13:30 - 14:30
14:30 - 14:40
14:40 - 15:20
15:20 - 15:50
15:50 - 16:00
16:00 - 16:40
16:40 - 17:10
17:10 - 17:50
17:50



主讲人
王晓锋
徐吉磊
左 雄
刘佳
董绪强
武 莎
唐志成
高 卫
南云程
李 骢
侯 超
刘 佳
张 闯
郑文莉
张 闯
22

2023年校园宇宙线观测暑期学校合影留念

中国·成都 2023.08.25-26

西南交通大学：开学合影



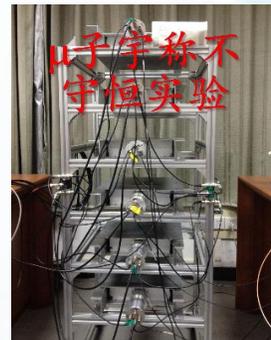
2023校园宇宙线观测暑期学校

西南交通大学：结业合影



2025年校园宇宙线观测暑期学校

- 时间：2025年8月21-22日（20日报到，23日离会）
- 地点：中国科学院大学、清华大学、中国科学院高能物理研究所
- 8月21日，国科大：联盟团队代表作为授课老师，讲授宇宙线社团活动一堂课，包含遇到的问题、解决办法或意见和建议等。最后进行交流和总结。
- 8月22日，清华大学：近代物理实验演示课（DIY云室实验、 μ 子寿命和衰变能谱测量、 μ 子宇称不守恒实验、宇宙线与天体类数值仿真实验.....）。
- 高能所：参观北京正负电子对撞机和粒子天体物理国家重点实验室。



开发了《重走宇宙线发现之旅》课程 并出版了图书

- 空气电离之谜
- 每秒有多少宇宙线穿过我们的身体
- 来自宇宙的光速炮弹
- 大气保护了地球生命
- 宇宙线从哪来的
- 宇宙线是否带电
- 宇宙线电荷正负问题

同时配合实验有一系列实际数据
操作课程



颁发结业证书和授课证书

证书编号: 20240914

— Certificate of Completion —

结业证书

左志宏 学员

2024年9月21日至22日, 参加校园宇宙线观测联盟举办的
“2024年校园宇宙线观测暑期学校”培训。
经考核合格, 特颁此证。



校园宇宙线观测联盟
Campus Cosmic-ray
Observation Collaboration

校园宇宙线观测联盟
《现代物理知识》编辑部 (代章)
编辑部
2024年9月22日



授课证书

何会海 老师:

参加校园宇宙线观测联盟举办的“2024年
校园宇宙线观测暑期学校”并授课。

特颁此证!

物理知识
校园宇宙线观测联盟
《现代物理知识》编辑部 (代章)
编辑部
2024年9月22日



校园宇宙线观测联盟
Campus Cosmic-ray
Observation Collaboration

Discover Cosmic Rays

INTERNATIONAL COSMIC DAY

November 4 | 2020

Cosmic particles, these unnoticed particles that surround us all the time, are the focus of this day. Students, teachers and scientists get together to talk and learn about Cosmic Rays and answer questions like:

What are cosmic particles?
Where do they come from?
How can they be measured?
And what can we learn from them?

If you want to know more about the secrets they bring with and to be part of this day, get here more information:

Image Credit: DESY, Science Communication Lab

<http://icd.desy.de>
<https://www.facebook.com/InternationalCosmicDay>



WOCHE DER
TEILCHENWELT
NETZWERK
TEILCHENWELT
04.11. - 06.11.2020



Fermilab



4、参加国际宇宙日等交流活动

International Cosmic Day (ICD)

- 2012年由FNAL和DESY等国际高能物理机构发起。
- 国际宇宙日关注我们身边每时刻都存在的宇宙射线。让我们用一天时间来探索它们，并发现它们带给我们的秘密。
- 希望全世界对于宇宙粒子感兴趣的年轻人都有机会参加这一天活动。
- 在这一天里，学生、教师和科学家在一起讨论和学习宇宙线：

➤ 宇宙粒子是什么？

➤ 它们来自何处？

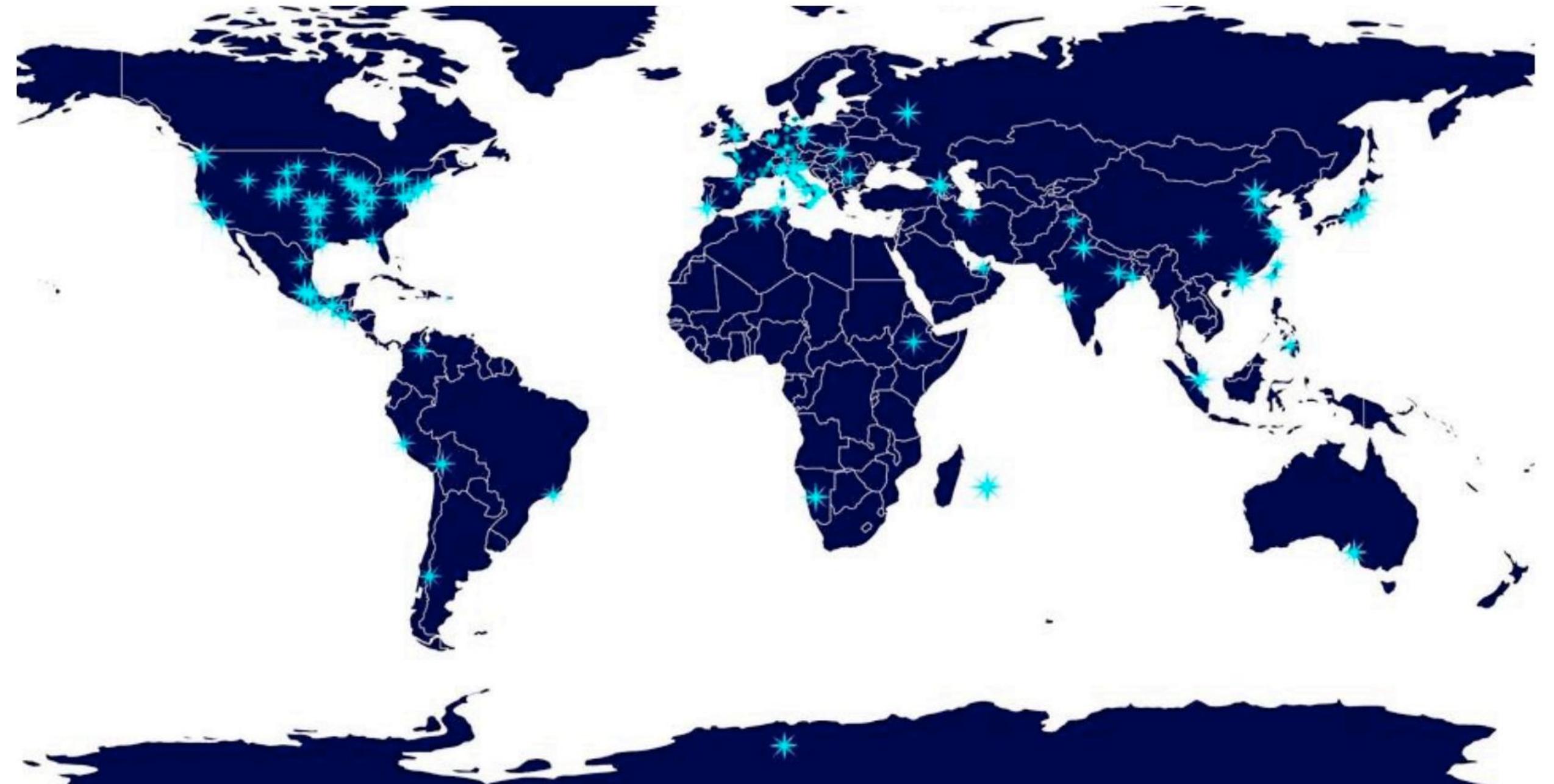
➤ 如何测量它们？

➤ 我们从能它们学到什么？

- 通过LiveStream共享著名科学家的讲座。



参加2021年第十届中国国际宇宙线日的单位



Discover Cosmic Rays

INTERNATIONAL COSMIC DAY

November 10 | 2021

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Image Credit: DESY, Soanoo Collaboration Lab

INTERNATIONAL COSMIC DAY NOVEMBER 10 | 2021

Measurement of intensity for extensive air shower depending on zenith angle near sea level

江苏省姜堰中学

Jiangyan High School of Jiangsu Province, China

Our Team

Data Analysis

Experimental conclusion

We found that the EAS intensity of cosmic rays decreases with the increase of zenith angle. After the zenith angle degree increases to a certain value, the EAS intensity decreases significantly and becomes gentle with zenith angle.

We also found that there is no significant difference in the change of cosmic ray EAS intensity with zenith angle during the day and night. This shows that solar activity has little effect on the EAS intensity of cosmic rays observed on the ground.

↑ The EAS intensity of cosmic rays decreases with the increase of zenith angle

↑ The comparison of cosmic ray EAS at different zenith angles of day and night

INTERNATIONAL COSMIC DAY

第十届中国国际宇宙日

(2021年11月10日)

REPORTS

On the following pages, we have contributions for this booklet. These contributions document your insights obtained on ICD with images, comments, notes or preliminary results and data analysis – as scientists do when they submit a proceeding after a conference. We have sorted the contributions by countries in alphabetical order. Let's start with...

CHINA

Who are you? What do we do? What did we find out? What's your take-home message?

More activities in ICD! More fun!

INTERNATIONAL COSMIC DAY NOVEMBER 10 | 2021

Xinghua High School of Jiangsu Province Successfully Participated in the 10th International Space Day Exchange Activity

江苏省兴华中学

Xinghua High School of Jiangsu Province, China

Who are you? At 13:30 GMT on November 10, 2021, nine students from Xinghua High School of Jiangsu Province successfully participated in the 10th International Space Day international exchange activity!

The Video Call

International Cosmic Day

The students of Xinghua High had an interactive discussion in English with five other cosmological ray research teams from different countries and showed foreign researchers their experimental data and research conclusions drawn through their cosmic ray detector device made by the open programming.

By means of such global joint activity, students, teachers, scientists, the general public, or anyone interested, will have a broad understanding of such questions: What are cosmic rays? Where do cosmic rays come from? And how to measure cosmic rays?

In 2019, Xinghua High School of Jiangsu Province and the Chinese Academy of Sciences established the relationship of cooperation between the scientific and technological innovation and give more students the opportunity to join the talent plan under the guidance of colleges and universities. Xinghua High has promoted their school-running philosophy Institutional Cooperation, Joint Development for the Cultivation of Innovative Talents for the Talzhou Excellent Education Project, aimed at further promoting the improvement of students' scientific and technological attainments while continuously pushing forward quality-oriented education. As a consequence, the core members of the program will be engaged as mentors for the building of the Local Integrated Practice and Research-based Learning Curriculum.

To carry out cosmic ray research in middle schools is an effective way to combine science popularization with scientific research. When scientists and schools work together, with

INTERNATIONAL COSMIC DAY NOVEMBER 10 | 2021

EAS Changed With Zenith Angle

湖南师范大学附属中学

The High School Attached To Hunan Normal University

I. Background

Cosmic rays usually consist of high-energy particles from space. On the way high-energy cosmic rays shoot from space to earth, they need to pass through the atmosphere and it is the time that they interact with atomic nuclei in the atmosphere, knocking out various secondary particles. These secondary particles will interact with atomic nuclei in the atmosphere again during the flight, producing more secondary particles, which are sprinkled from the air to the earth like a rainstorm, and conducting cascade reactions continue to occur in this way. This process is also known as "air shower". More specific, these secondary particles produced by cosmic rays repeatedly act to produce more secondary particles until the average energy is equal to a certain critical value, and the number of secondary particles reaches the maximum value, which is called shower maximum. After that, the particles gradually decay or are affected by the atmosphere. Absorption, so that the number of secondary particles gradually decreases.

High-energy cosmic rays can form "showers" with large area, which produce a large number of secondary charged particles reaching the ground almost simultaneously. By measuring these charged particles arriving at the same time, the "shower" cases can be obtained. Scientists usually study on cosmic rays by indirectly detecting these "showers" reaching the surface of the earth. In general, the higher the energy of cosmic rays, the larger the shower area that reaches the surface. In practical experimental setup, detector array are often used for detection.

In this article, we analyzed the data detected by the detector array of Donghimen Middle School in Beijing, China (39.933°N latitude, 116.417°E longitude, 46.4 meters above sea level). The detector array is composed of 9 scintillation detectors, separated by 10 meters, set in a 3x3 matrix pattern, and the sensitive area of each detector is 0.5 square meters.

INTERNATIONAL COSMIC DAY NOVEMBER 10 | 2021

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INTERNATIONAL COSMIC DAY NOVEMBER 10 | 2021

AN INVESTIGATION ON THE RELATIONSHIP OF COSMIC MUON FLUX AND ZENITH ANGLE

中国人民大学附属中学

High School Affiliated to Renmin University of China

Who are you? A team of student-body Cosmic Ray enthusiasts dedicated to explore and publicize particle physics

What have we done? An investigation on the relationship between Muon Flux with Zenith Angle

What did we find out? A great qualitative Fe between experimental data and referenced approximation

What's your take-home message? A maximum Muon Flux at 0 degree zenith angle. Continuous symmetrical decline of Muon Flux with increasing/decreasing zenith angle. A qualitative verification is made to the reference empirical approximation. The results of our experiment can be utilized in interpreting the internal structure of concealed objects, (e.g. nuclear plants) and cosmic ray detection in outer space.

INTERNATIONAL COSMIC DAY NOVEMBER 10 | 2021

ANALYSIS OF THE DETECTOR COUNTING RATE

西南交通大学

Southwest Jiaotong University, China

Team Introduction

We are the Institute of Astroparticle Physics which consists of 12 teachers, 5 doctoral candidates, some master degree candidates and undergraduates.

What have we done? Southwest Jiaotong University has five ed detector arrays, which are placed on the roof of the teaching building. The five detectors upstairs transmit the information to the clock synchronization system downstairs through the photoelectric composite cable, and then store it in the computer, so that we can process the data offline.

What did we find out? This is the chart drawn by our team. It is the counting rate of the three detectors collected on September 8. From these three diagrams, we can see that the change of the counting rate has the same trend, and the sudden change of those curves may be affected by the outside.

The take-home message

We analyzed the data of five detectors, focusing on the study of counting rate, and analyzed the relationship between atmospheric environment and sudden change of counting rate curve.

INTERNATIONAL COSMIC DAY NOVEMBER 10 | 2021

Measurement of intensity for extensive air shower depending on zenith angle near sea level

北京市东直门中学

Beijing Donzhimen High School

1. Equipment

When a very high energy primary cosmic ray arriving atmosphere, it collides with air nuclei, and by interaction produces a several secondary particles. All secondary particles with very high energy collide with air nuclei again, through strong or electromagnetic interaction produce more secondary particles. Such cascade interaction forms a great number of particles flight down as a shower. Such phenomenon is called as Extensive Air Shower (EAS).

On the roof of our school, we built a detectors array to measure EAS, as shown in Figure 1. It consists of 9 scintillation detectors, spaced 10 meters apart in a 3x3 matrix and each detector has a sensitive area of 0.5 square meters. It is located at latitude 39.933°N, longitude 116.417°E, altitude 46.4 meters above sea level. The electronics digitalize each signal from detectors, a computer continuously acquires data and controls all the equipment online. Whenever a charged particles of cosmic ray passes through our each detector, the GPS time with nanosecond accuracy, amplitude of signal, and triggered detector's location are recorded.

2. Data analysis

Some procedures to reconstruct the measured tracks of EAS have done, they reconstruct only the EAS event in 400 square meters covered by our array with coincident fold x3. We analyzed the direction of each EAS event during 4-3 days since Beijing time 0 o'clock on 18th October 2021, and obtained the events number Ni in each range of the i-th zenith angle uniform ranges from 0° to 90°. Its standard error $\sigma_i = \sqrt{N_i}$. For the zenith angle range A to B, it covers a stereoscopic angle $\Omega = 2\pi(\cos A - \cos B)$, and the effective area of the array is $400m^2 \times \cos\theta(B)$ (θ is the median of zenith angle range i). By this way, we get the average EAS intensity $I = N_i / (3 \times \Omega \times \cos\theta(B))$ in each zenith angle range within the unit steradian range and 1 day. Its standard error $\sigma_I = I \pm (3 \times \Omega \times \cos\theta(B))$.

INTERNATIONAL COSMIC DAY NOVEMBER 10 | 2021

Measurement of intensity for extensive air shower depending on zenith angle near sea level

北京市东直门中学

Beijing Donzhimen High School

3. Result

The experimental data are listed in table 1 below, and the corresponding curves are shown in Figure 2.

sequence number i	1	2	3	4	5	6	7	8	9
Range of zenith angle	0-10°	10-20°	20-30°	30-40°	40-50°	50-60°	60-70°	70-80°	80-90°
Mean of zenith angle	5°	15°	25°	35°	45°	55°	65°	75°	85°
Measured counts in 1 day-Ni	3294	2067	1042	590	353	204	120	70	42
Standard deviation of Ni	57	45	32	24	19	14	11	9	6
Covered stereoscopic angle Ω (sr)	0.9556	0.6529	0.4262	0.2748	0.1817	0.1093	0.0686	0.0406	0.0241
Effective area S (m ²)	119	139	159	179	199	219	239	259	279
Intensity I (m ⁻² sr ⁻¹ day ⁻¹)	27.5	14.8	6.6	3.2	1.7	0.9	0.5	0.3	0.1
Standard deviation of I	0.47	0.34	0.22	0.16	0.12	0.08	0.06	0.04	0.03

4. Discussion

When the primary cosmic ray flights down through atmosphere, the number of EAS particles increases first, then it decreases gradually after reaching a maximum value since the energy of all particles reduces and decaying or stopped probability increase. The higher the initial energy, the more EAS particles survive and reach ground. Only when the detectable particle density reaches threshold value of the ground detector array, such EAS can be detected. Therefore the energy threshold of detectable EAS of a ground array increases with the increase of atmospheric depth.

When zenith angle increases, the depth of the atmosphere increases. Therefore, for a ground array the detectable EAS energy threshold E increases with the increase of the zenith angle. Because the integral intensity of isotropy primary cosmic ray is approximately proportional to E⁻², the EAS intensity is the descending function of zenith angle.

第十一届国际宇宙日

(2022年11月10日)



国内共有7家单位参加，属于联盟的6家，\包括高能所、北京东直门中学、江苏省姜堰中学、江苏省兴化中学、汇文中学垂杨柳分校、西南交通大学、常州工学院（非联盟成员）。

第十二届国际宇宙日

(2022年11月21日)

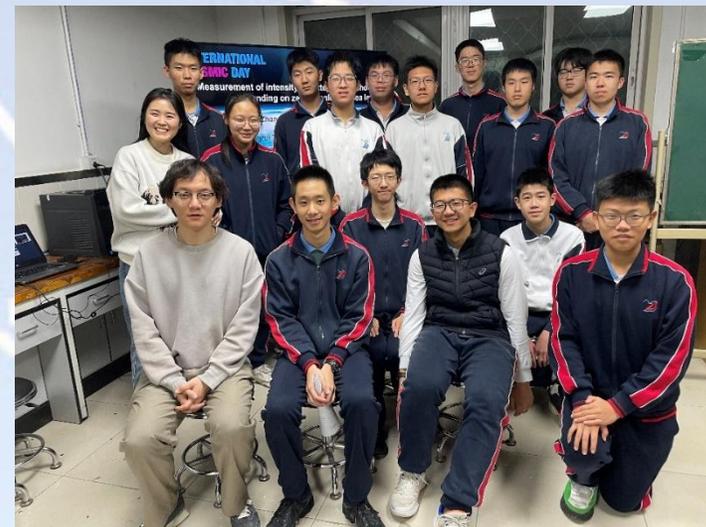
- 11月21日，第十二届国际宇宙日活动举办，共有19个国家和地区的88个小组参加了活动，其中12个国家和地区的44个小组做了交流报告。
- 中国科学院高能物理研究所、**江苏省姜堰中学**、**江苏省兴化中学**、北京汇文中学朝阳垂杨柳分校、江西省芦溪中学、北京市东直门中学、河北省石家庄第一中学、湖南省师范大学附属中学、常州工学院、大湾区大学等**10个单位**的宇宙线观测团队参加了活动。
- 5个团队做了交流报告，引起了关注和讨论。



第十三届国际宇宙日

(2024年11月26日)

- 9个大中院校和科研机构的宇宙线观测团队参加活动:
- 联盟成员8个: (中国科学院高能物理研究所)、北京市东直门中学、江苏省姜堰中学、江苏省兴化中学、北京汇文中学朝阳垂杨柳分校、江西省芦溪中学、河北省石家庄第一中学、重庆育才学校
- 非联盟成员1个: 大湾区大学



国际繆子周

(2023年2月13-24日)





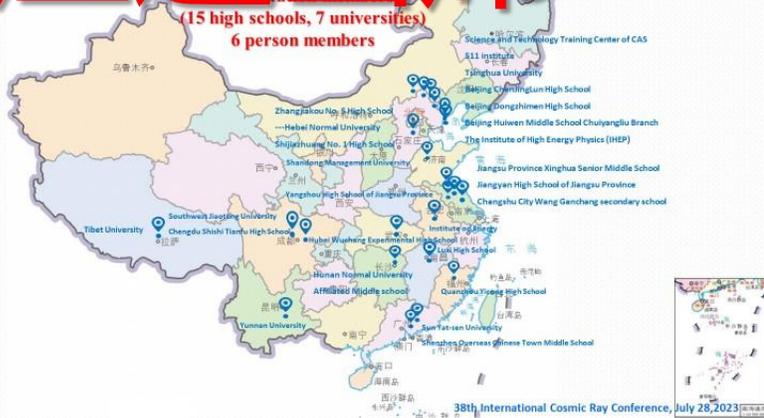
CCOC and Its Activities in China 校园宇宙线观测联盟

Wenli Zheng on behalf of CCOC
Institute of High Energy Physics
Chinese Academy of Sciences

IGRC 2022, Nagoya, Japan
July 8, 2023

应邀出席2023年国际宇宙线大会并报告

Members



Activities

4. Organize training courses and workshops

CCOC training for ICD



Activities

6. Coordinate International Cosmic Day in China

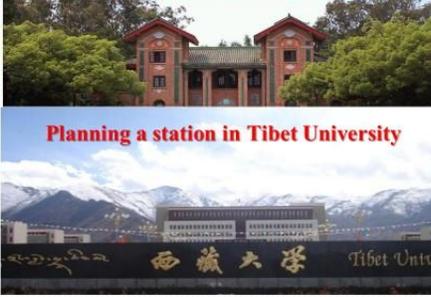
On the ICD of 2021, China has seven units participating independently, six of which belong to the CCOC, reaching the largest scale over the years.



1. Set up cosmic-ray observation stations in campuses



2. Push forward R&D of instruments



About CCOC Campus Cosmic-ray Observation Collaboration

- Established on September 28, 2020
- Connected to the Institute of High Energy Physics (IHEP), Chinese Academy of Sciences (CAS)

Purpose

- to set up campus observation stations and network
- to popularize cosmic-ray knowledge
- to encourage cosmic-ray study
- to strengthen collaboration on cosmic-ray observation
- to facilitate student and teacher training
- To strengthen relevant international exchanges

Activities

Organization

Advisor C.Q.Shen	Advisor W.Q.Zhang	Director C.Zhang	Vice Director D.Chen	Vice Director S.W.Cui	Vice Director S.Wang
TD H.H.He		Secretary General W.L.Zheng		Member of the Council G.Chen	
J.Liu	Z.C.Tang	J.L.Xu	Y.D.Cheng	H.M.Zhao	F.R.Zhu

Working Groups

- Technical development WG
 - by H.H.He
- Educational instrument WG
 - by C.Gu
- Campus promotion WG
 - by S.Wang
- Cosmic-ray popularization WG
 - by S.W.Cui
- Secretary Service WG
 - by W.L.Zheng

Activities



INTERNATIONAL COSMIC DAY 10

REPORTS

CHINA

CCOC, we are from China!

校园宇宙线联盟

An Investigation on the Relationship of Cosmic Muon Flux and Zenith Angle

中国人民大学附属中学

Measurement of intensity for extensive air shower depending on zenith angle near sea level

北京市东直门中学

ANALYSIS OF THE DETECTOR COUNTING RATE

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江苏省姜堰中学

EAS Changed With Zenith Angle

湖南师范大学附属中学

Measurement of intensity for extensive air shower depending on zenith angle near sea level

宇宙线EAS强度随方位角的变化

Measurement of intensity for extensive air shower depending on zenith angle near sea level

西南交通大学

Measurement of intensity for extensive air shower depending on zenith angle near sea level

西南交通大学

CCOC Seminar

Astroparticle Outreach at DESY

Date and Time: 2022.3.15 16:00 (China Time)
Location: Room 626, Main Building IHEP
Zoom Meeting ID: 87472728322
Password: 427343

Topic

In the talk, she will give an overview of the outreach activities of DESY in Southern, which techniques/experiments we use for this activity and in which networks we are involved. For example, she will talk about our efforts in the student lab at DESY, as well as about the organization of the worldwide International Cosmic Day in the last 10 years.

About the Speaker: Carolin Schwandt
She works at DESY in Zeuthen, Germany, as a research assistant in the communication group. She designs, develops and supervises the offers for the project "measurements of cosmic particles" in the school laboratory "physik.bogrefen" and she is responsible for the main site coordination of the astroparticle project in the nationwide "Netzwerk Teilschwermetalle".

More information: <http://ccoc.ihep.ac.cn/>

Pierre Auger Observatory 2024 国际大师课活动

2024年3月10日，校园宇宙线观测联盟受邀组织参加2024年国际大师课（**International Master Classes 2024, IMC2024**）活动。来自北京汇文中学朝阳垂杨柳分校、北京市东直门中学、北京市第二中学、北京市第十八中学、北京市第一七一中学、北京市师范大学第二附属中学、石家庄市第一中学、北京大学的**70余名教师和学生**参加该活动。同学们听取了科普报告，并参观了**国科大校园、高能所博展馆和粒子天体物理实验室**，大科学装置和卫星实时监控场景激发了同学们对科学研究的浓厚兴趣。

2024年3月12日下午，汇文中学选拔了**5名同学**来到中国科学院大学进行了**Pierre Auger Observatory 实验数据分析**。他们在高能所专家的指导下，利用天文台的交互式显示可视化实例，重建了原初宇宙线到达的方向，通过拟合数据，确定了原初宇宙线的能量、选择了向源事例，并解释了天图中不同的坐标系。他们还与Pierre Auger Observatory进行了视频会议，吕亚璠同学作为中方学生代表与国外科学家进行了交流，分享了我们的研究成果和心得。



Pierre Auger Observatory 2025 国际大师课活动

河北师范大学物理学院组织参加2025年国际大师课，石家庄第一中学学生体验“做一日科学家”科普活动：



三、学习和思考

这次全国天文公众科学大会，在精彩的报告中吸取营养，在会间讨论中交流学习，加深了对天文科学前沿的了解，收获了天文科普工作的经验，也对校园宇宙线观测科学教育进行思考。

- 如何将校园宇宙线观测做得像天文爱好者活动那样激起学生的兴趣？
- 如何将宇宙线观测仪器制作与数据采集和研究分析相结合？
- 如何在高考“指挥棒”下，开展好校园宇宙线观测活动？
- 如何完善评价体系，使宇宙线观测志愿者的工作得到各方面的支持？
- 如何解决校园宇宙线观测和相关活动的经费问题？

如何推动校园宇宙线观测与学校教学和公众科学深度融合，促进创新型人才的培养？

工作计划考虑

- 在前5年工作的基础上，按照联盟章程继续开展各项工作；
- 与科技馆（北京、上海、合肥和澳门等）合作开展校园宇宙线观测活动；
- 依托高海拔宇宙线观测站LHAASO组织国际大师课。
- 使用LHAASO和慧眼卫星等的科学数据进行处理分析和研究。
- 在校园开展宇宙线科学研究（近期：不同纬度、海拔、季节等；远期：超高能宇宙线观测研究）。
- 宇宙线描迹仪及显形仪的研制和宇宙线观测APP的开发。
-

路漫漫其修远兮



校园宇宙线观测联盟

将上下而求索

A complex particle physics diagram is overlaid on a background of a mountain range. The diagram features various particles and interactions: a central vertex with a photon (γ) and a neutrino (ν); a proton (p) and neutron (n) interaction; a deuteron (d) and triton (t) interaction; and several other particles like π^+ , π^0 , π^- , N , e^+ , e^- , μ^+ , and μ^- . The diagram is rendered in white and light blue lines on a light blue background.

敬请教正