Brainstorming on a distributed, open and diversified cosmic ray detector

Piotr Homola

Institute of Nuclear Physics PAS, Krakow

Next-Generation Techniques for UHE Astroparticle Physics, Chicago, 29.02.2016

Motivation

UHE Astroparticle Physics = fascinating science field
→ **potential to explain the mysteries of the Universe**

But we have to do much better than now to **explore** this **potential**...

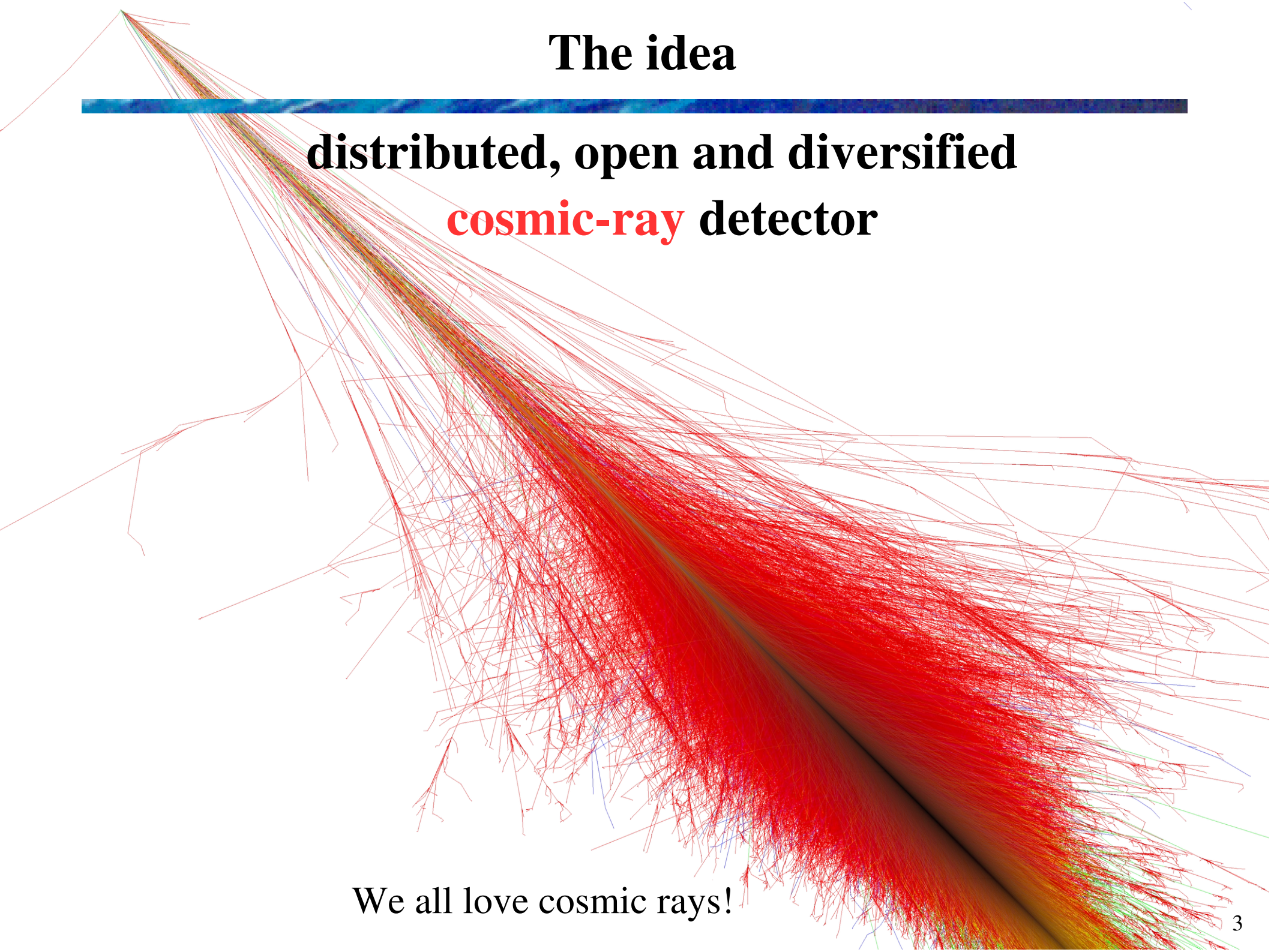
→ Next-Generation Technologies!
→ larger/better detectors
} most of the talks

→ more talented enthusiasts = Next-Generation manpower
} this talk

What can we do to attract more people to work in our field?

→ give the opportunities
→ assist in joining a scientific effort
→ find the synergy from working together
→ organize the „expertise pyramid"

The idea



distributed, open and diversified

cosmic-ray detector

We all love cosmic rays!

The idea

distributed, open and diversified cosmic-ray detector

Distributed: go international

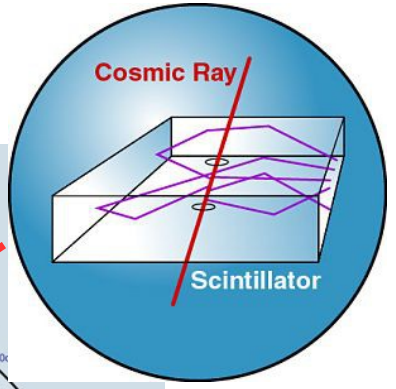
The idea

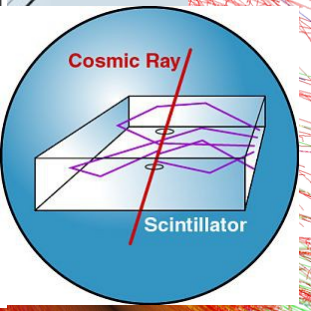
distributed, open and diversified cosmic-ray detector

Open: everybody welcome

The idea

distributed, open and diversified cosmic-ray detector





Diversified: release your creativity

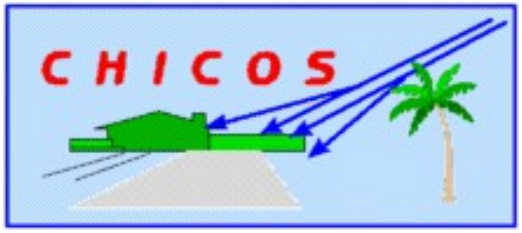
The idea

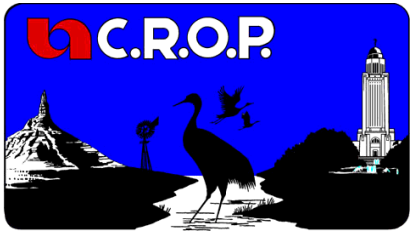
distributed, open and diversified cosmic-ray detector

Central database/interface: access to everything for everybody

Prototypes exist(ed)

Educational CR detectors (networks):





...

(-): mostly inactive, too educational, mono-technique, not global
(+): HiSPARC still alive and expanding (several sites in Netherlans + UK + Denmark)
→ **how to keep on growing?**

Smartphones as CR detectors:

(+): CRAYFIS (arXiv:1410.2895): observing UHECR with smartphones
(-): M. Unger, G. Farrar (arXiv:1505.04777): infeasible, too low user density
→ **which / how many additional detectors needed to make the smartphone network useful?**

(How) can we do better?

educational detectors + smartphones + global + science?

+ few basic rules

1. **expert? come and help to organize everything**

2. **student? Come and build a global UHECR project from scratch**

3. did something? write something

4. used something? evaluate

5. saw/used something good? approve [for experts]

6. are you rich? fund something

Strong and weak points

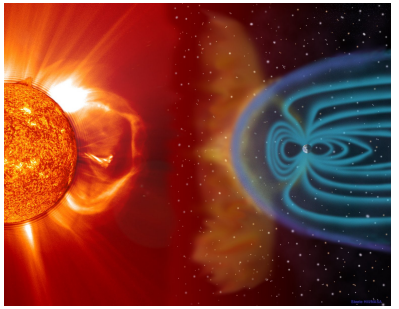
+ **Global**! Being a member of a vital community doing important things!
+ **Join quickly** and easily!
+ **No** geographical or financial **limits**!
+ Experience (and more) a **real science**!
+ **Be creative** with the detection techniques and hardware!
+ **Prepare well** for top science projects!

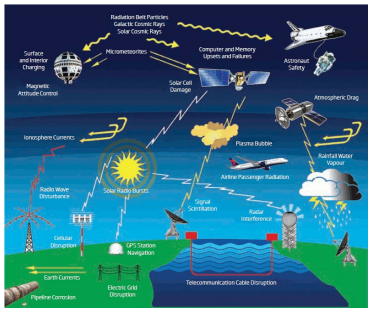
? Can we have a good **science case**?
? Can we generate the **pyramid effect** transmitting our expertise to the new generations?
? Will there be enough funds for the **minimum maintenance**?

Science case!

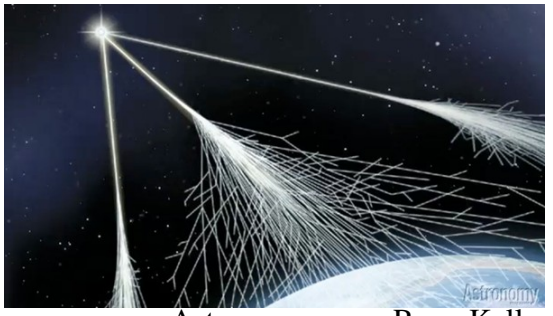
Generate enthusiasm about UHECR and attract enthusiasts
only possible with an **attractive science case**!
(consider good examples: SETI@home, Planet Hunters,...)

→ Guaranteed science:
- space weather
- ....





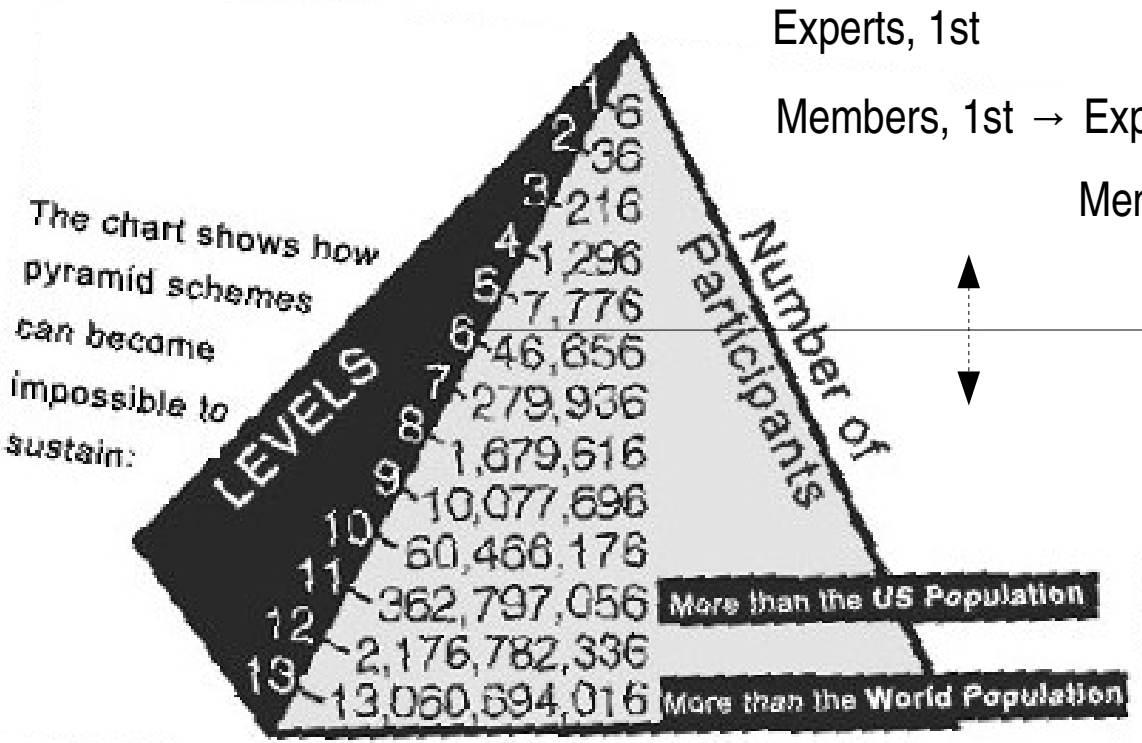
→ **Unexpected but possible science:**
- large distance correlations in time
  (GW follow up, ...)???
- ...



Astronomy.com, Roen Kelly

→ **Best comes unexpected:**
- on the edge of the energy scale expect ….**discoveries**!

Pyramid effect!



Experts, 1st

Members, 1st → Experts, 2nd

Members, 2st → Experts, 3rd

Members, 3rd → Experts, 4th

We don't need an ∞ pyramid :)

The goal:

Astroparticle Physics Community → **Astroparticle Physics Community**

Stress on **transmitting the expertise** to the next generations of members!

Tentative acronym :)

CREDO

Cosmic-**R**ay **E**xtremely **D**istributed **O**bservatory

['credo' in latin: I believe (that it is not too crazy)]

Tentative road map

Should we do something global for the Next Generations of Astroparticle Physicists?

YES

Let's discuss details (this idea or another)

- project web site → start to register contributors and their competences at all levels
- basic rules: involve experts
- basic know-how: start filling the knowledge pyramid
- open first detectors (eg as students labs, water container + PMT)
- data base prototype + test fill from the first detectors (experts)
- standardized detectors: step by step info on how to buy/build/install/run/connect a detector
- basic analysis tools/codes
- aggregate enthusiasts
- detector/data quality selection rules → approval towards subsets usable for the analysis
- science case: example science goals facilitating the decisions about location and type of the detector(s)
- including the existing "serious" experiments, if agree
- CR detector webstore/factory: variety of detectors: how to build / where to buy, install and run (commercial aspect)
- simple database
- build inventory of available detectors: wide range of techniques, favour the most economic ones + easy how-to on detector setup

NO

Relax...

Vision

Why don't we use our water container for a more humanitarian purpose? Let's join CREDO!

Cool, we too! Ice-house can be a CR detector, And we can work at home!