Entering the Simon and Diana Raab Presentation Contest

Designing a presentation based upon the talks given at the Teachers’ Conference at the

on

May 16, 2009

Questions/Topics

- Experience of creating presentation
- Show representative slides
- How much effort?
- Useful in classroom? Shared with others?
- Additional recognition?
- Show accompanying problems
- Suggestions for prospective entrants

The Five “W’s” of Preparing a PowerPoint Presentation

The Who, What, Where (now replaced with How), Why, and When of preparing a presentation about the talks that are being presented here today.

Who?

1. You
   - Work within your comfort zone of curriculum
   - Do your research
   - Set a time limit
2. Your audience
   - Students & Teachers
   - Post-secondary physics educators
   - Interested general public
3. The presenters here today
   - Be sure to give appropriate credit to them
   - Work them into your presentation as appropriate, for example…

Question #2: What can we learn about our world from the LHC?

Our quest for answers on this part of our journey will be guided by RAMAN SUNDRUM, a Professor of Physics in the Department of Physics and Astronomy of the Johns Hopkins University. His research interests include the unification of electromagnetism and the weak nuclear force as well as the study of Dark Energy.

What?

- Stand alone presentation
  - May or may not be teacher-guided/presented
  - Support slides with notes as necessary
  - Be certain that it “flows”
- Accompanying curriculum
  - Varying levels of difficulty
  - Write this so that it may be used as slide show progresses or used as a follow-up assignment
- Visually appealing and engaging

Sample Curriculum

P1. Constant Velocity Problems

1. The MINOS experiment fires a beam of neutrinos from the Fermilab near Chicago to the Soudan Mine in northern Minnesota. The distance the neutrinos travel is 735 km and they do this at the speed of light. How much time does it take?
2. How far does a photon go in one millionth of a second?
3. How much time does it take a proton to travel once around the LHC. The proton travels at the speed of light and the LHC has a radius of 4.3 km.

P6. Energy & Conservation Problems

1. What is the total energy of a proton whose kinetic energy is 15 GeV? What is its wavelength?
2. How does the unit of a Joule compare to the unit of a GeV?
3. What is the wavelength of a 400GeV proton?
4. How much kinetic energy does a common housefly possess when moving through your bedroom? How does this compare the energy of a proton in the LHC?

Sample Curriculum cont'd

Q3. Relativity Questions

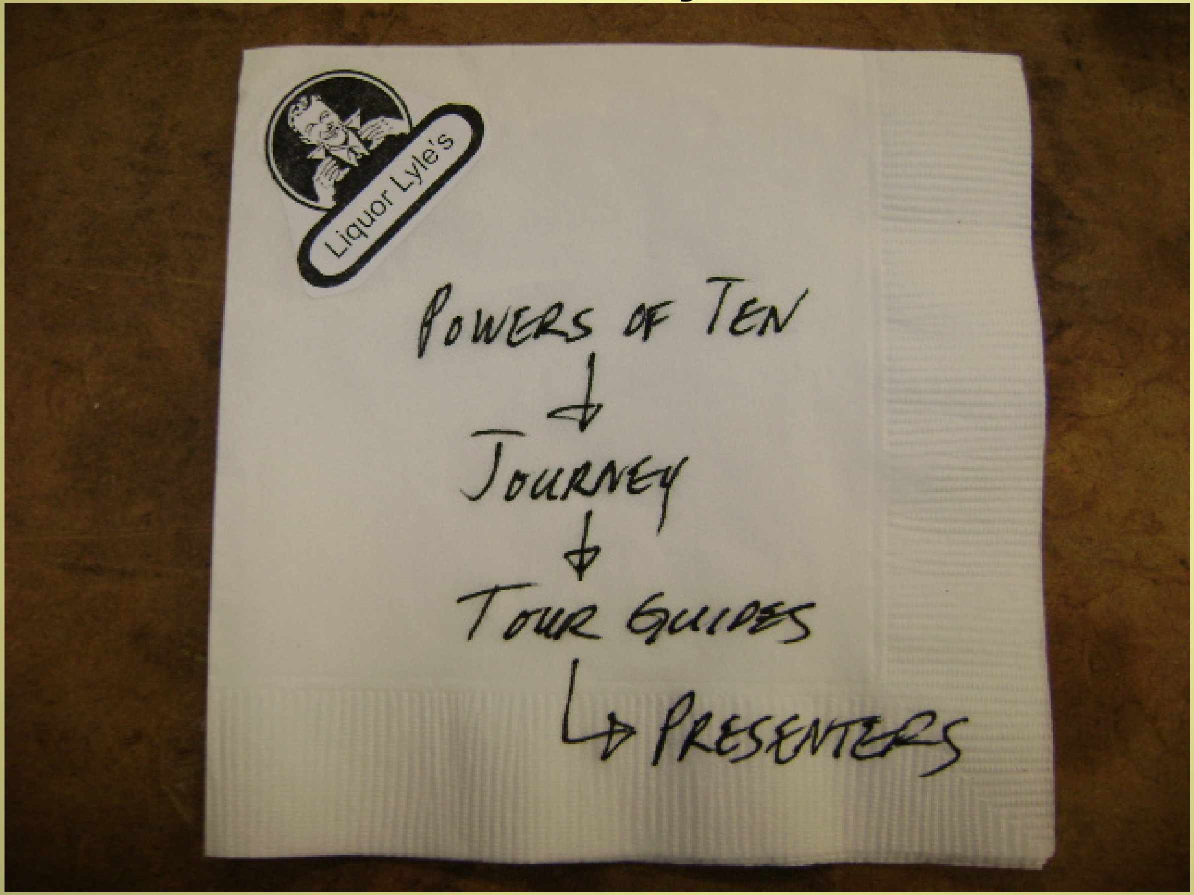
1. You are on a speedboat on a lake. Ahead of you, there is a wavefront, left by another boat that is moving away from you. You accelerate, catch up with, and pass the wavefront. Is this scenario possible if you are in a rocket and you detect a wavefront of light ahead of you? Explain.
2. You are packing for a trip to another star, to which you will be traveling at 0.99 c. Should you buy smaller sizes of clothing, because you will be skinnier on the trip? Can you sleep in a smaller cabin than usual, because you will be shorter when you lie down? Explain.

Q4. Dark Matter and Dark Energy Questions

1. Students may explore, at their own pace or as directed by the teacher, the questions that are posed at the following website: http://aether.lbl.gov/
2. How is the presence of dark matter detected?
3. How much more material is there in clusters of galaxies than we would expect from the galaxies and hot gas we can see?
4. Students may explore, at their own pace or as directed by the teacher, the following website: http://cosmology.berkeley.edu/Education/IUP/Big_Bang_Primer.html

~~Where?~~ How?

- As ideas occur to you, write them down.

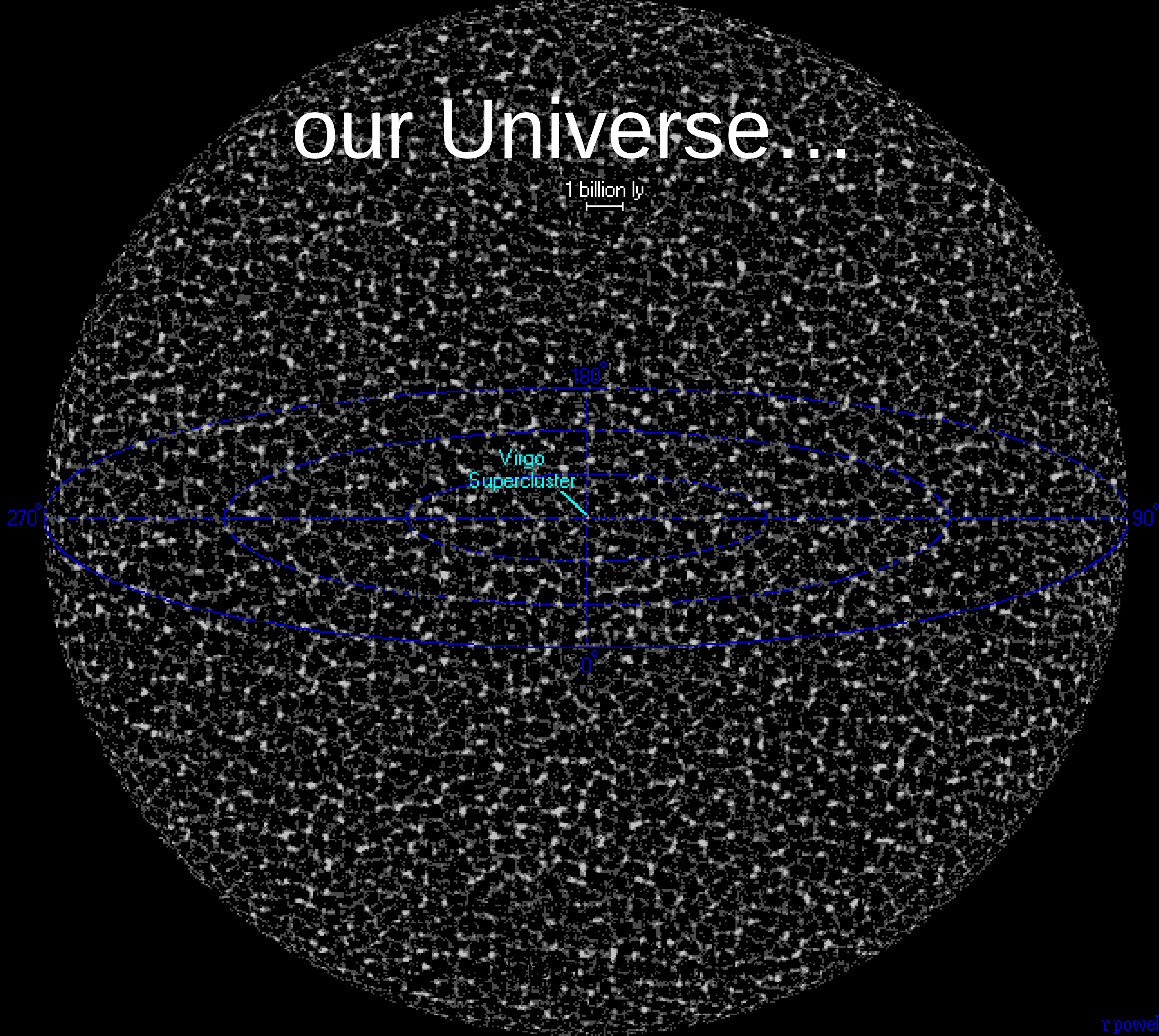


This example led to the following slides...

We are about to take a journey into the world of particle physics

A trip that begins at the far edges of…

our Universe…



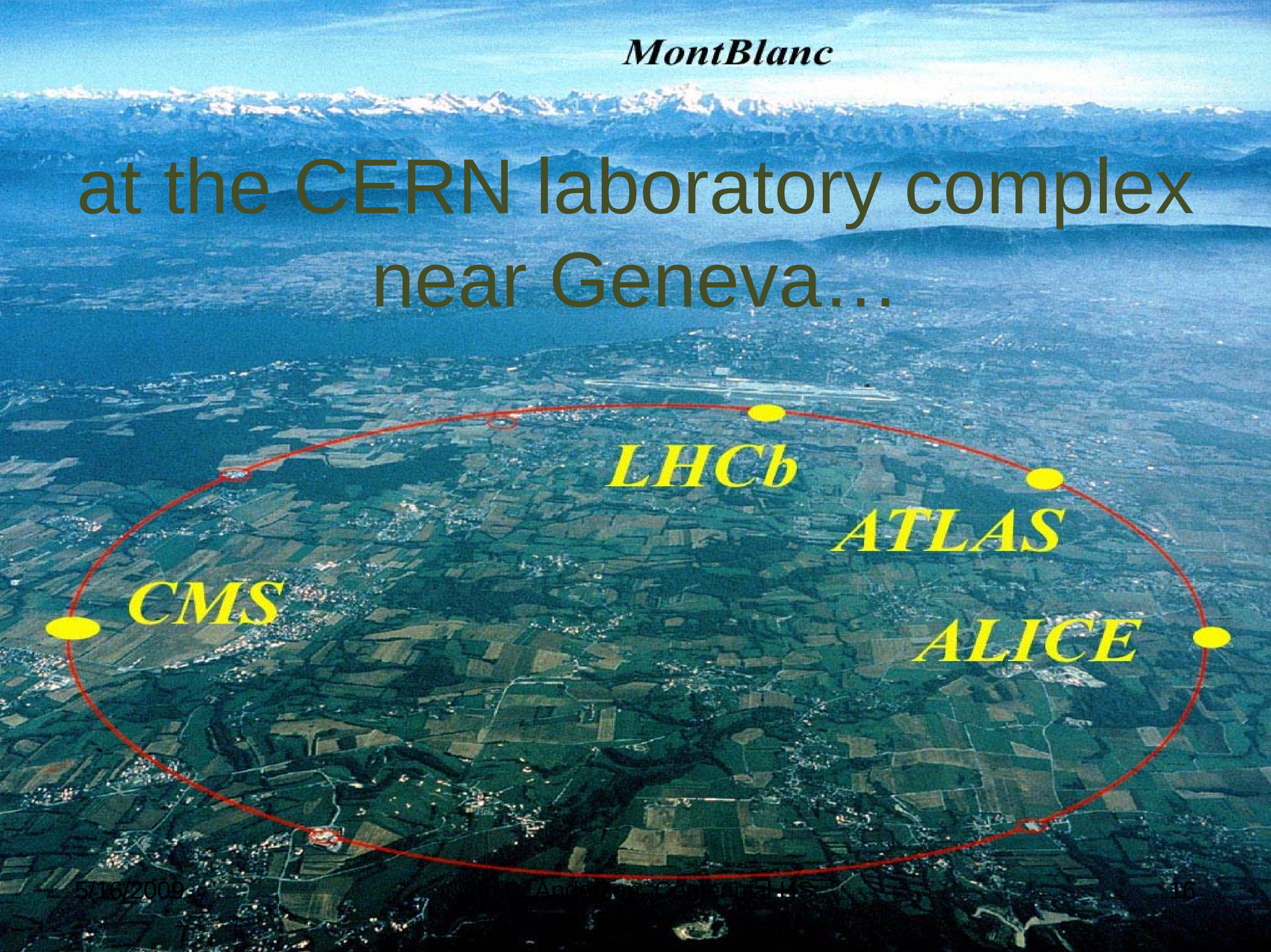
then continues to the Milky Way Galaxy….

enters the Solar System…

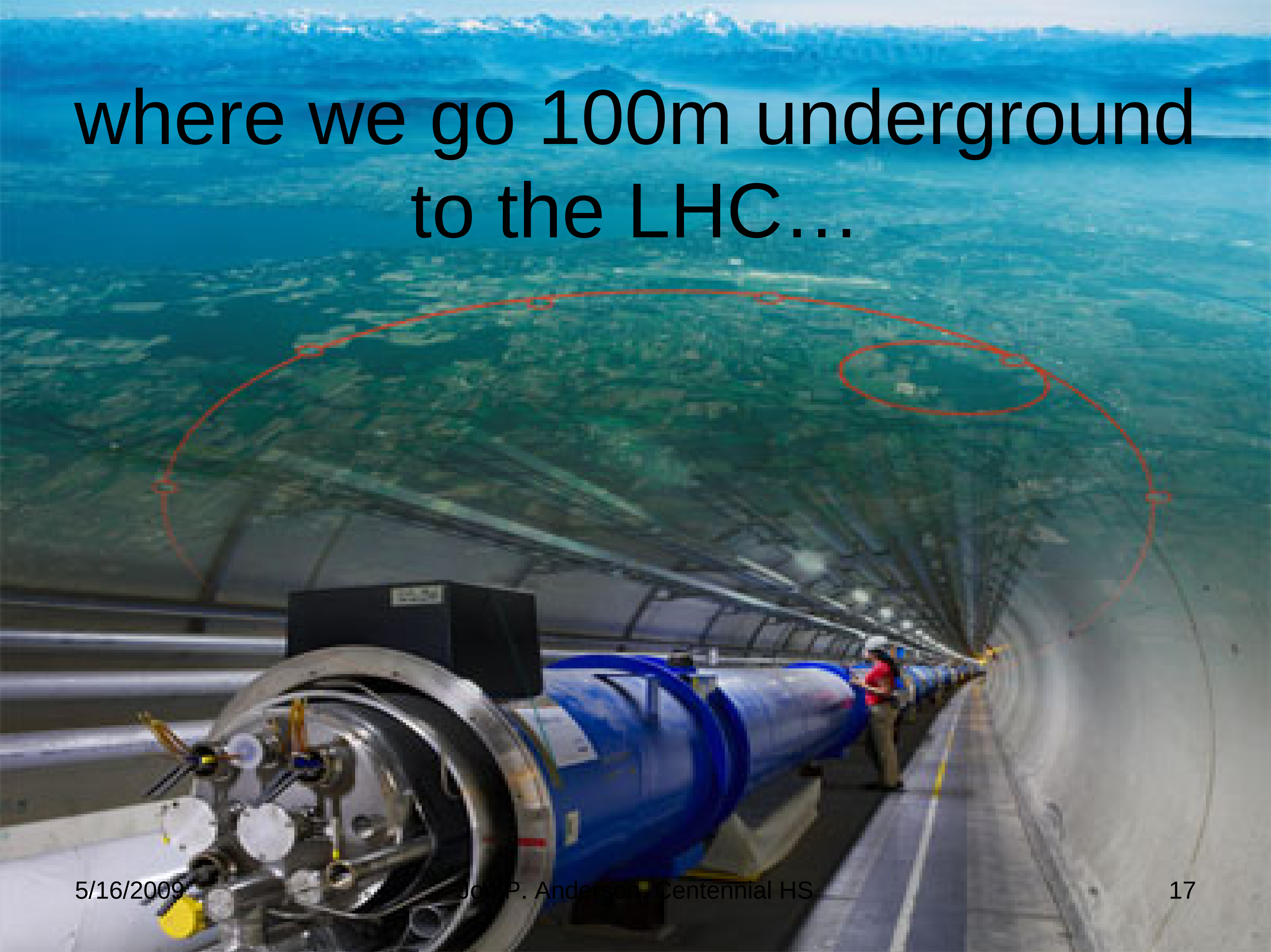
continues to the Earth…

and arrives in Switzerland…

at the CERN laboratory complex near Geneva…



where we go 100m underground to the LHC…



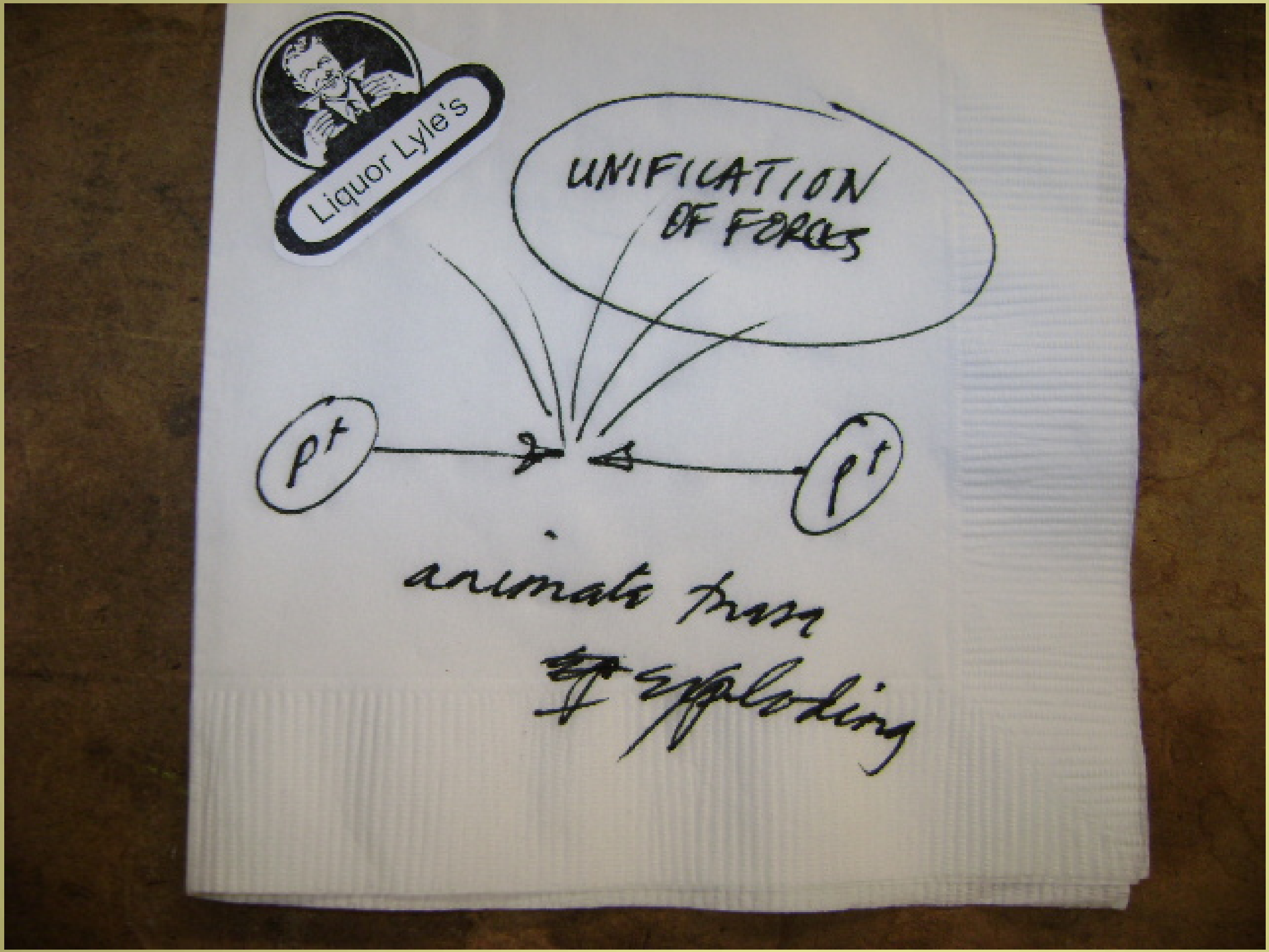
where the journey is far from over!

- It is actually here that the **REAL** journey begins.
- Every good journey needs a map and ours will follow this path and address these questions

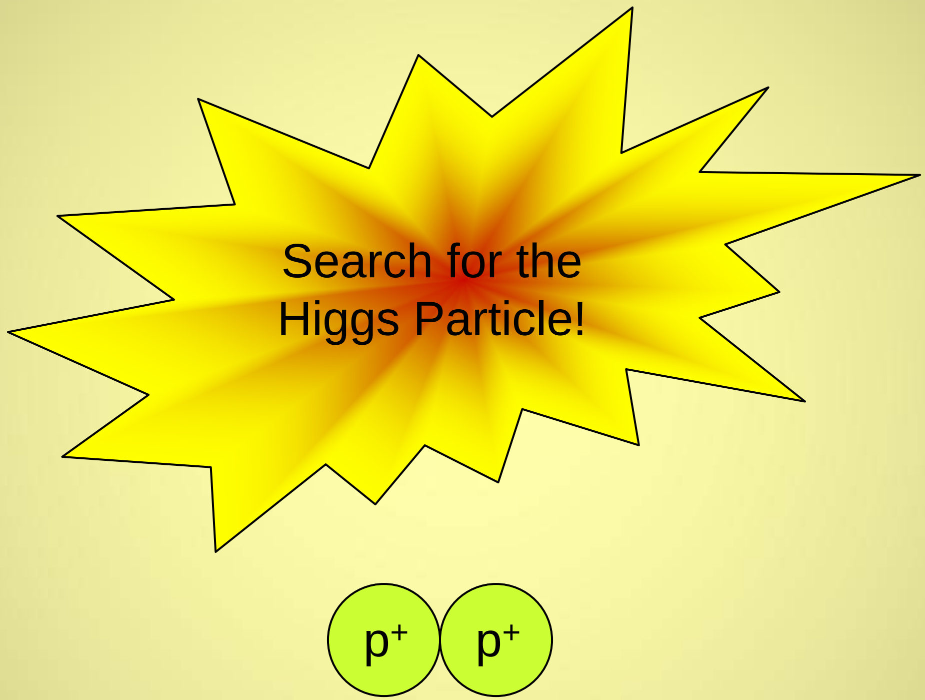
  1. How does the LHC work?→ 2. What can we learn about our world from the LHC?→ 3. How can the LHC help us learn about other physics?→ 4. What can we learn about the universe from the LHC?

Let the the **REAL** journey begin!

How (cont'd)



Example #2 led to slides such as this one


Search for the
Higgs Particle!
p+
p+

What (who) is the Higgs?

Yes, this is Peter Higgs and he did propose the existence of the Higgs boson.

Yes, this picture shows that he was found at CERN.

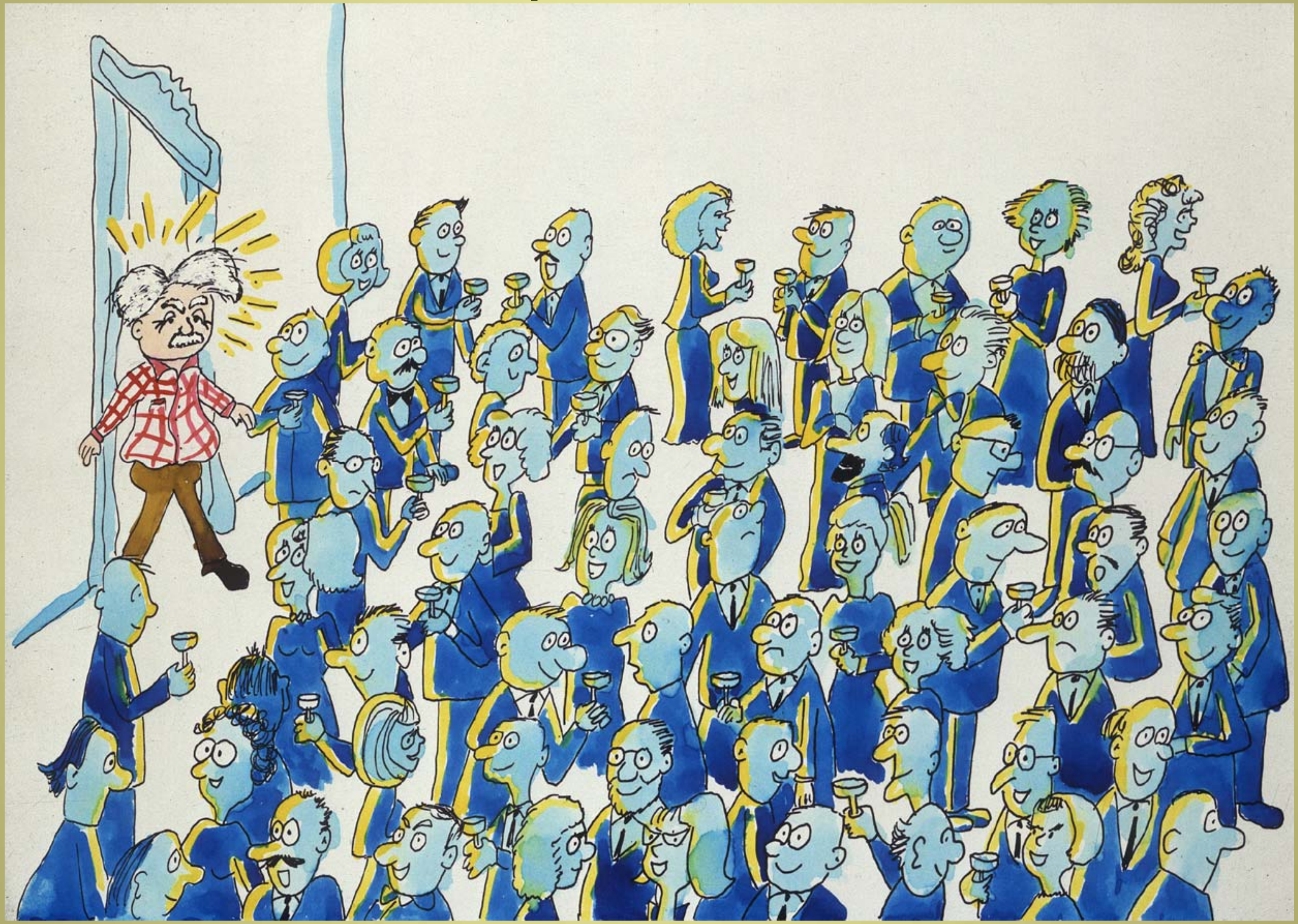
But, this is not the Higgs that is being sought at the LHC.

The Higgs boson in three easy slides

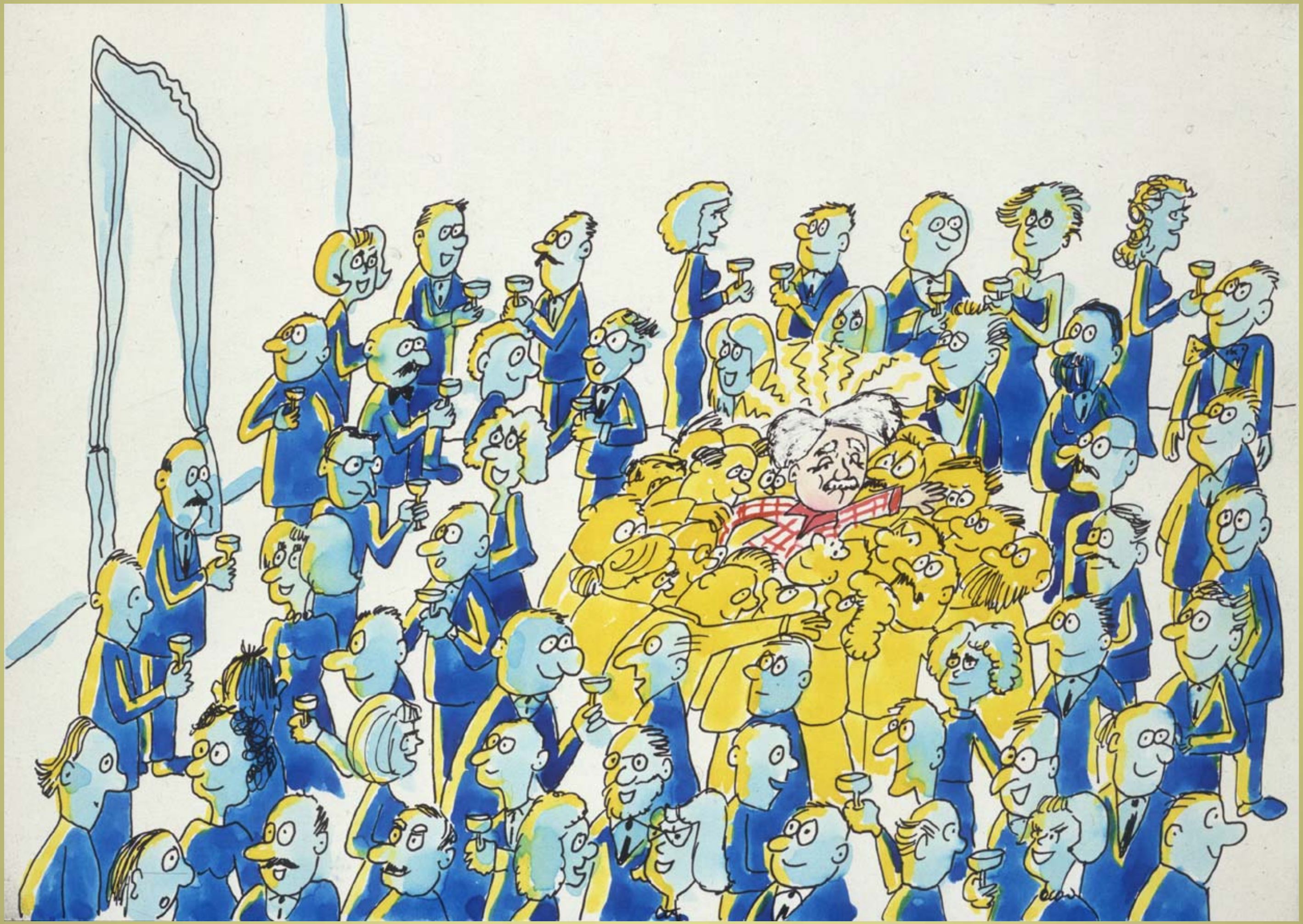
The next three slides are intended to illustrate what many physicists hope to find at the LHC. What's been called the "elusive Higgs boson" and the "God particle" can be described as the mechanism which extends the Standard Model to explain how particles acquire the properties associated with mass. The Higgs boson is the exchange particle in this field.

Roomful of people = scattered particles with mass

Famous person entering room = massive particle



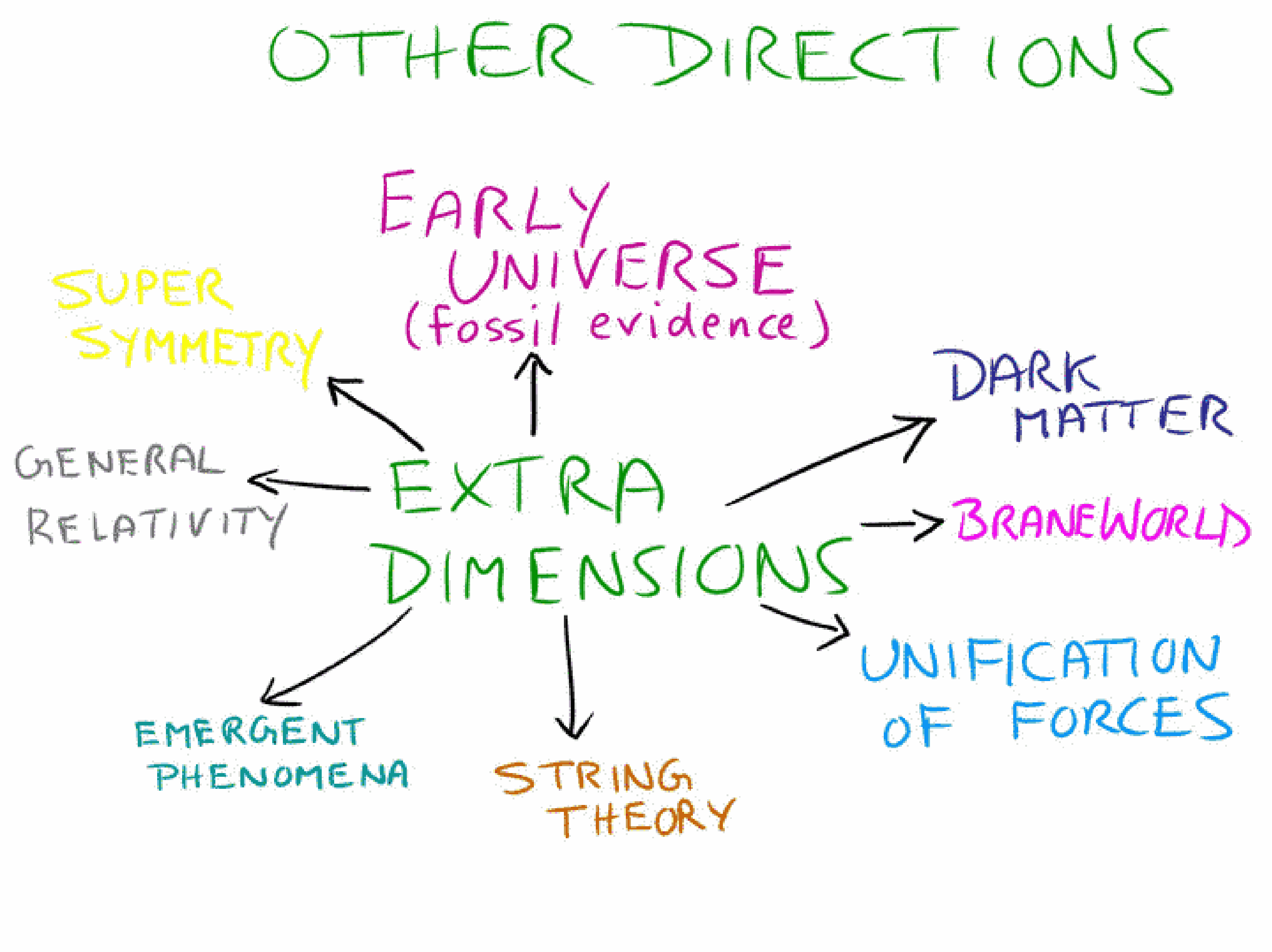
Swarm of people = group of particles = mass



More How

- Presentations and slides are posted at http://www.kitp.ucsb.edu/activities/teachers/ after the conference. These are a good source of review and information.
- Incorporate slides from conference presentations into your own presentation as appropriate
- Examples…

What can we learn about our world from the LHC?



Will it be possible to find the Higgs Boson?

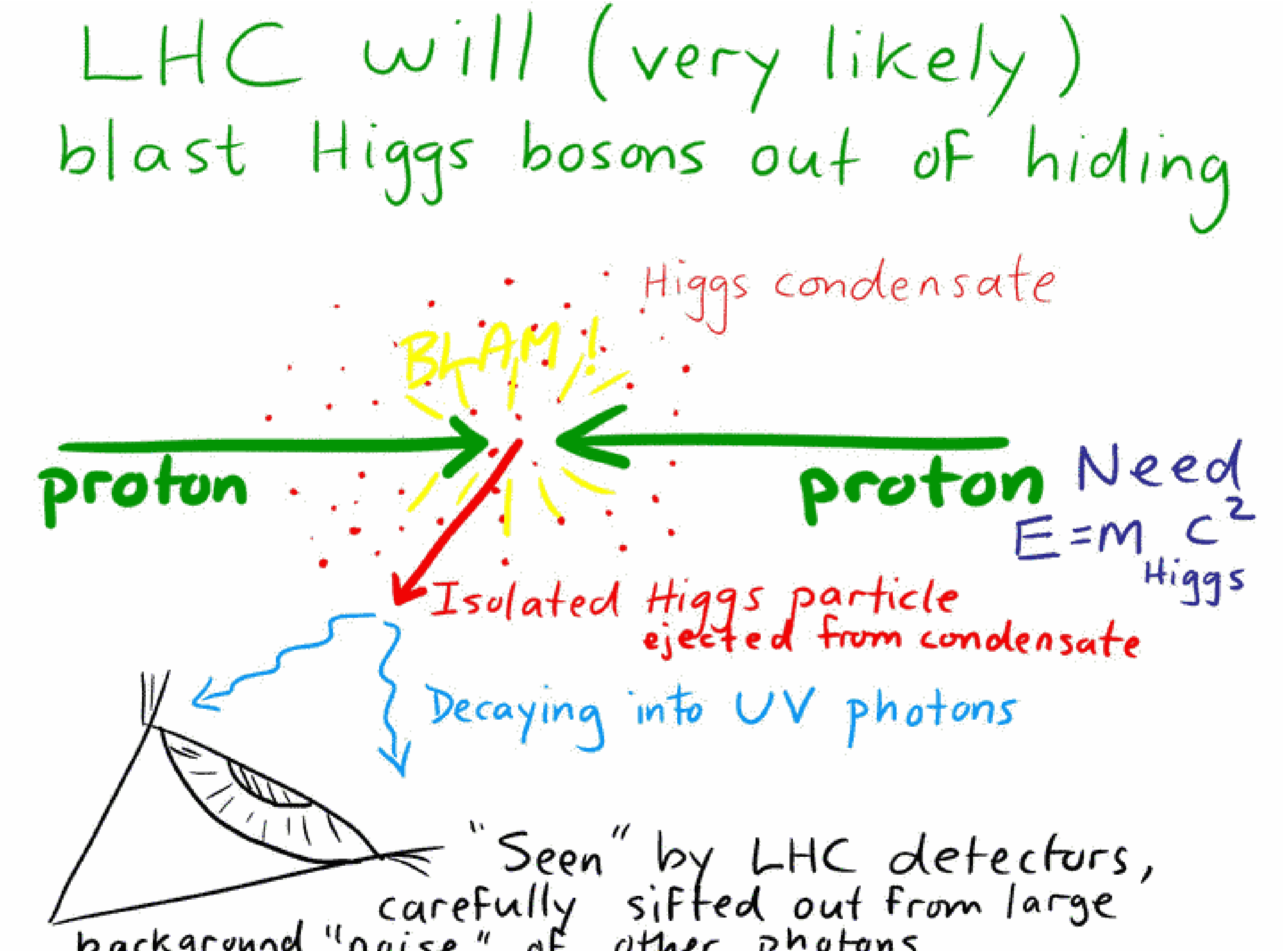
"STANDARD MODEL"

⇒ Elementary particles are fundamentally all massless, but "vacuum" is a rich bath ("condensate") of Higgs Bosons that

(a) is extremely difficult to detect, evading all tests for an aether etc.

(b) slow down elementary particles below light speed (so they acquire mass)

How will the Higgs boson be found?

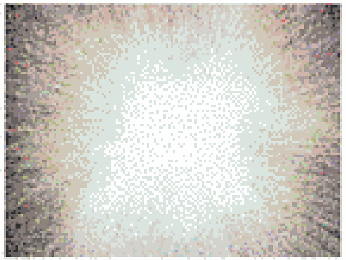


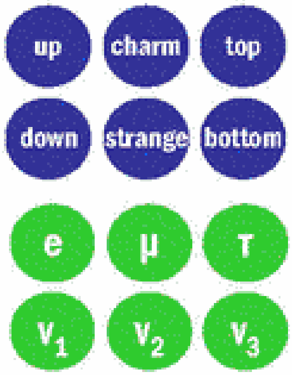
Even more How!

- Support slides with notes
  - o Provide additional background information on slide topic
  - o Provide resources for additional investigation of slide topic
  - o Written primarily with the teacher in mind as the primary audience of the notes.
  - o May be read in preparation or as part of the presentation

Where are Neutrinos Found?

- We should find neutrinos anywhere there are weak interactions!



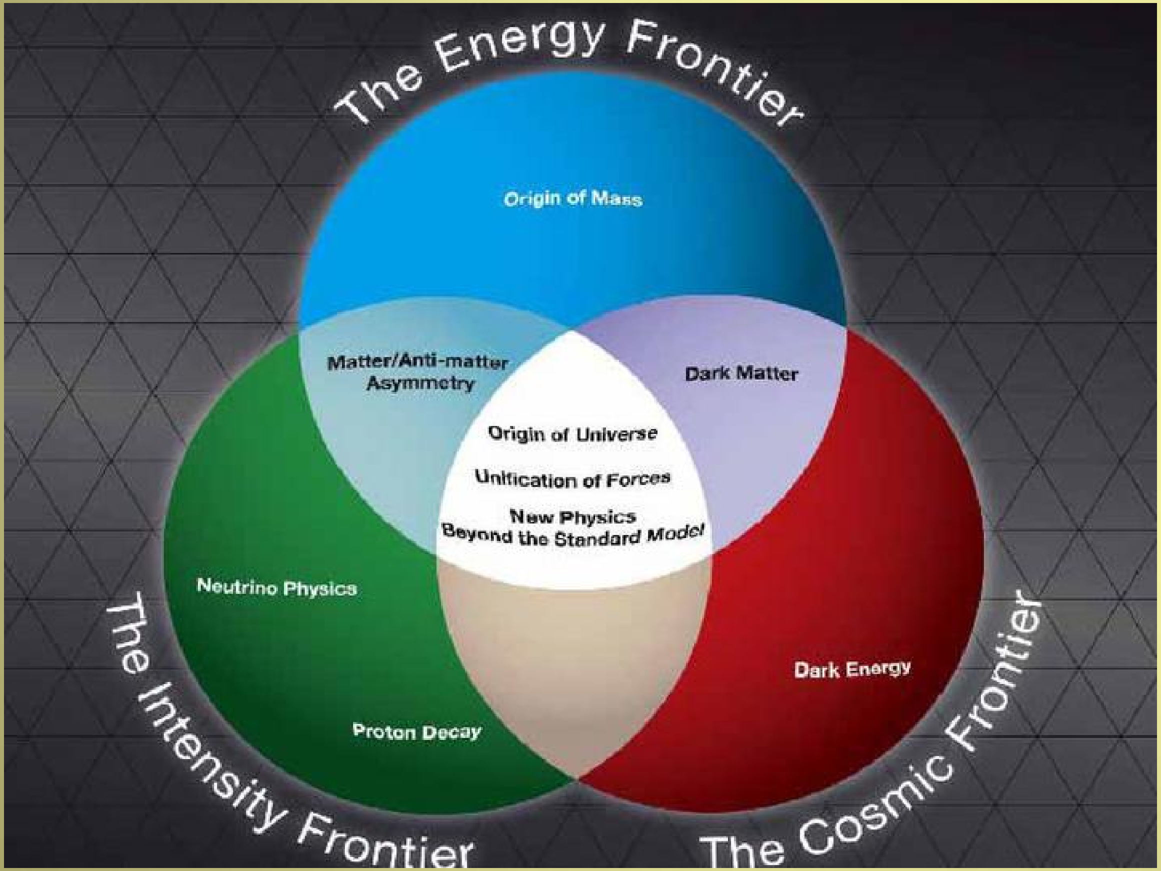


- The early Universe
  - Decays of heavy generations left a waste trail of 100/cm^3 of each neutrino species
  - They are (now) very cold and ***slow*** and hard to detect
  - But if they have even a very small mass, they are a significant part of the mass of the universe
    - as much as atoms, according to the latest results

Slide notes that accompanied previous slide

Here a discussion of neutrinos and neutrino sources could be initiated. Neutrinos are uncharged leptons that travel at nearly the speed of light. They are able to pass through most matter without leaving a trace. Because of this, they are extremely difficult to detect. Neutrinos are created by beta decay or nuclear reactions such as those that take place in the Sun, in particle accelerators, or when cosmic rays hit atoms. There are three types, of neutrinos: *electron neutrinos*, *muon neutrinos* and *tau neutrinos*; each type also has an antimatter partner, called an antineutrino. Interactions involving neutrinos are generally mediated by the weak force. Most neutrinos passing through the Earth were created in the Sun, and more than 50 trillion solar electron neutrinos pass through the human body every second. For information on how neutrinos are detected, see: http://minerva.fnal.gov/ and http://www-numi.fnal.gov/. These links will take you to the MINERvA and MINOS sites. Both are neutrino detectors.

Multiple overlapping frontiers can provide even more answers



I like this slide! This takes the classic diagram of the mixing of the primary colors of light and frames it in terms of explorations at the frontiers of particle physics. It does an excellent job of summarizing the different fields of study in particle physics and how they all work both independently and in harmony.

Why?

- Opportunity to think about and synthesize the physics that was presented at the conference.
- Opportunity to develop curriculum related to the physics from the conference.
- Prize $!
- Opportunity to develop something that can be used by the larger community of physics teachers.
- Personal satisfaction
- Recognition for school and physics program at school.

Kavli Institute for Theoretical Physics

Second Prize

is hereby granted to:

Jon Anderson

for the best secondary school science class presentation

in the 2008 Raab Contest

Granted: November 26, 2008

David Gross, Director

KAVLI INSTITUTE FOR THEORETICAL PHYSICS

UNIVERSITY OF CALIFORNIA
SANTA BARBARA, CALIFORNIA [illegible]
http://www.kitp.ucsb.edu

TELEPHONE: [illegible]
TELEFAX: [illegible]
gross@kitp.ucsb.edu

November 25, 2008

Jon Anderson
Department of Physics and Astronomy
Centennial Senior High School
4757 North Road
Circle Pines, MN 55014

Dear Jon:

I am delighted to inform you that your physics presentation, "Particle Physics in the Age of the Large Hadron Collider (LHC)," has been awarded the second prize of the *Simon and Diana Raab Prize* for the 2008 KITP Teachers' Conference. We are proud to host it on the institute's web site at http://www.kitp.ucsb.edu/kitpnews/files/raab/presentation_anderson.pdf.

Congratulations on creating a valuable and well-crafted presentation, which we hope will have national impact as a teaching tool for your peers. I am sure that you will continue to provide inspiration to your students and to physics teachers unable to attend our annual meetings. I look forward to seeing you at future Teachers' Conferences at the KITP.

Sincerely,

David Gross
Director
Frederick W. Gluck Professor of Theoretical Physics

a school of the institute of technology
school of physics & astronomy

News Room

Anderson wins prize for presentation

Jon Anderson (Right) teaches a physics for elementary teachers class.

Alex Schumann

Jon Anderson, PhysTEC Teacher in Residence, has won second prize from the 2008 Kavli Institute for Theoretical Physics Teachers Conference for the best presentation by a secondary school teacher on the subject of Particle Physics in the Age of the Large Hadron Collider.

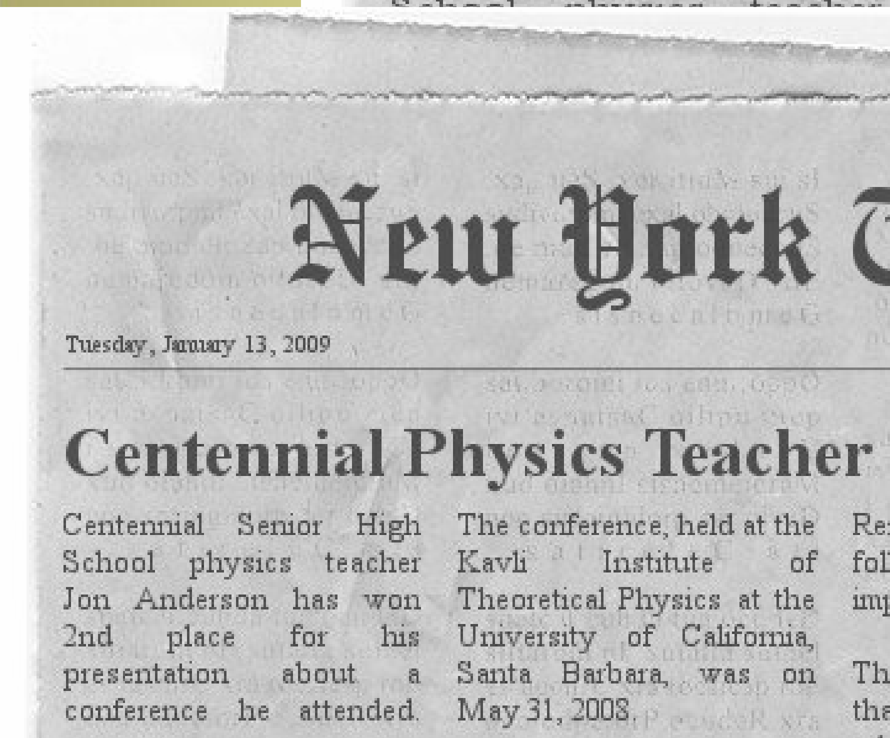
Anderson won $2,500 for his presentation. It can be viewed online at the Institute's website.

Posted Monday, November 10th 2008 by Jenny Allan

Wednesday, December 17, 2008

Centennial P

Centennial Senior High



Tuesday, January 13, 2009

Centennial Physics Teacher

Centennial Senior High School physics teacher Jon Anderson has won 2nd place for his presentation about a conference he attended.

The conference, held at the Kavli Institute of Theoretical Physics at the University of California, Santa Barbara, was on May 31, 2008.

When?

- Start today! Write down ideas and concepts that interest you, that you want to incorporate into your presentation, and that you want to research further.
- Take on interpreter role. What was presented and how will it work with your target audience?…you're the expert here!
- Finish the school year!
- Note the KITP deadline