Cosmic rays and the structure of the universe studied in Cosmic Ray Extremely Distributed Observatory with citizen science

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CREDO - What is it?

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Cosmic Ray Extremely Distributed Observatory

The idea created in 2016 by Piotr Homola (INP PAS, Krakow)

(Division of Particle Physics and Astrophysics (NO1)

Department of Cosmic Rays and Neutrins (NZ15))

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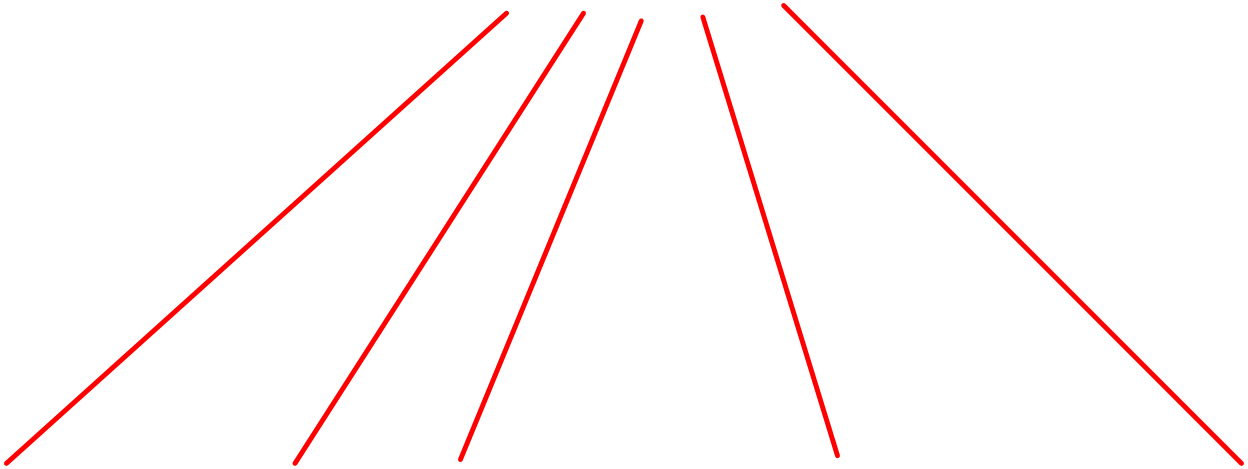

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What is CREDO?

Is it science? or just popularization?

CREDO is primarily a science,

but

without popularization, it could not work at all!

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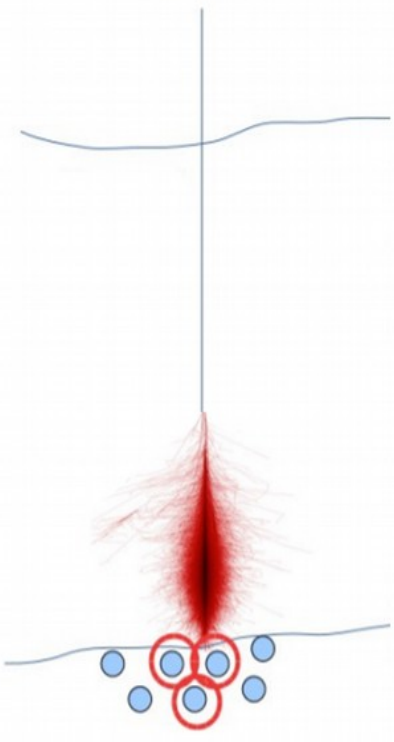
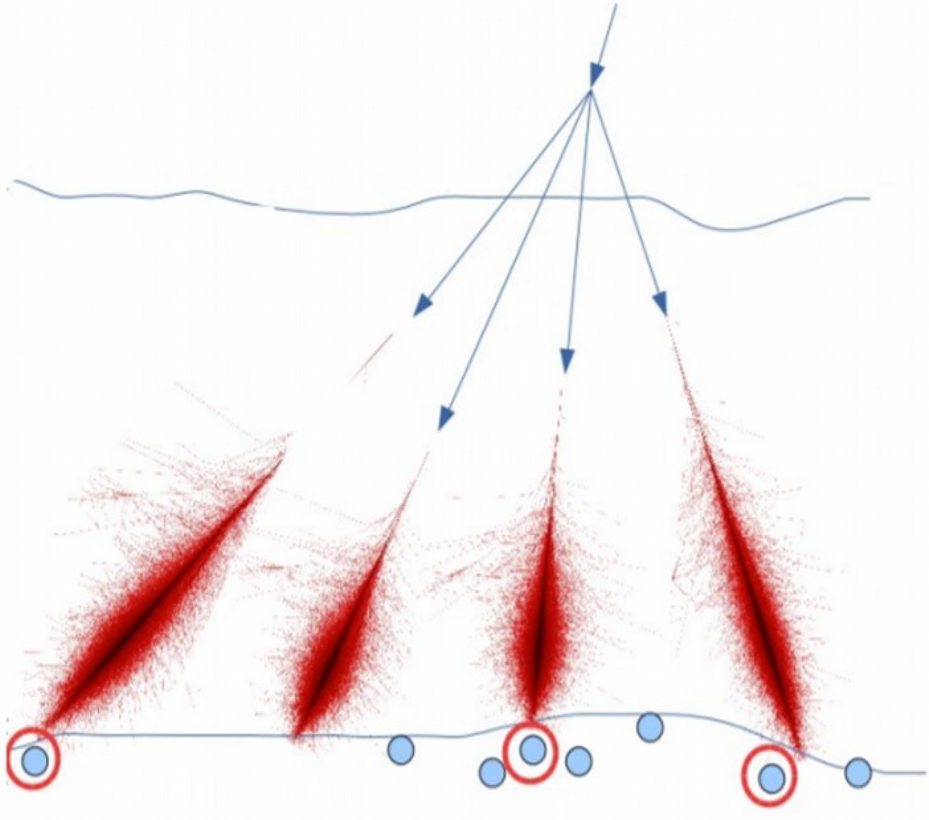
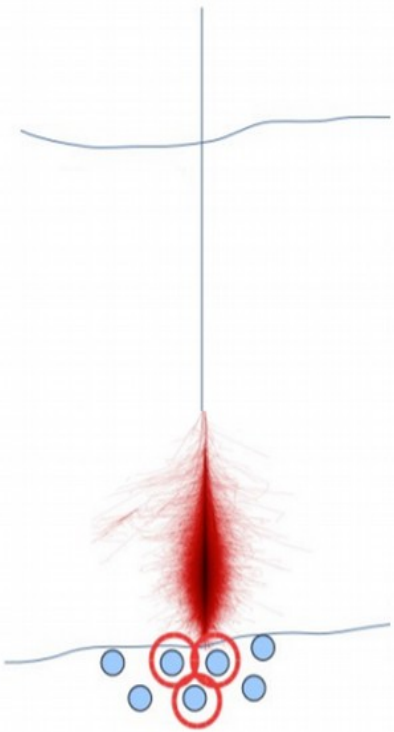
science $\Longleftrightarrow$ popularization

Science:





Science:



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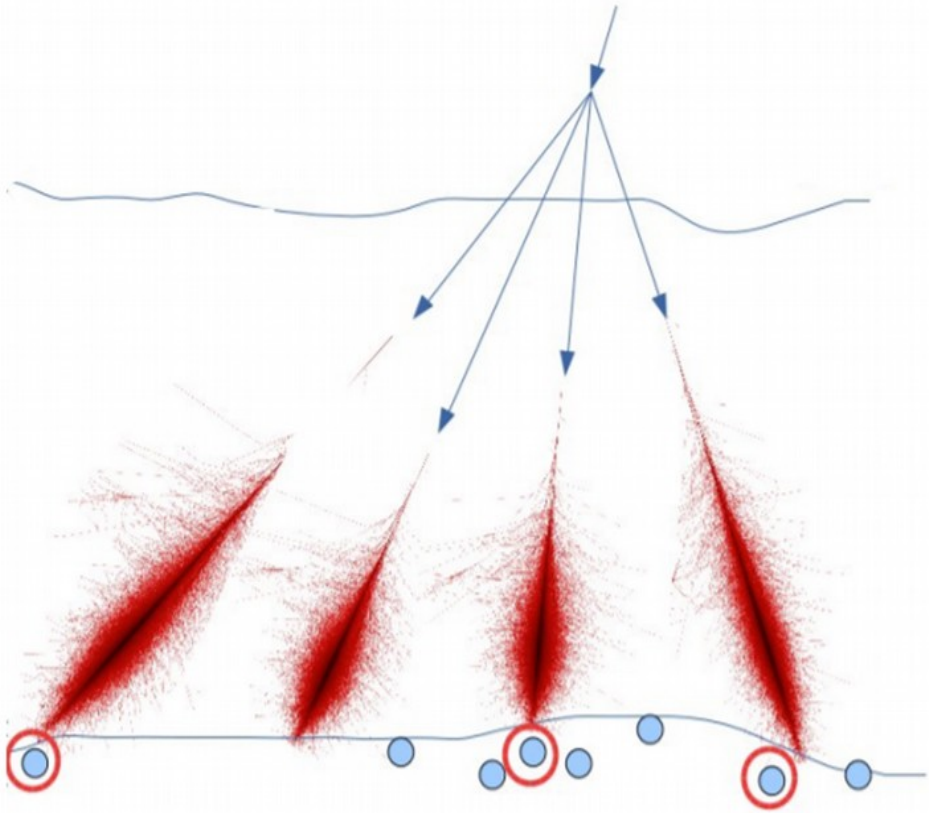

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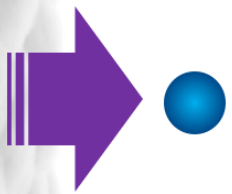
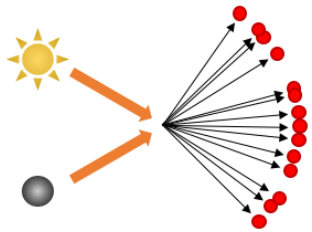
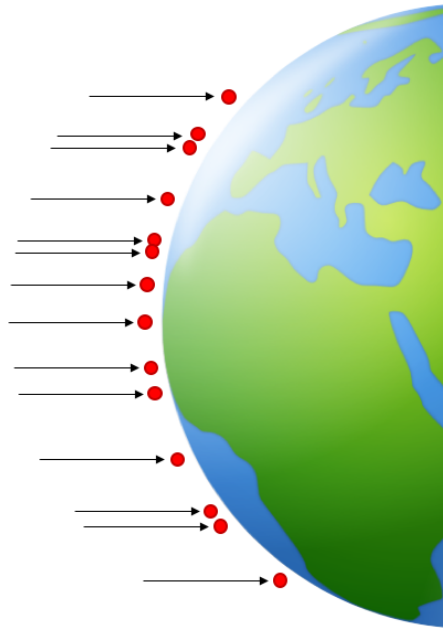






Super Massive Particles formed in the early Universe

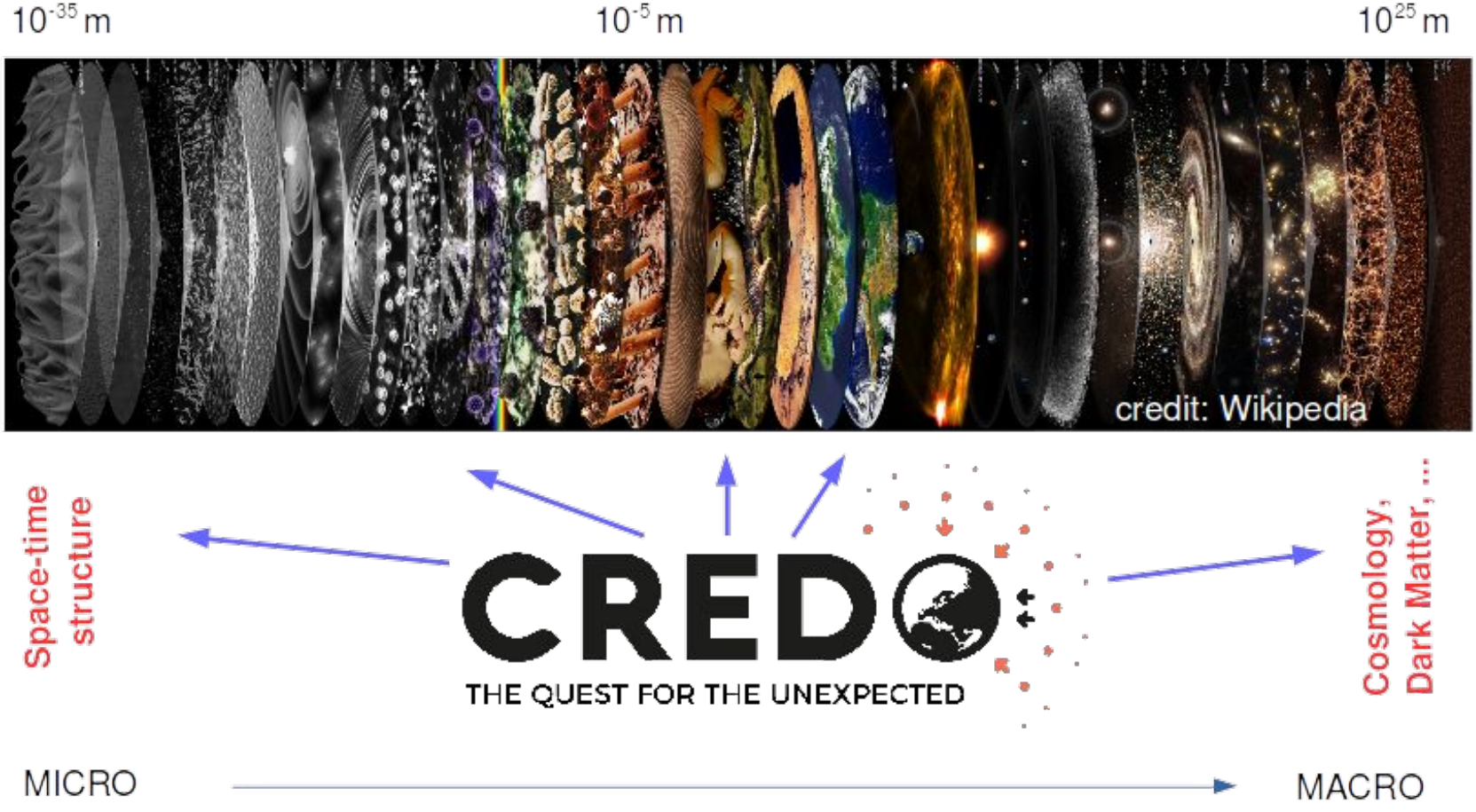
Super massive particle decays to a very high energy photon

High energy photon collision creates lots of low energy photons

Low energy photons in a super-preshower are detected on the Earth

Scientific goal:

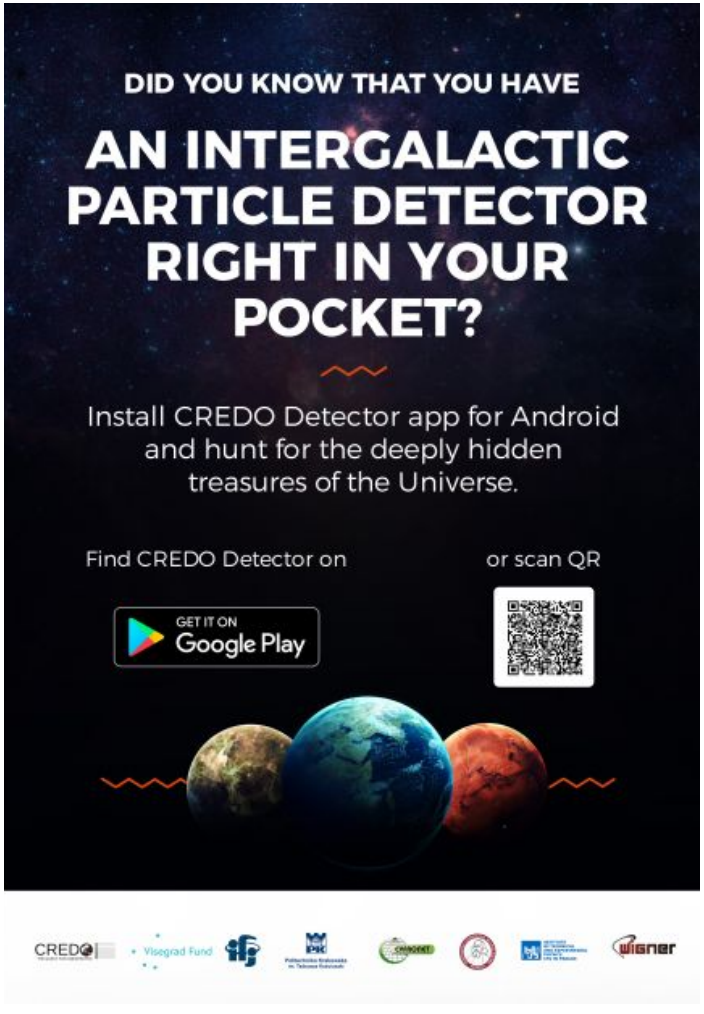
CREDO Science Potential



more (popular level): https://credo.science/education-materialyeng/podcast/ (EN) / https://credo.science/education-materialypl/podcast/ (PL)

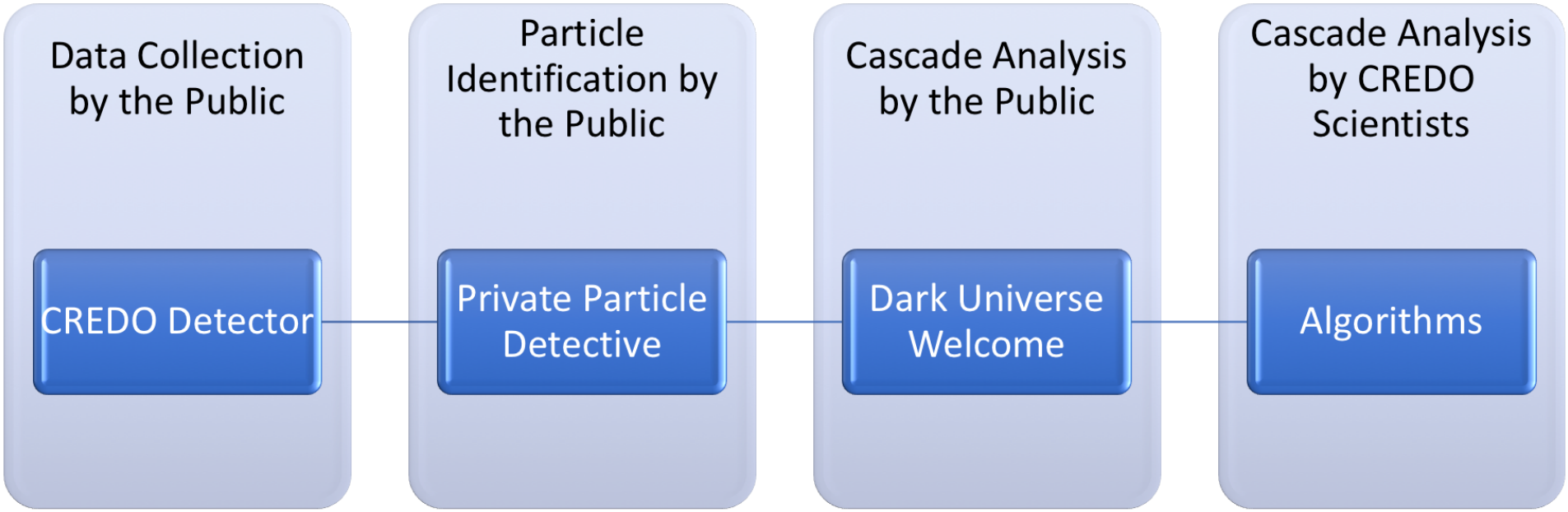
Scientific method:

Novel Global Solution: **cloud of clouds**



-> “new data”!

Scientific method:



Data:

CREDO Detector: what do we see?

[work in progress, e.g. at IFJ PAN]

scenarios!

muons?

air showers ?

CRE?

Data:

CREDO
THE QUEST FOR THE UNEXPECTED

Main page

Detections (10843034) Users (14189) Teams (11261)

Top users

Login	Detections
DŚ	939045
Grzegorz D.	460190
DawQid	394161
Antos M	326091
Jakvb Chwastek	263135

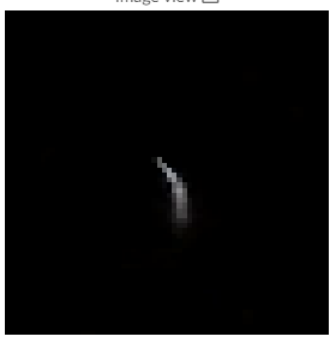
Recently registered users

Login	Detections
Kajetan	0
Pawel7363	0
AK58179	17
tomek9000@gmail.com	0
Bartek Feltman	0

Last 20 detections

date	login	team	img
2021-06-27 18:42:18.963	Asaf	Israel	
2021-06-27 18:42:18.963	Asaf	Israel	
2021-06-27 18:41:40.685	Marek		
2021-06-27 18:41:19.579	michal.b.svk		
2021-06-27 18:37:33.721	Grzegorz D.	no team	
2021-06-27 18:36:17.128	Paweł Tłuścik		
2021-06-27 18:35:59.631	ZMSR	CIBio	
2021-06-27 18:35:39.431	ZMSR	CIBio	
2021-06-27 18:33:44.802	Asaf	Israel	

Image view



x: 689 y: 141

Science AND popularization:

CREDO: already global

42 institutions / 19 countries / 5 continents / ~ 11 900 users / ~ 4400 teams / > 10 000 000 smartphone detections / > 1100 smartphone work years

Organized by CREDO

year	name	place
2016	CREDO Inauguration	INP PAS
2017	International Cosmic Day 2017	INP PAS
	CREDO Anniversary Symposium	INP PAS
2018	CREDO Visegrad Project Meeting	Bratislava
	CREDO in school	Kraków
	CREDO Week	INP PAS
	Scientists' Night	INP PAS
	science picnic	Kraków
	meetings in schools	Poland
2019	CREDO Workshop	INP PAS
	Visegrad Workshop	Opava
	Scientists' Night	INP PAS
	science picnic	Kraków
	science picnic	Olsztyn
	science picnic	Warszawa
	meetings in schools	Poland
2020	Scientists' Night	INP PAS
	Open Day	INP PAS
2021	Scientists' Night	INP PAS
	EduSky conference for teachers	Kraków
	Physics as the key to understanding the world-	
	-CREDO and cosmic rays	INP PAS
	Open Day	INP PAS

long-term activities:

advanced and already in progress:
Particle Hunters - in schools (in Poland for now) 2018-2021

Look deep into the universe - for interested (in Poland for now) 2021,

started and planned for the visually impaired and the blind:

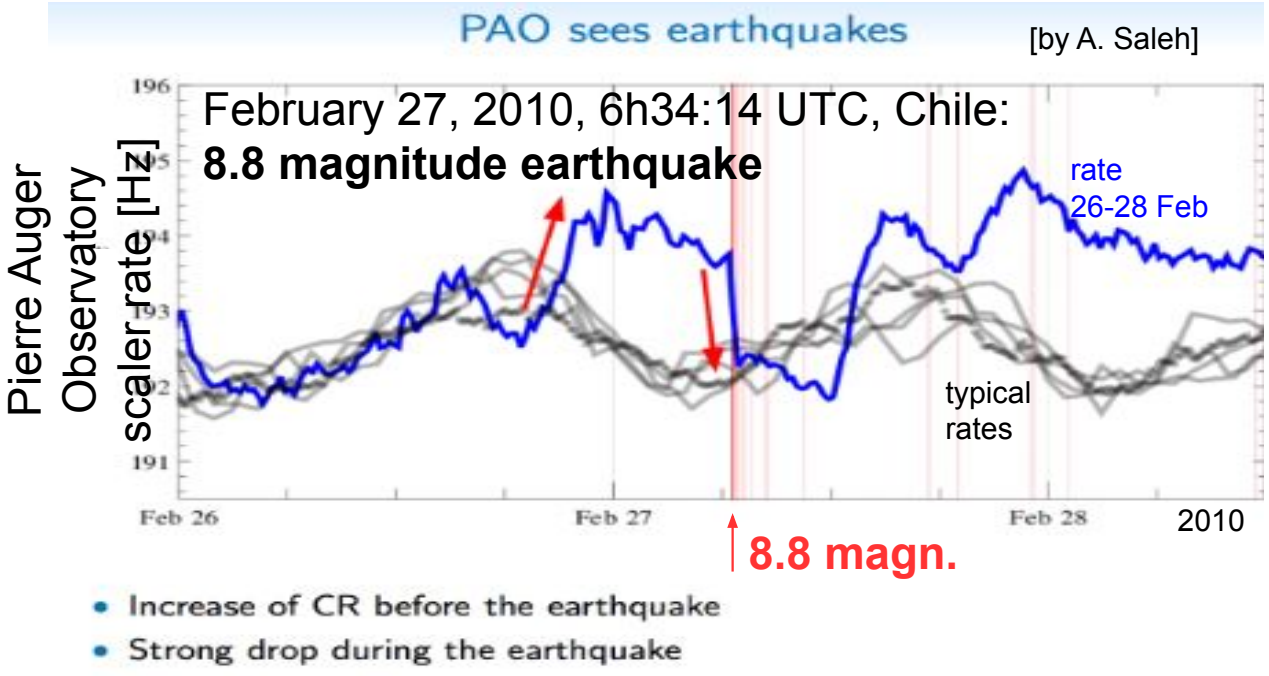
- grant for ESERO Ambassador'2021 *"One hour for science"*
- sonification of data collection,
- sonification of data analysis,
- meetings with visually impaired students and other groups,
- continuous work with them,
- processing of depictions of basic knowledge about the cosmos into tactile forms - tyflographics

scientific adventure with CREDO:

- *Citizen Science* - science for all interested,
- Anyone can participate from the stage of data collection, e.g. with a smartphone to the analysis of the collected data,
- CREDO wants to create a platform for people with disabilities, e.g. the blind,
- you can take part individually or in groups (e.g. in schools) in competitions organized by CREDO, e.g. "particle hunters",
- you can do student internships, write master's and doctoral theses,
- you can propose your ideas, implement them together with scientists and share them during the CREDO conference,
- ... you can co-author scientific papers ...

CREDO project

The seismic precursor in cosmic rays: inspiration from the Pierre Auger Observatory



→ **CREDO-earthquakes task**

Inhabitants of territories threatened by earthquakes [= potential CREDO public engagement target]:

2,7 billion people

Science as a service to the human community?

Even the smallest chance to save lives

= **a must check!**

International Cosmic Rays Conferences, where they started?

37th July 2021, Berlin, 36th July 2019, Medison USA, 35th July 12-20, 2017 - Bexco, Busan, Korea, 34th July 30-August 6, 2015 - The Hague, Netherlands, 33rd July 2-9, 2013 - Rio de Janeiro, Brazil, 32nd August 11-19, 2011 - Beijing, China, 31st July 7-15, 2009 - Lodz, Poland, 30th 2007, Merida, Mexico, 29th 2005, Pune, India, 28th 2003, Tsukuba, Japan, 27th 2001, Hamburg, Germany, 26th 1999, Salt Lake City, United States, 25th 1997, Durban, South Africa, 24th 1995, Rome, Italy, 23rd 1993, Calgary, Canada, 22nd 1991, Dublin, Ireland, 21st 1990, Adelaide, Australia, 20th 1987, Moscow, USSR, 19th 1985, La Jolla, United States, 18th 1983, Bangalore, India, 17th 1981, Paris, France, 16th 1979, Kyoto, Japan, 15th 1977, Plovdiv, Bulgaria, 14th 1975, Munich, Germany, 13th 1973, Denver, United States, 12th 1971, Hobart, Australia, 11th 1969, Budapest, Hungary, 10th 1967, Calgary, Canada, 9th 1965, London, United Kingdom, 8th 1963, Jaipur, India, 7th 1961, Kyoto, Japan, 6th 1959, Moscow, USSR, 5th 1957, Varenna, Italy, 4th 1955, Guanajuato, Mexico, 3rd 1953, Bagnères-de-Bigorre, France, 2nd 1949, Como, Italy, **1st 1947, Kraków, Poland**

Here is an 75-second trailer made of a science picnic on the Main Square in Krakow in 2018.

Let’s start the scientific adventure with CREDO!