



# CCOC and Its Activities in China

## 校园宇宙线观测联盟

Institute of High Energy Physics  
Chinese Academy of Sciences

IPPOG Global Cosmic Group Meeting  
May 11, 2022

# History of cosmic ray research in China

- 2016: began construction
- **Goal:** discover high energy  $\gamma$ -ray sources; precisely measure the radiation spectrum of the  $\gamma$ -ray sources & energy spectra of cosmic ray species over a wide range
- **2021: LHAASO Discovers a Dozen PeVatrons and Photons Exceeding 1 PeV and Launches Ultra-High-Energy Gamma Astronomy Era**



**LHAASO – Sichuan 4410m**

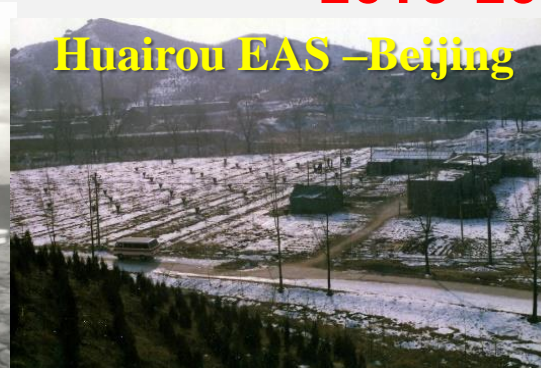
**2016-2021**



**LXS – Yunnan 3200m**



**GBL-Tibet 5500m**



**Huairou EAS –Beijing**



**YangBaJing – Tibet 4300m**

**China-Japan As- $\gamma$**

**China-Italy ARGO**

**1954**

**1977**

**1988**

**1990**

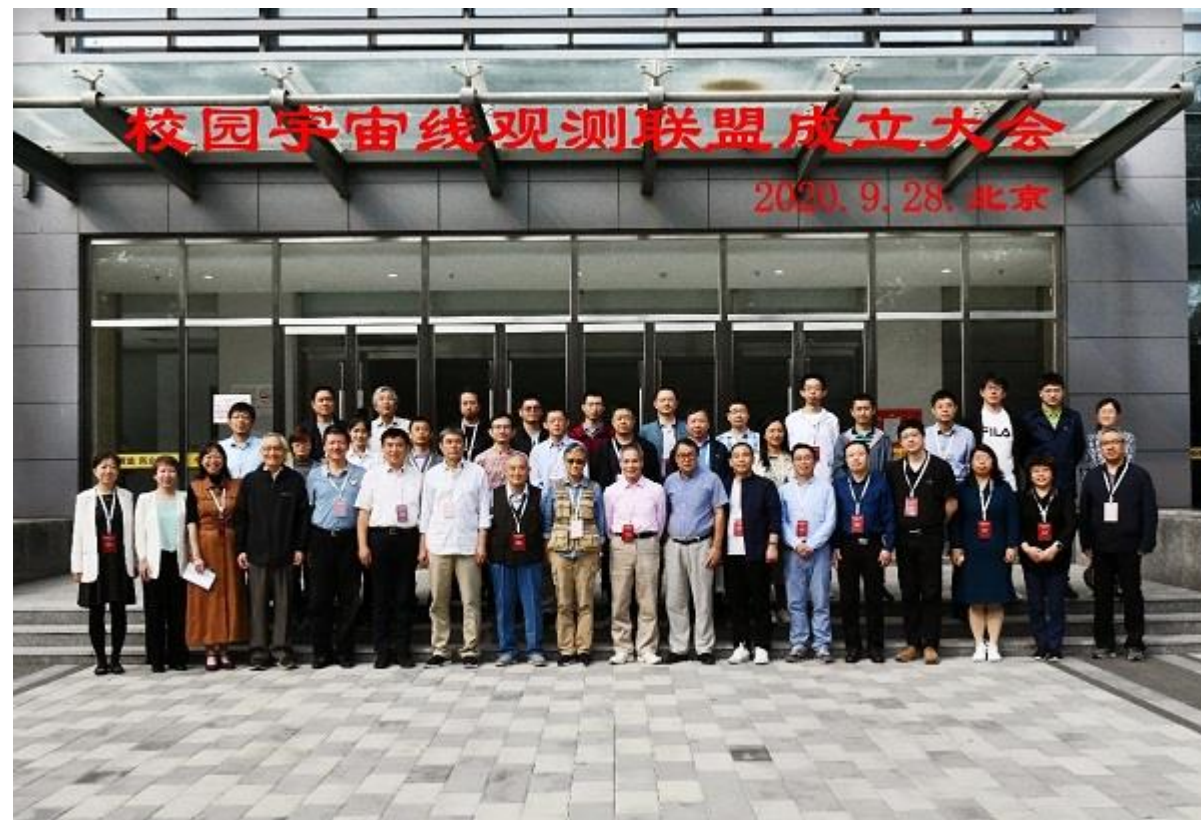
**1998**



# 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 promote the campus cosmic-ray observation in China
  - ✓ Seeks cooperative ways





# About CCOC

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### 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





# Development

With the help of the IHEP, Beijing Dongzhimen High School has built the first cosmic-ray observation station on the campus of Chinese middle schools. School began to participate in the activities of the International Cosmic Day.

The seminar on cosmic ray research in middle schools was held in Beijing. Scientists from the IHEP spontaneously set up a campus cosmic-ray working group.

Cosmic-ray observation station in South-West Jiaotong University opened to obtain cosmic ray data.

Cosmic-ray observation station in Shijiazhuang No.1 High School started to run.

The founding meeting of CCOC was held at the Institute of High Energy. It was initiated by the IHEP, CAS.

**Apr., 2016**

**Jan., 2019**

**Jul., 2019**

**Sep., 2019**

**Sep., 2020**



# Organization

Technical development WG

H.H.He



Advisor

C.Q.Shen



Member of the Council

G.Chen



Director General

C. Zhang



Y.D.Cheng



## 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

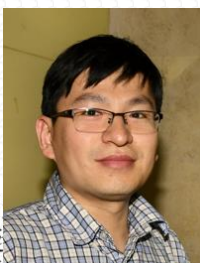
J.Liu



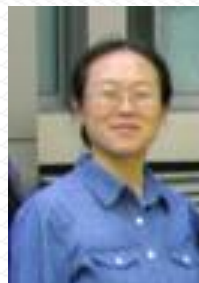
Z.C.Tang



J.L.Xu

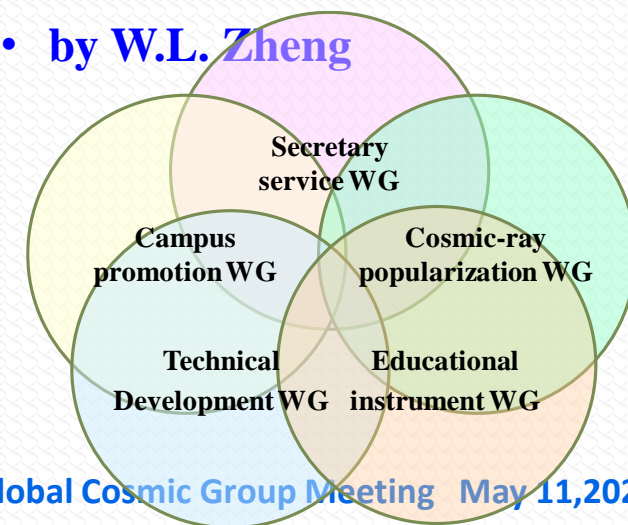


H.M.Zhao



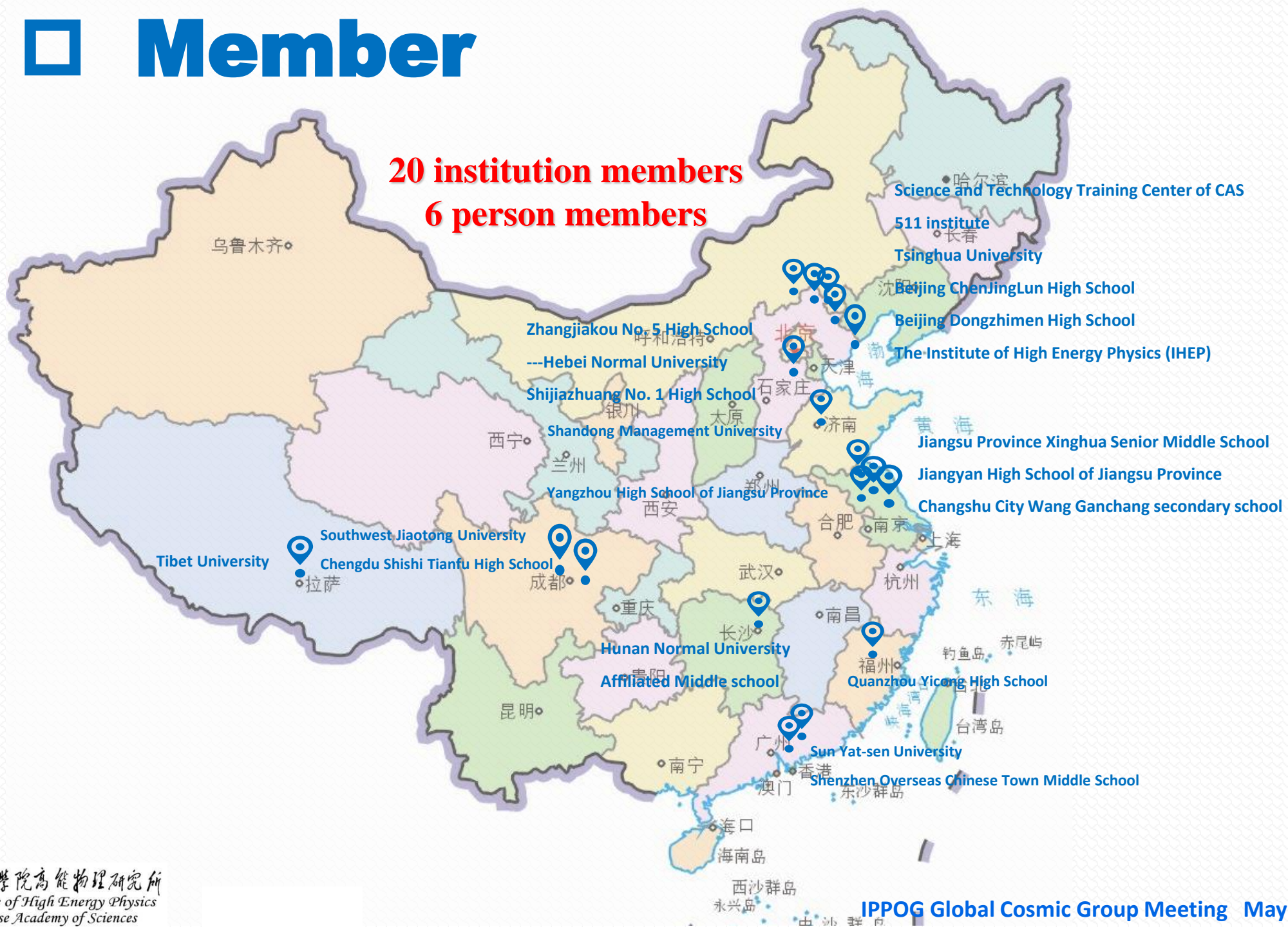
Secretary General

W.L.Zheng



# Member

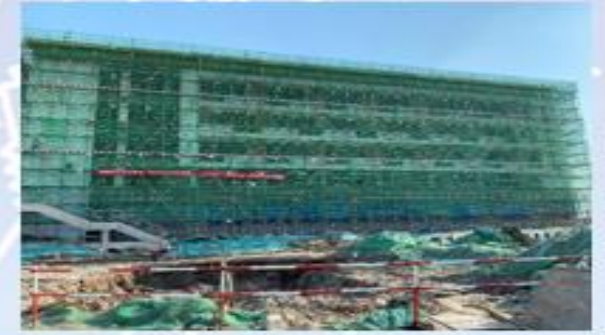
**20 institution members**  
**6 person members**



# Activity

## 1. Set up cosmic-ray observation stations in campuses

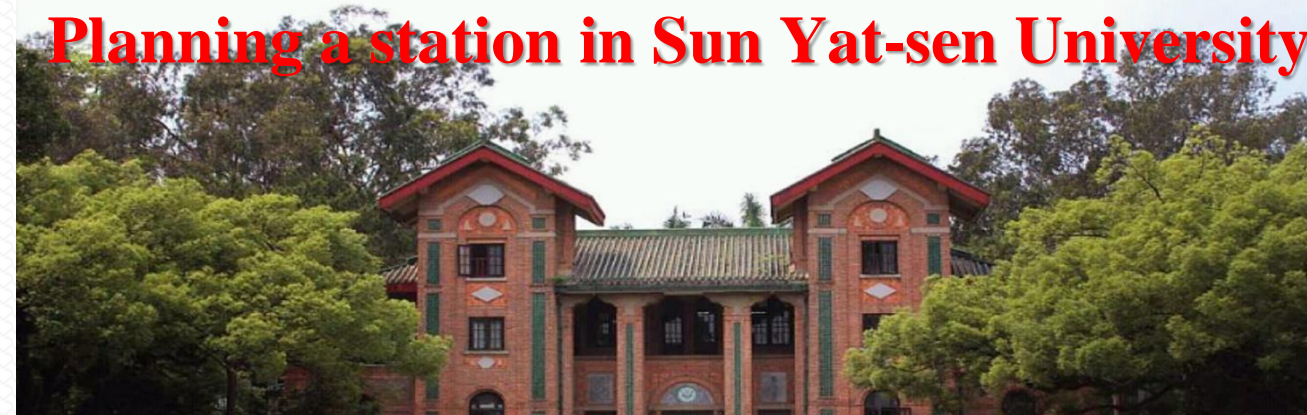
### Planning a station in Xinghua High School



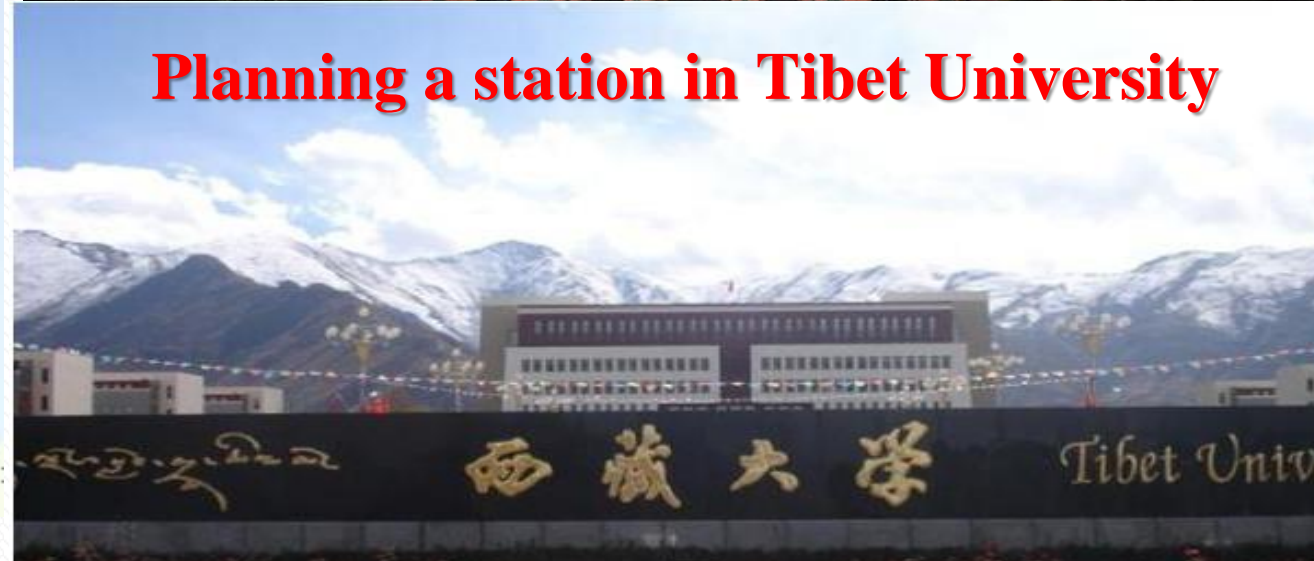
### The Jiangyan High School station will be installed



### Planning a station in Sun Yat-sen University



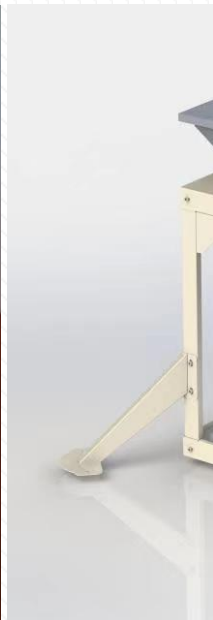
### Planning a station in Tibet University





# Activity

## 2. Push forward R&D of instruments



物理学前沿的重大科学问题之一。  
高能 $\gamma$ 射线天文观测是科学家探索宇宙演化的重要手段。  
人体无时无刻都受到宇宙射线的照射，每秒钟就有几个宇宙线带电粒子穿过我们的身体，成为我们日常接受放射性剂量的重要部分。这个仪器能让你看见神秘的宇宙射线就在我们身边！



# Activity

## 校园宇宙线数据中心

首页 图集 校园站点

校园宇宙线联盟

### 3. Facilitate the cosmic-ray observation and study

- Create the cosmic-ray observation database
- The data from existing campus stations are stored
- The data can be shared by all the members of CCOC
- Incorporated with CCOC website ([ccoc.ihep.ac.cn](http://ccoc.ihep.ac.cn))

### 欢迎!

这里是校园宇宙线联盟数据中心。

依托校园宇宙线联盟，作为一个高能物理及宇宙线科研与科普结合的项目，我们通过布置在中学校园和高等院校里的小型探测阵列进行宇宙线观测，推动科学前沿与教育教学的有机结合。同时通过共享这些探测站点的数据，不具备建设条件的学校也可以参与到其中。

本网站将提供科学数据展示，原始数据共享，培训文档等功能。具体请查看相应的页面。

数据中心分享平台提供现有站点的历史数据查询和下载功能，网站上也提供数据处理的教程。可供感兴趣的学校使用，进行数据处理，进行自己的学生科普实践和宇宙线研究。数据平台上的提供的数据包括文本格式和ROOT格式，包括全部的初级数据和相应的在线刻度数据，以及经过选择和重建的大气簇射事例。数据平台上还提供了部份事例的示意图以及统计信息图表。



### 簇射事例

数据记录了簇射事例，包括每个事例的时间，单元数，各单元的输出幅度、每个单元的击中时间，以及简单计算的大气簇射来源方向的方位角与天顶角。 示例如下：

# 数据日期：2016年01月01日

#	天	秒	计数	粒子数										相对时间(纳秒)				方位角,天顶角(度)						
0	1	3	0	0	0	0	0	0.5	0.3	0.6	0	0	0	0	0	16	17	1	0	0	85.9	24.9		
0	2	3	0	0	0.4	1.1	0	0	0	0	1.4	0	0	0	0	0	16	10	0	0	1	0	97.1	14.0
0	4	5	0	0.7	0.6	0.5	0	0.5	0.3	0	0	0	0	53	14	12	0	1	4	0	0	0	117.0	60.8
0	8	3	0	0	0	0.6	0.5	0	0.8	0	0	0	0	0	0	14	1	0	12	0	0	0	171.3	23.2
0	11	5	1.0	0	1.7	0.7	0	0	0	1.0	0.9	40	0	73	1	0	0	0	13	30	47.1	69.0		
0	19	5	0	1.2	0	1.5	1.8	1.6	0	1.4	0	0	0	1	0	17	12	22	0	25	271.0	19.3		
0	20	3	0	0	1.0	0	1.2	0	0.5	0	0	0	0	0	0	16	0	1	0	22	0	240.9	27.6	
0	26	4	0.8	1.0	0.4	0	0	0.5	0	0	0	52	16	1	0	0	0	58	0	0	190.5	51.0		
0	26	3	0	1.1	0	0.5	1.5	0	0	0	0	0	1	0	21	9	0	0	0	0	213.7	25.6		
0	33	4	1.5	0	0.8	0.5	0	0	1.1	0	46	0	0	1	21	0	0	15	0	51.9	76.3			
0	34	5	0	0.6	0.6	0	0.6	0.4	0	0.6	0	0	24	37	0	35	13	0	1	0	98.1	25.1		
0	34	3	0.5	0	0	0	0	0	0.6	0.8	1	0	0	0	0	0	0	10	9	0	257.5	7.9		
0	37	7	1.0	0.4	0	2.2	1.9	0	0.7	1.2	5.7	47	48	0	26	28	0	1	14	27	63.8	39.4		
0	42	3	0.8	0	0	0	0	0.7	0	0.7	0	63	0	0	0	0	1	0	10	0	148.2	56.6		
0	45	3	0.8	0.5	0	0	0	0	0.3	0	0	1	27	0	0	0	0	3	0	0	357.8	51.3		
0	46	4	0.8	0	0.5	0	0.4	0	0	0.6	0	20	0	31	0	19	0	0	1	0	64.9	22.8		
0	47	3	0.6	0	0.7	0	0	0	0	0.6	0	12	0	3	0	0	0	0	0	1	167.5	7.9		
0	47	3	0.8	0	0.3	0	1.4	0	0	0	0	1	0	39	0	18	0	0	0	0	6.0	34.9		



# Activity

## 4. Organize training courses and workshops

### CCOC training for ICD



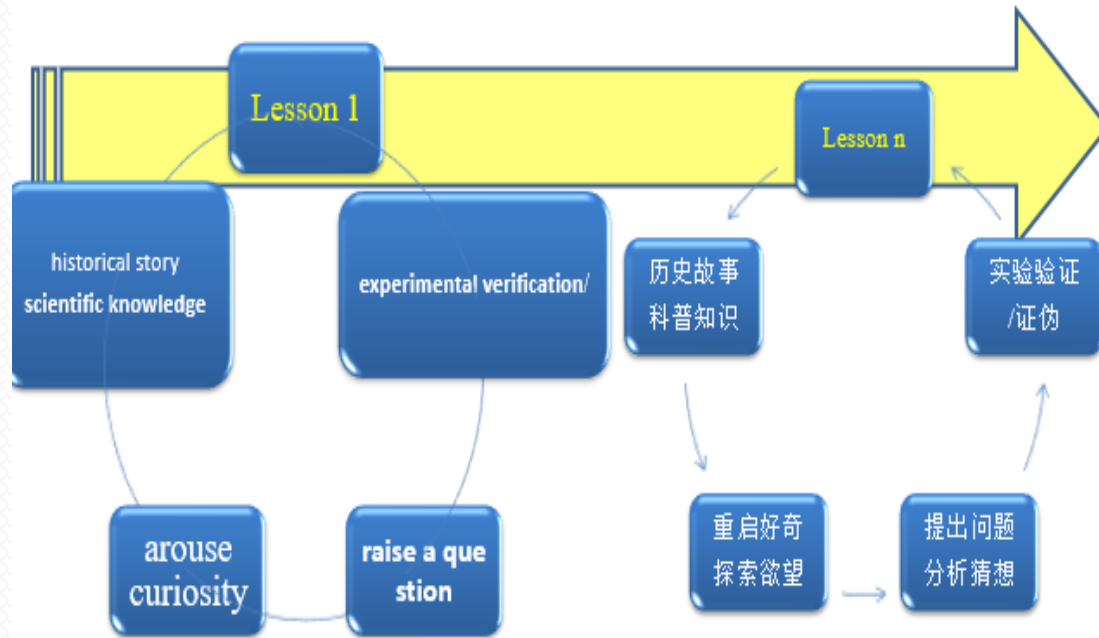
2021 CCOC Summer School



# Activity

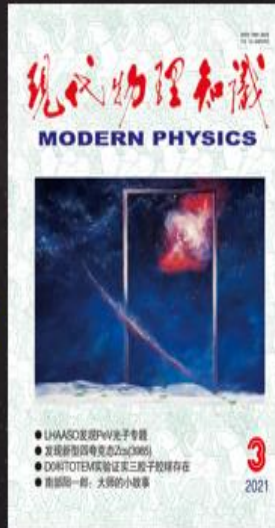
## 5. Carry on cosmic-ray education

### A New Journey toward the Discovery of Cosmic Rays



### A New Journey toward the Discovery of Cosmic Rays Course Theme:

- How are "cosmic rays" found? Why is it called "cosmic ray"?
- What is the intensity of these "cosmic rays" (secondary cosmic rays) on earth? How many cosmic ray particles pass through our bodies every minute?
- How fast does the "cosmic ray" fly on earth?
- Do cosmic ray particles from outer space literally hit our bodies? Will the earth atmosphere protect us?
- Now that we have the means to measure the cosmic rays, let's where do these cosmic rays come from.
- Cosmic rays do not come from the solar system and they are the only material sample that humans can get from outside the solar system. As a particle has the property of electric charge, is cosmic ray charged or uncharged?
- Now that we know that most cosmic rays are charged particles, is it positively or negatively charged?



# Activity

## 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.



IHEP, CAS, Beijing



Dongzhimen Middle School, Beijing



Jiangyan Middle School, Jiangsu



School Att. Hunan Normal University



Southwest Jiaotong University



Video for 10<sup>th</sup> anniversary of ICD



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

CCOC Seminar

Astroparticle  
Outreach at DESY



Date and Time: 2022.3.15 16:00 (China Time)  
Location: Room 415, Main Building IHEP  
Zoom Meeting ID: 87477278322  
Password: 427343

Topic

In the talk she will give an overview of the outreach activities of DESY in Zeuthen, which techniques/experiments we use for this activity and in which networks we are involved. For example, she will talk about our offers 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 Schwerdt

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.begreifen" and she is responsible for the scientific coordination of the astroparticle project in the nationwide "Netzwerk Teilchenwelt".

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

# □ Measurement

## Cosmic ray detector array

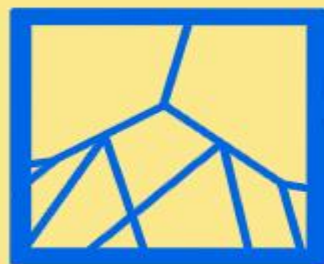
- Measurement of Extensive air shower (EAS), which is generated by primary cosmic ray
- Measure the direction of EAS with accuracy better than  $2^\circ$  degree
- Measure the arriving time of EAS with accuracy better than 2 nanosecond
- Measure the energy of EAS with core inside the array
- Measure the cosmic ray muon counting rate (flux)

## Muon telescope

- Measure the cosmic ray muon flux in any specific direction ( all differate zenith angle and differate azimuth angle)
- Measure the speed of cosmic ray muon
- Measure the life of muon
- Measure the east-west different effect of cosmic ray flux indused by earth magnetic field

## Acknowledgment:

Prof. C. Zhang  
Prof. C. Q. Shen  
Prof. H. H. He  
J. Liu  
Prof. L. M. Song  
Z. C. Tang  
X. L. Bian  
Y. O. Jiang



Campus Cosmic-ray  
Observation Collaboration

*Thanks for your attention*  
**谢谢!**

