

# The General AntiParticle Spectrometer A Balloon Experiment

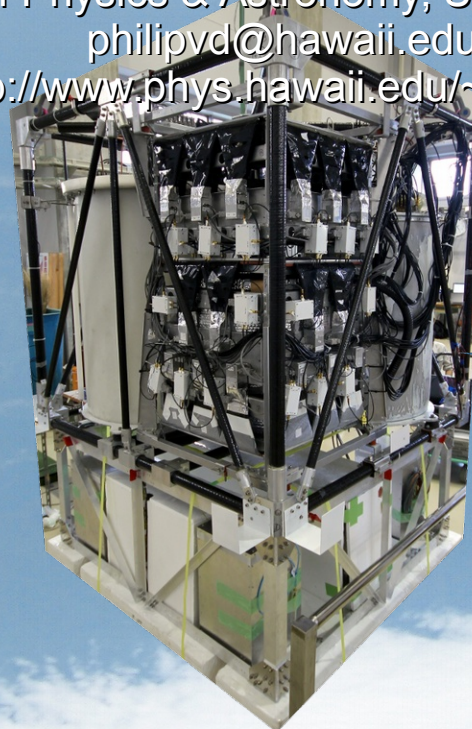
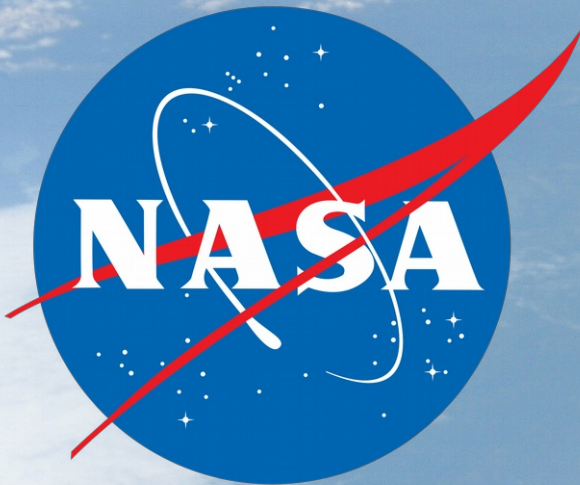
Physics & Astronomy Open House  
November 2014

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<http://www.phys.hawaii.edu/~philipvd>







We live here in the Milkyway

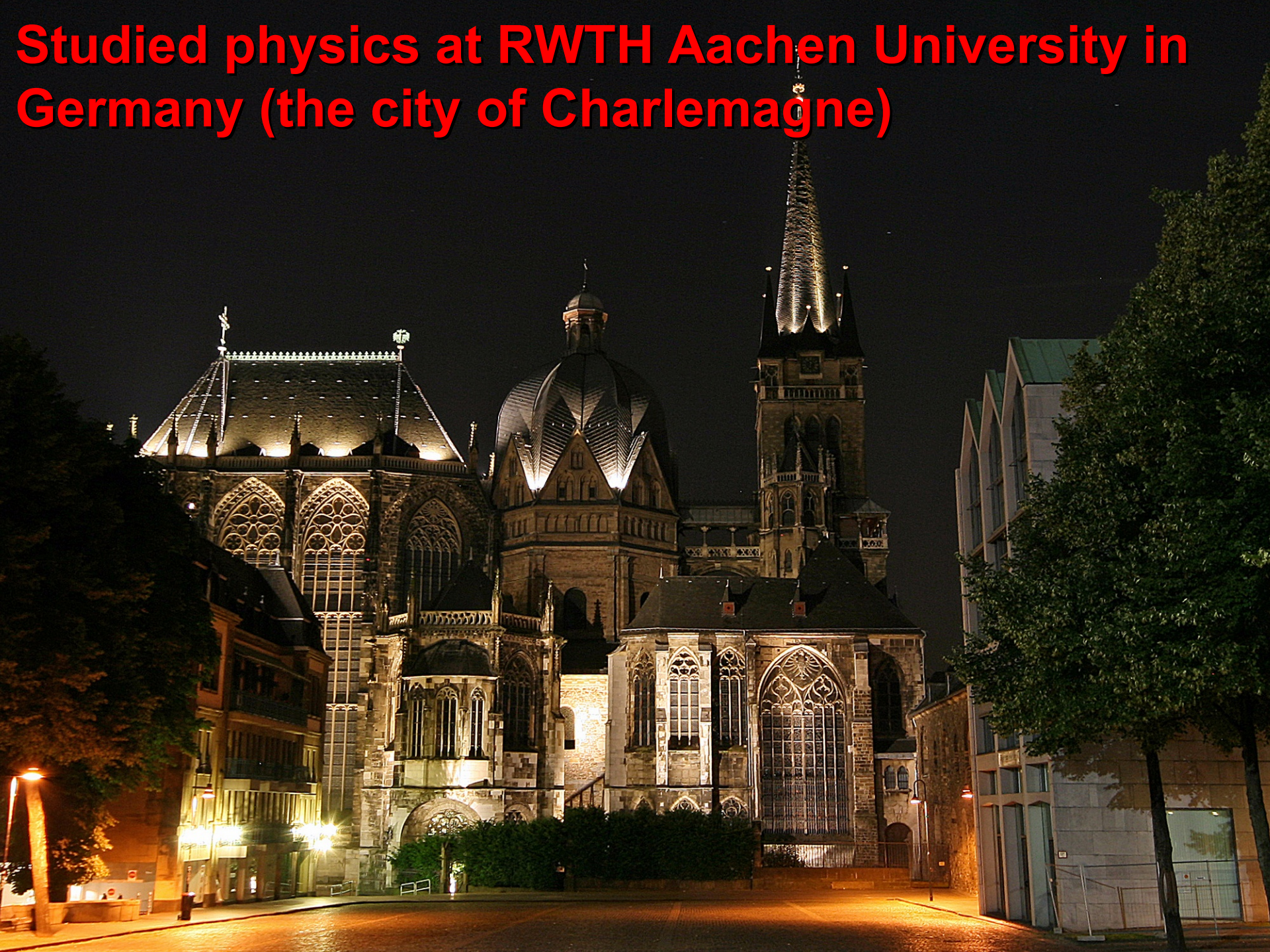
**What got me started to become a physicist?  
Earth is so small → What is out there?**



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

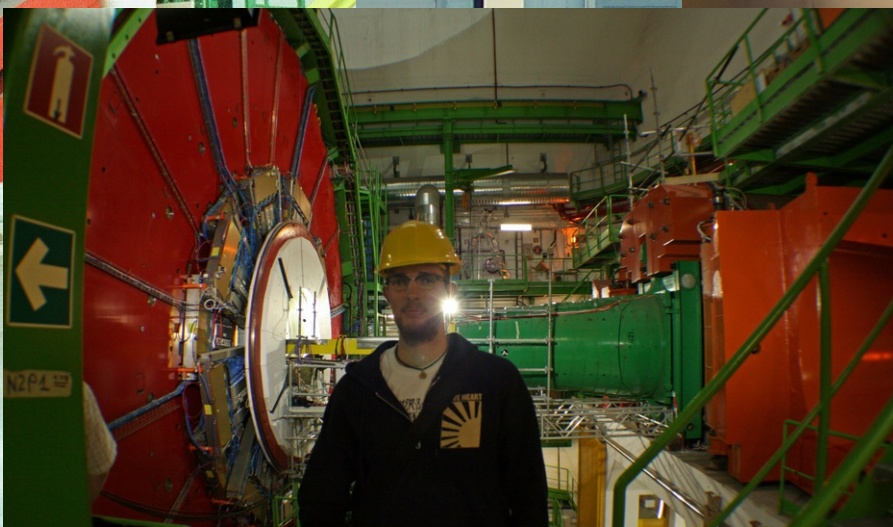
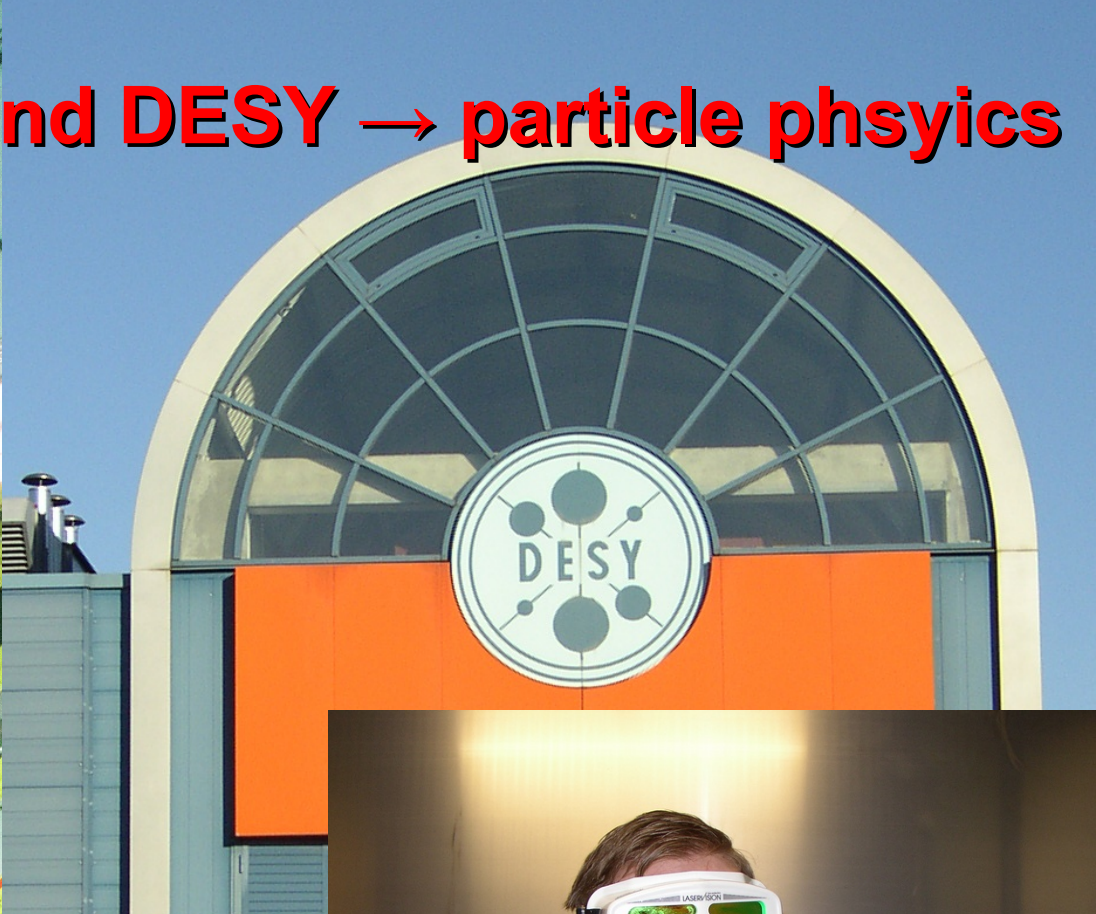


**Studied physics at RWTH Aachen University in  
Germany (the city of Charlemagne)**





# 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

Roberto Vittori

TK

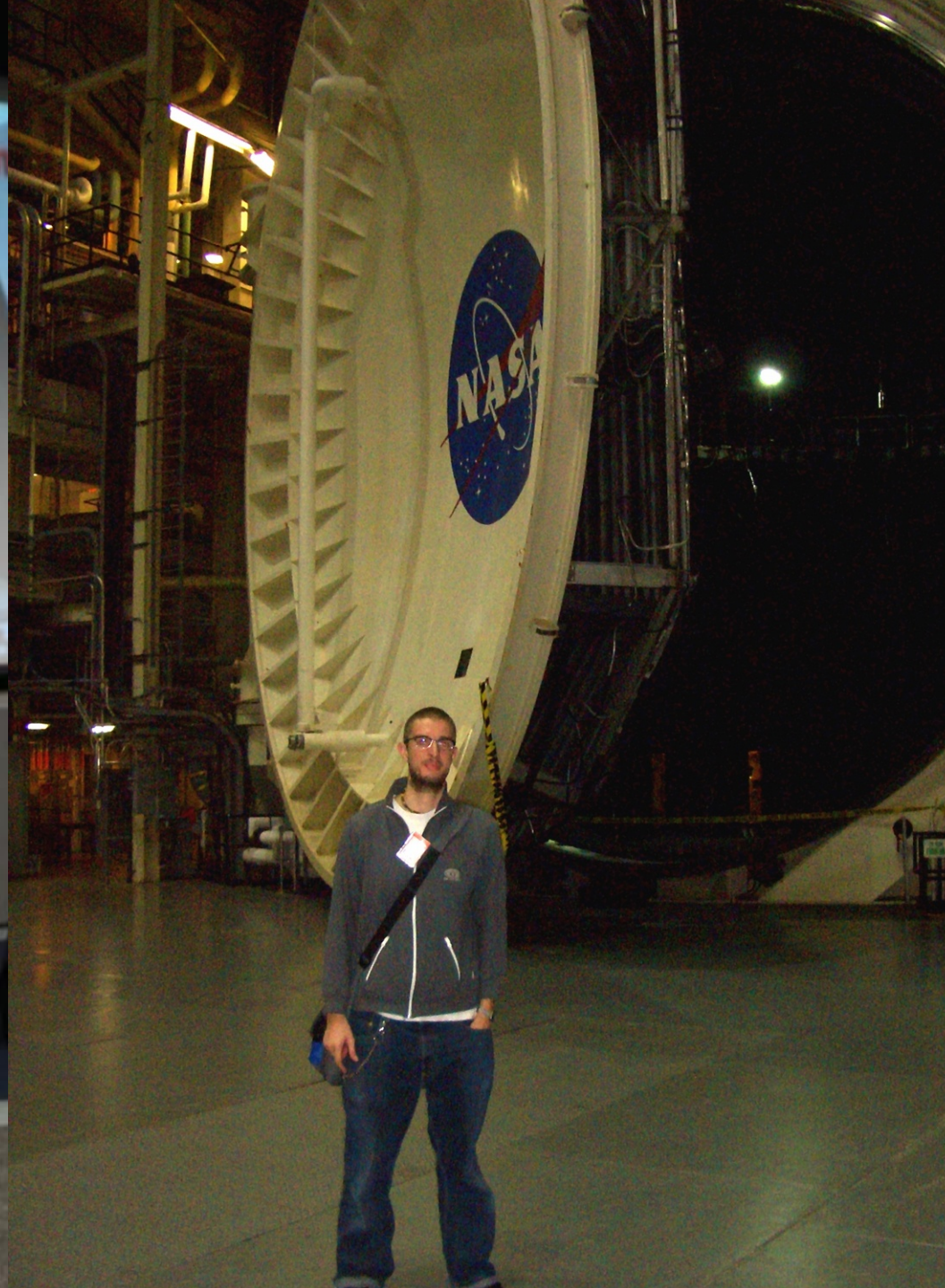
Edward M. Fincke

Samuel C. C. Ting





# Meetings at NASA



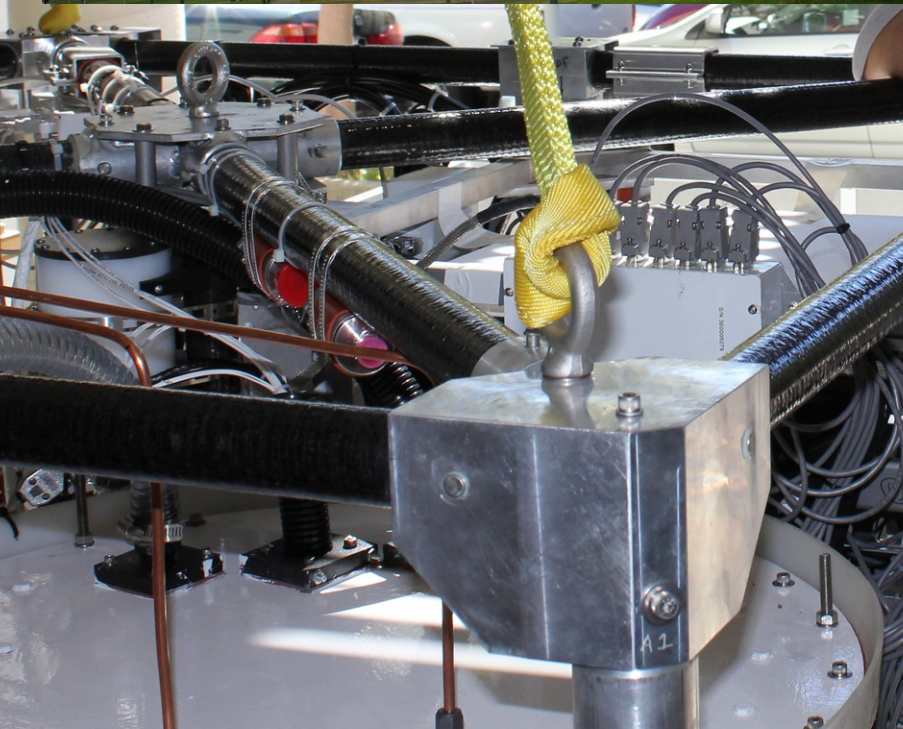


# AMS-02 on the launchpad



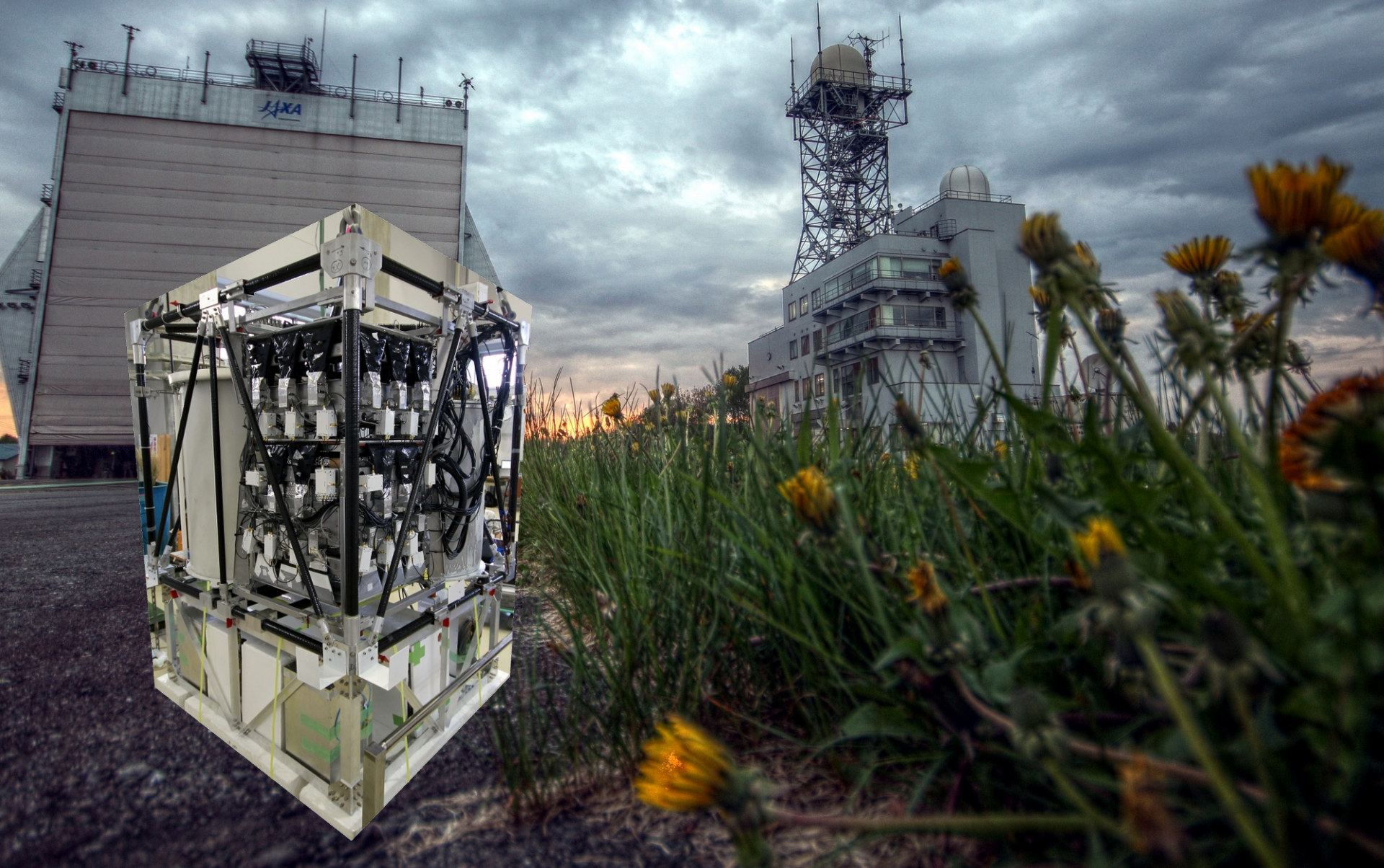


# GAPS experiment assembled at UC Berkeley





# **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 structure. 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 network of matter in the universe.

**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.**

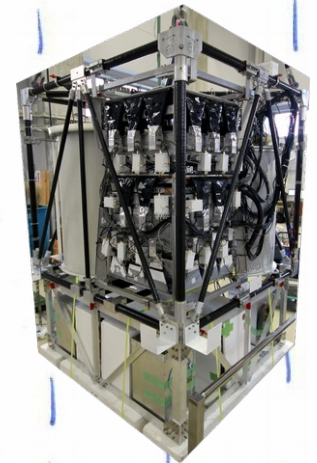


# Where to put such an experiment?

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!***

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



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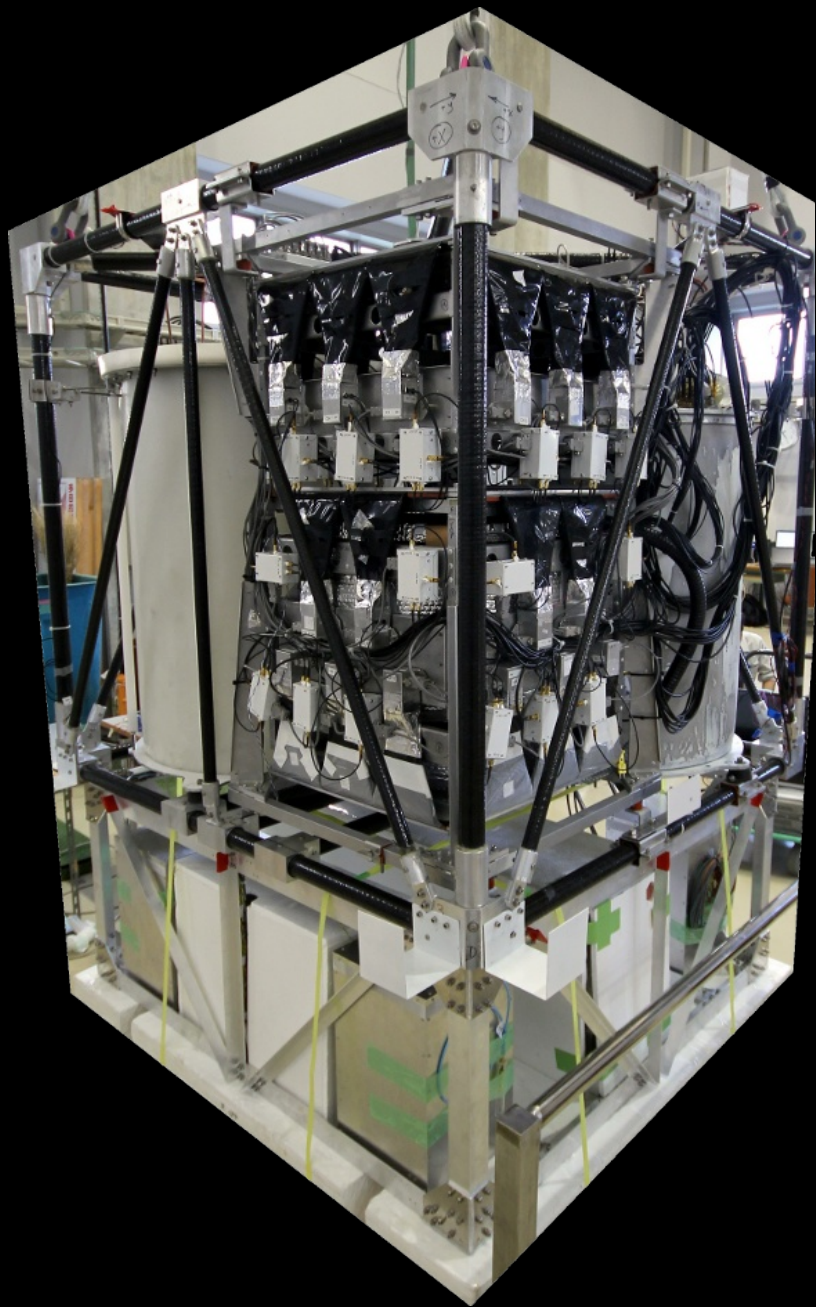
**use balloons**

**that go up very very high**

**→ 25 miles above ground**







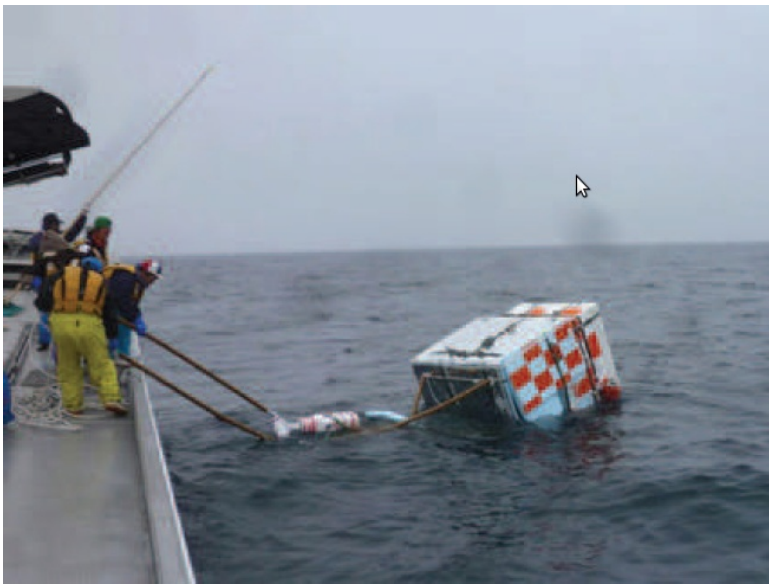
***A lot of hands on  
work with all sorts of  
different tasks!  
Playground for big kids***



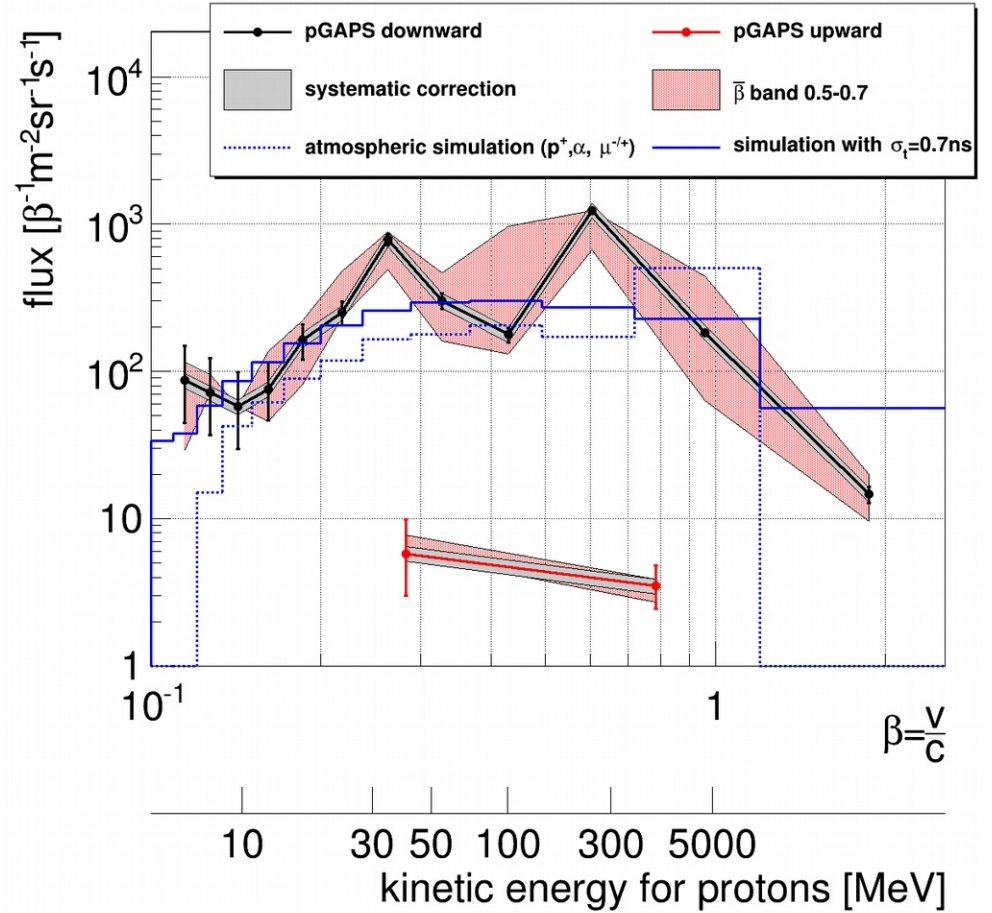


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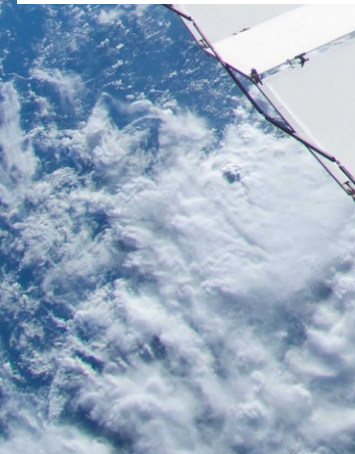
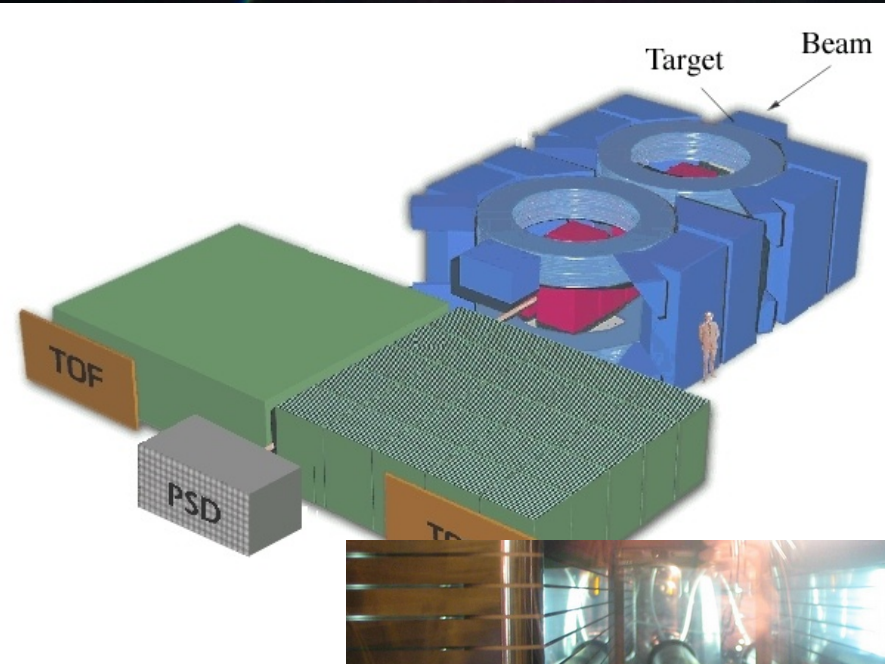


***Experiment  
landed in the  
Pacific ocean!***





# Confirmation of results is critical!





***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!***