

Cosmic rays and dark matter

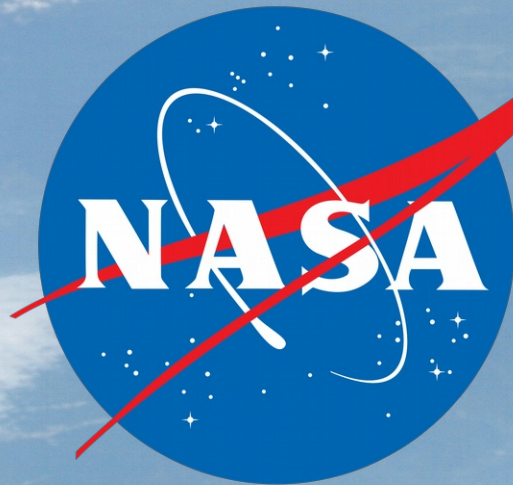
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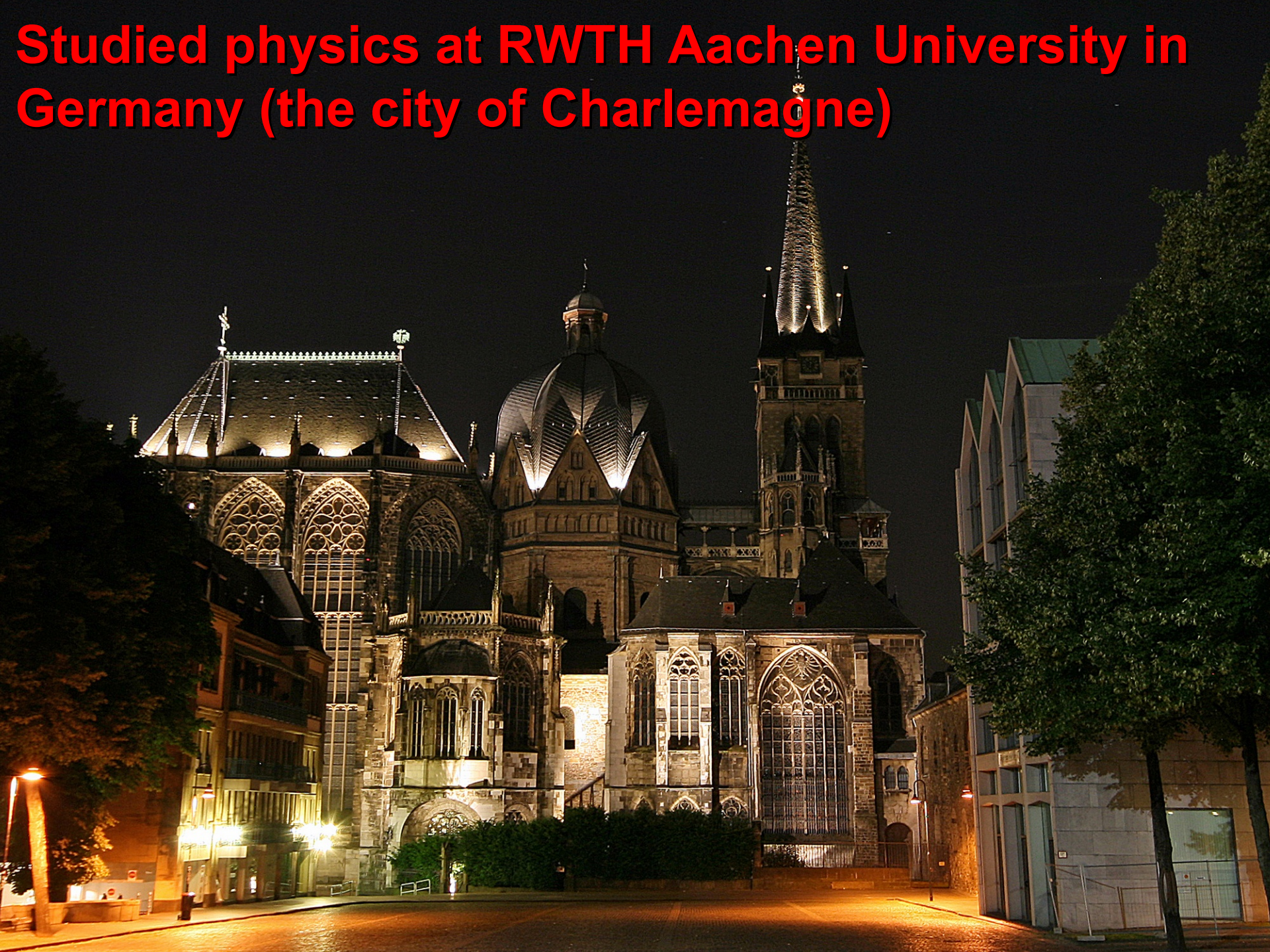
We live here in the Milkyway

**What got me started to become a physicist?
Earth is so small → What is out there?**

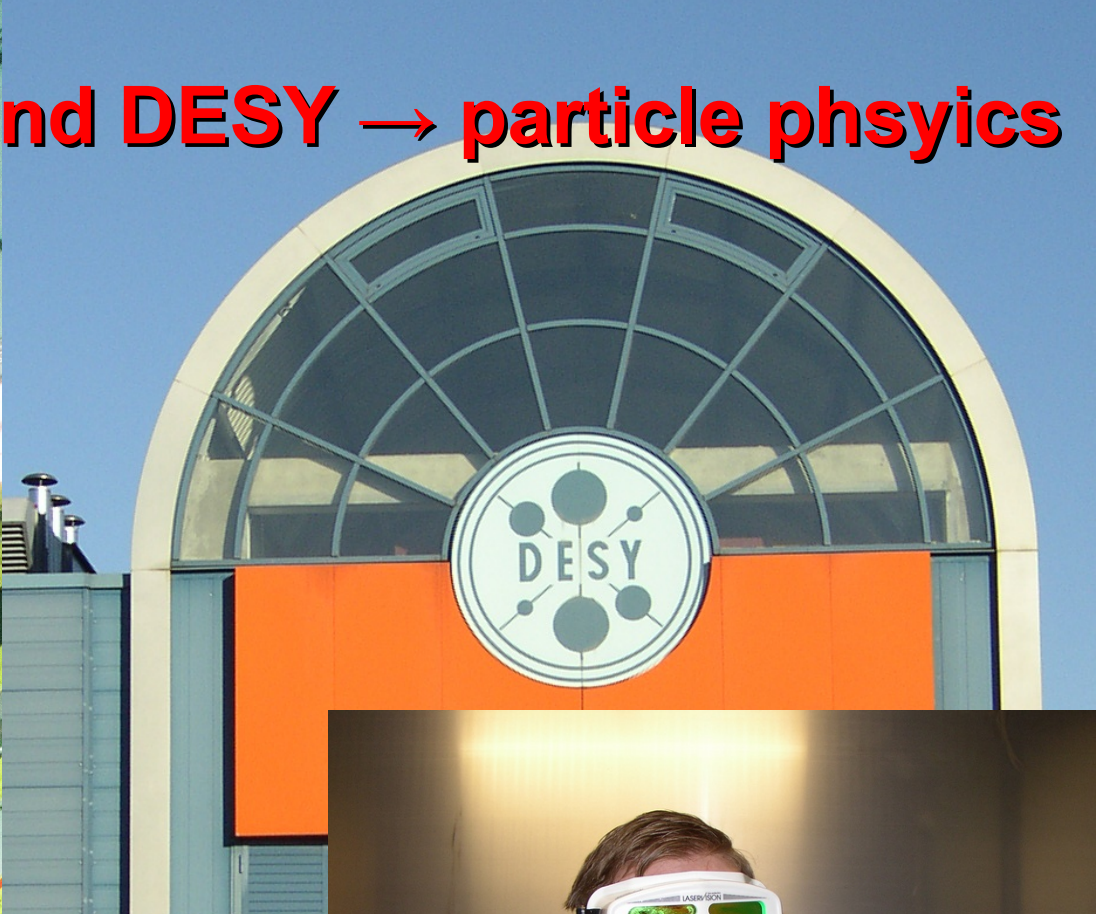


**Excursion in high school to DLR (German NASA)
→ saw early work on Rosetta**

**Studied physics at RWTH Aachen University in
Germany (the city of Charlemagne)**



Excursion to CERN and DESY → particle physics



Integration of AMS-02 at CERN with STS-134 astronauts



MW

PvD

AG

Mark E. Kelly

Gregory H. Johnson

Andrew J. Feustel

Gregory E. Chamitoff

TK

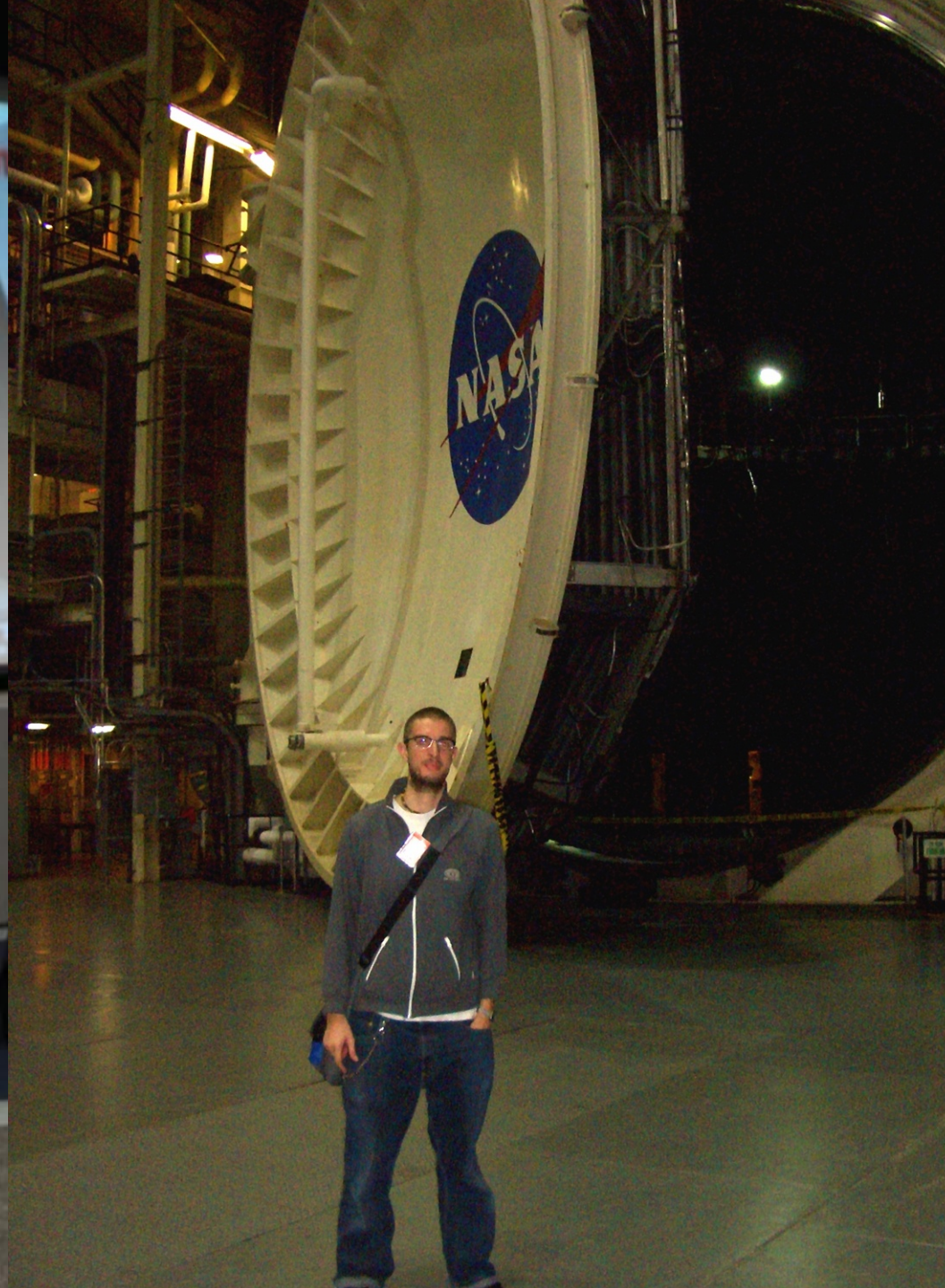
Roberto Vittori

Edward M. Fincke

Samuel C. C. Ting



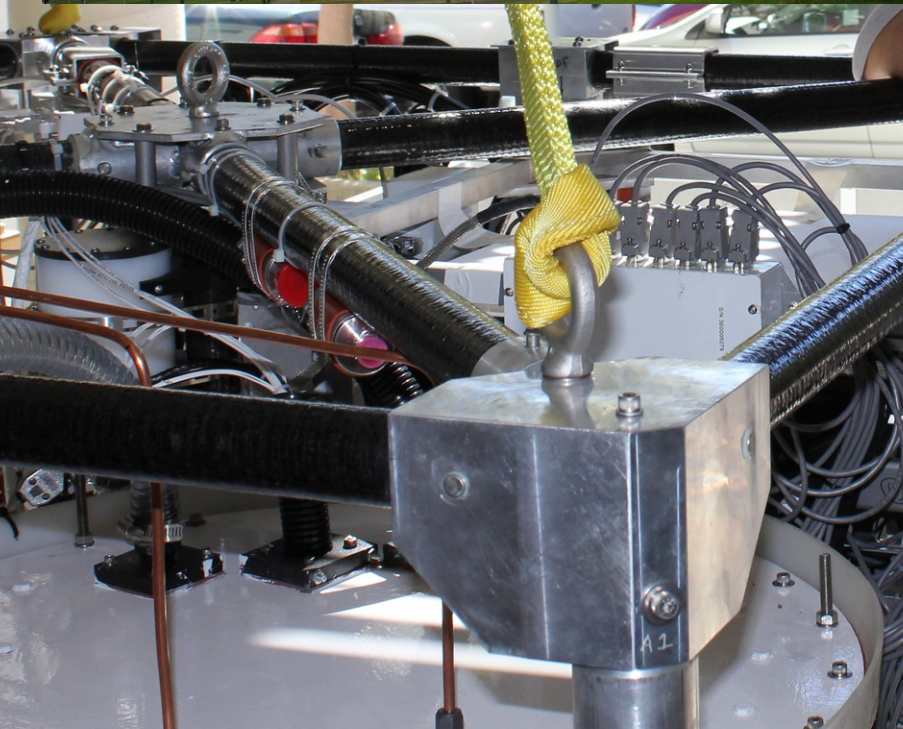
Meetings at NASA



AMS-02 on the launchpad



GAPS experiment assembled at UC Berkeley



GAPS balloon experiment launched from Japan



What keeps me going

stuff we know

stuff we don't know:
dark matter

→ makes
me curious!

Dark Matter:

We know it's there!

**Otherwise our whole Universe
would look different.**

**So far: no proof for what it is
exactly! :-)**

Now what?



Why not ask somebody who has been there and runs fast?



**Runners telling us
about Dark Matter
could be *cosmic rays***

?Cosmic rays - What is that?

It can get pretty violent out there,
which can produce all sorts of things!

for example: protons and electrons
(the matter we are made of)

A visualization of the cosmic web, showing a complex network of filaments and nodes. The filaments are thin, purple lines that form a dense, interconnected web. The nodes are bright, yellowish-orange points where the filaments intersect. The background is a dark, deep purple color. The overall appearance is that of a vast, intricate structure.

**Let's be honest: the details *do* require to study
Physics in more depth...however:**

125 Mpc/h

**We can build machines that measure these
runners (cosmic rays) and tell us more**

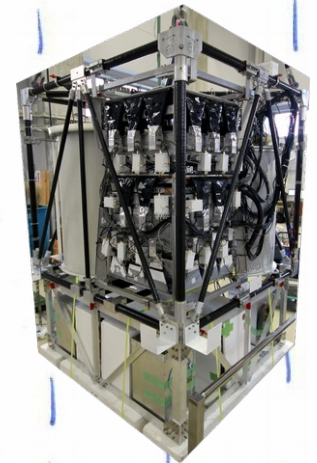
**We are looking for special types of cosmic rays
that hopefully know more about dark matter.**

Where to put such an experiment?

Imagine you wanted
to collect rain...



too dry



**The atmosphere acts as a
roof for cosmic rays**

atmosphere



***Which is good to stay
healthy, but bad to
measure cosmic rays***

**when you are hiking
at high altitudes**

**→ you are exhausted
much faster**

**→ because there is
less air to breathe**

**→ roof for cosmic
rays is getting weaker**

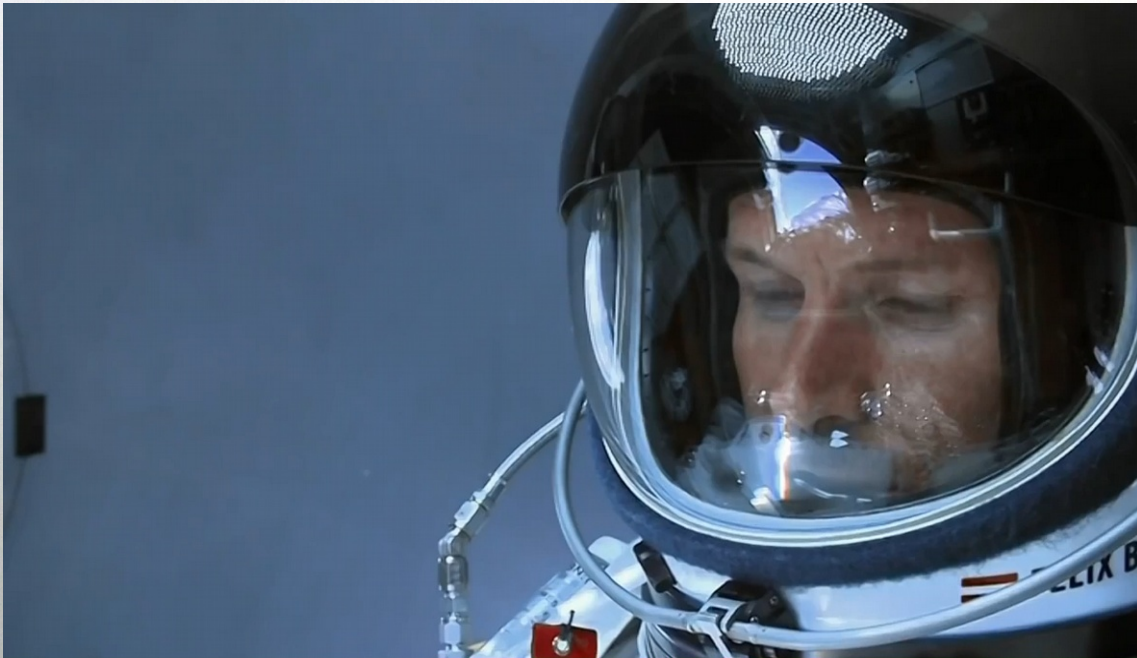


Therefore put the experiment as high as possible!



**Therefore put the experiment as high
as possible!**

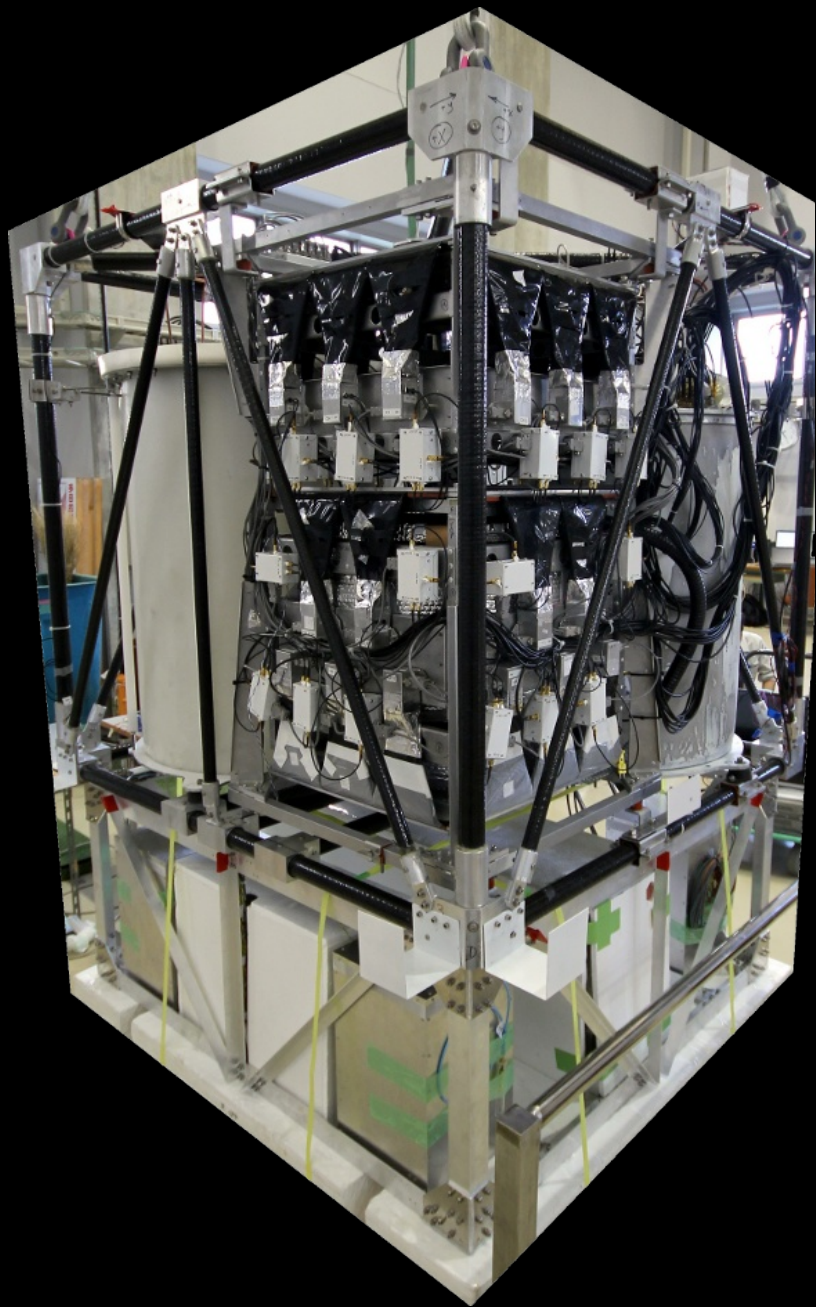
**Space is great, but super expensive
(\$1,000,000 for 2lbs)**



**use balloons
that go up very very high**

→ 25 miles above ground

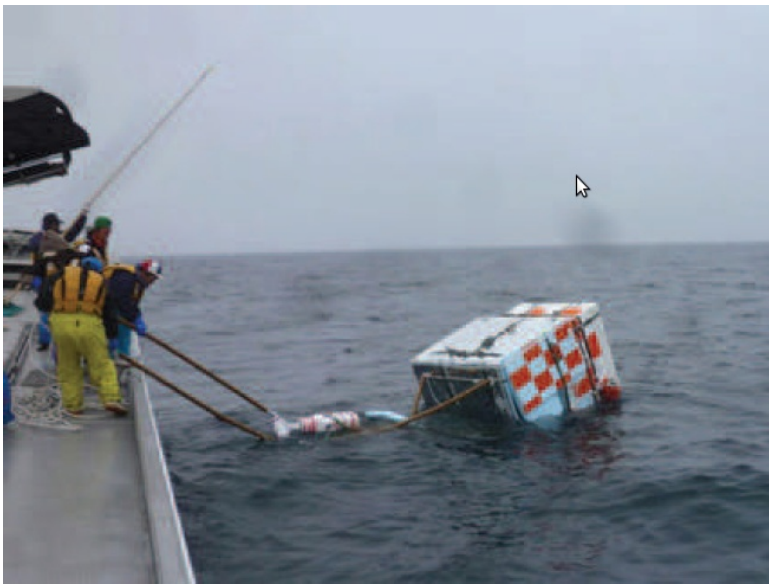




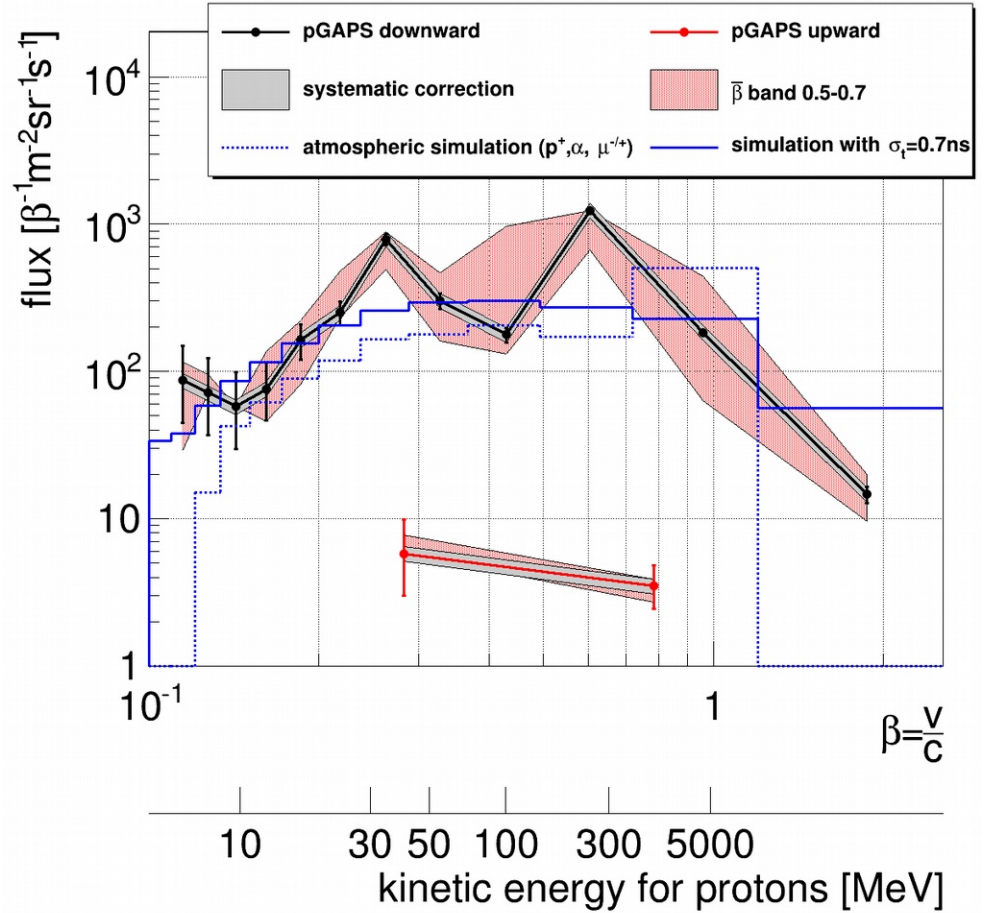
***A lot of hands on
work with all sorts of
different tasks!
Playground for big kids***



2012:06:03 02:29:14



***Experiment
landed in the
Pacific ocean!***



***We are just at the beginning to
understand dark matter!***

**I could only present one way to look
at the question**

Will keep us busy for many years!

***Please join us with your
ideas!***