

A wide-angle photograph of an Antarctic research station. The foreground is a vast, flat expanse of snow and ice, marked with numerous tracks from vehicles. In the middle ground, there are several large, cylindrical and rectangular structures, likely part of the IceCube telescope array. To the right, a large, white, four-engine aircraft is parked on the ice. The background shows a clear blue sky with a bright sun in the upper left corner, creating a lens flare effect. The overall scene is desolate and cold.


Live from IPY'09: IceCube In-Ice Antarctic Telescope

Casey O'Hara
12/11/2009



Wimba Classroom - Arctic Research Consortium of the United States (ARCUS)

WELCOME TO WIMBA



ARCTIC RESEARCH CONSORTIUM OF THE UNITED STATES

Connection strength: [Signal strength icon]

TALK [Microphone icon]

Options [Settings icon]

Exit - Lobby - Help

Chat window:
You have entered the lobby.
You have entered 'Arctic Research Consortium of the United States (ARCUS)'.
Your media format is WimbaMedia.
You say, "I'm going to change the slide momentarily- to show the one I need for my new screen shot?"
To: Main Room

People (3)	
Kristin_Timm	[Mute] [Unmute]
kristina_creek	[Mute] [Unmute]
Kristin_Timm	[Mute] [Unmute]

Raise your hand to ask a question

List of all participants

Return to the lobby or exit

Slides will be shown here

If using VOIP, press and hold here to talk

Your connection strength

'Chat' with one person or the entire group

Please note:

- Participant using the telephone can mute/unmute by pressing *6 on the phone.
- Today's event will be recorded and archived.

Roll Call

When called, please state your:

- ✓ Name
- ✓ School / Institution
- ✓ The number of students participating with you in the same location



International Polar Year (IPY)

The International Polar Year (2007-2009) is an exciting scientific campaign focusing on the world's polar regions!

IPY is a time for discovery, science, learning, and awareness about the polar regions with activities for youth, scientists, and the public.

www.ipy.org



What is PolarTREC?

PolarTREC is a professional development experience in which K-12 teachers are paired with researchers in authentic polar research experiences.

In the next three years over 40 teachers from around the United States will join scientists in the Arctic and Antarctica in celebration of the International Polar Year!

www.polartrec.com

About the Pole

- Quick facts about the South Pole
 - Located at 90° South Latitude
 - 9300 feet elevation
 - 24 hours of daylight in austral summer (24 hours of night all winter)
 - Average temperature mid-summer -25°C (-12°F)
 - Average temperature mid-winter -65°C (-85°F)

About the Pole

- Two “poles” at the South Pole
 - The geographic pole, around which the earth rotates
 - Since the ice moves about 9m a year, they re-plant the pole marker each January 1st.
 - The ceremonial pole, in front of the station, with flags of all the signatories of the Antarctic Treaty around it.

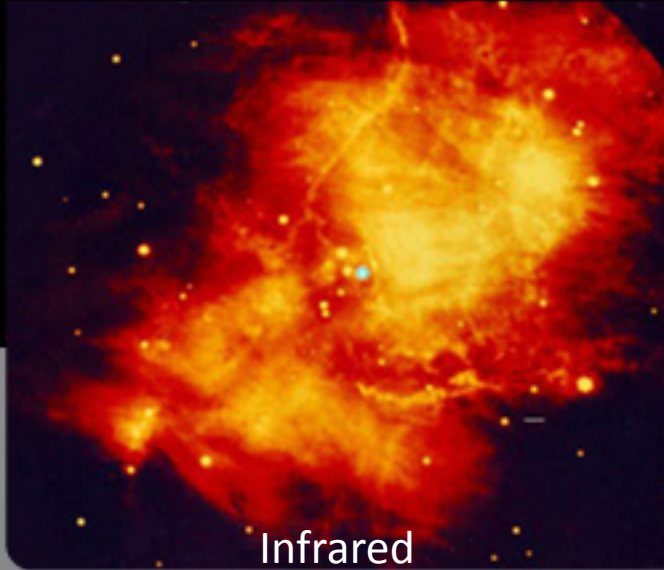


IceCube Neutrino Observatory

- What are Neutrinos?
 - Subatomic particles, like an electron with no electric charge
 - Passes through ordinary matter (atoms) except on rare occasions
 - Carry information from cosmic events
- IceCube is searching for “point sources” of neutrinos in the universe
- Why?

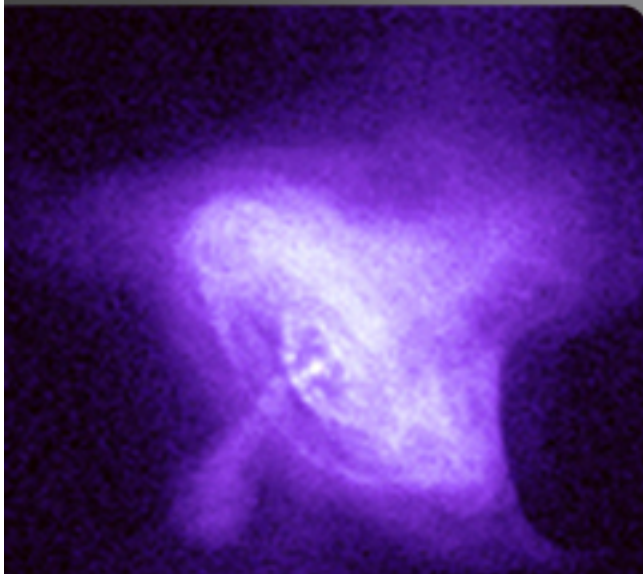


Visible Light



Infrared

Four views of the
Crab Nebula



X-Rays



Neutrinos?

Different ways of
looking at the
universe give us new
information and ideas

How does IceCube work?

- View my introductory animation...
- Rarely, neutrinos interact with a proton or neutron in an atom...
- This creates a muon, which continues in same direction...
- As that muon passes through a clear medium (like ice!) it leaves a trail of light that can be detected.
- IceCube uses the 3-km-thick South Pole ice as a medium and very sensitive light detectors called DOMs.

Detecting a Neutrino

1. Neutrino at near light speed



2. Neutrino hits proton



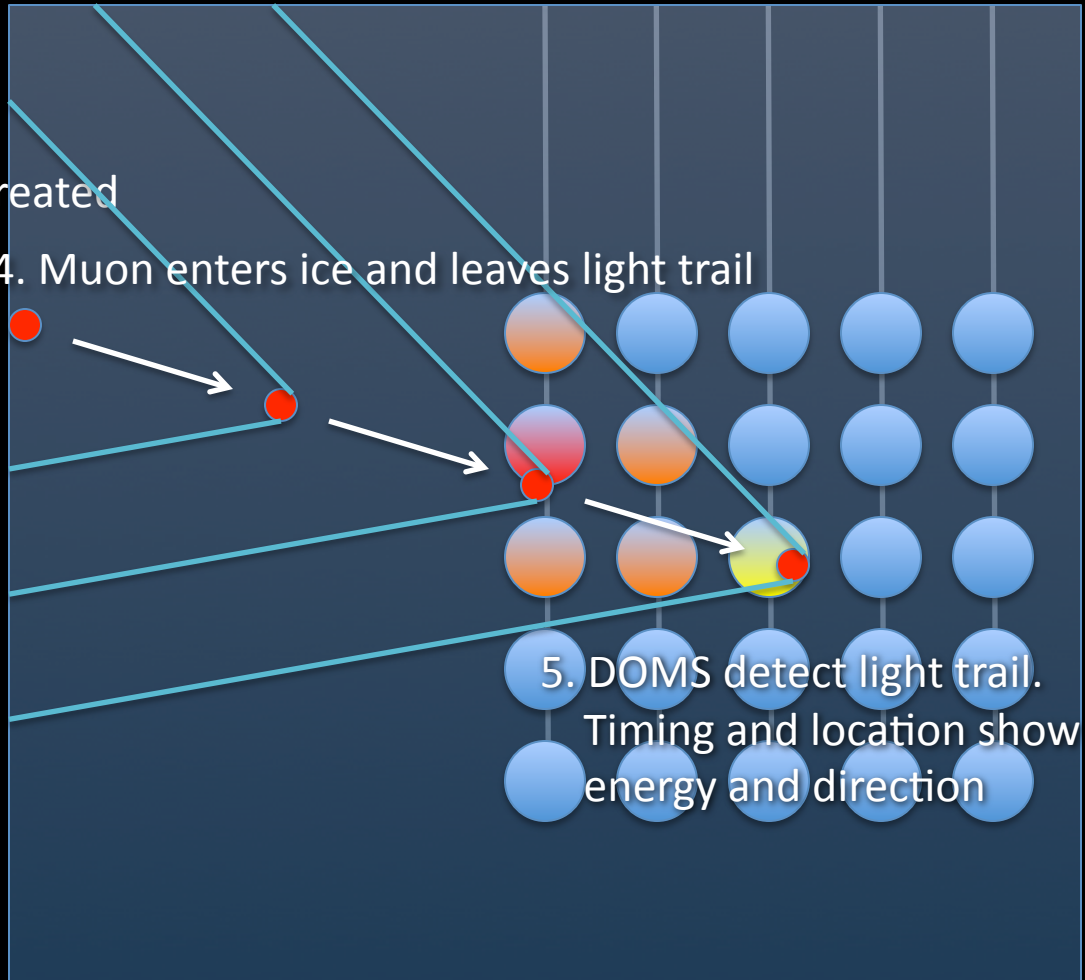
3. Muon is created



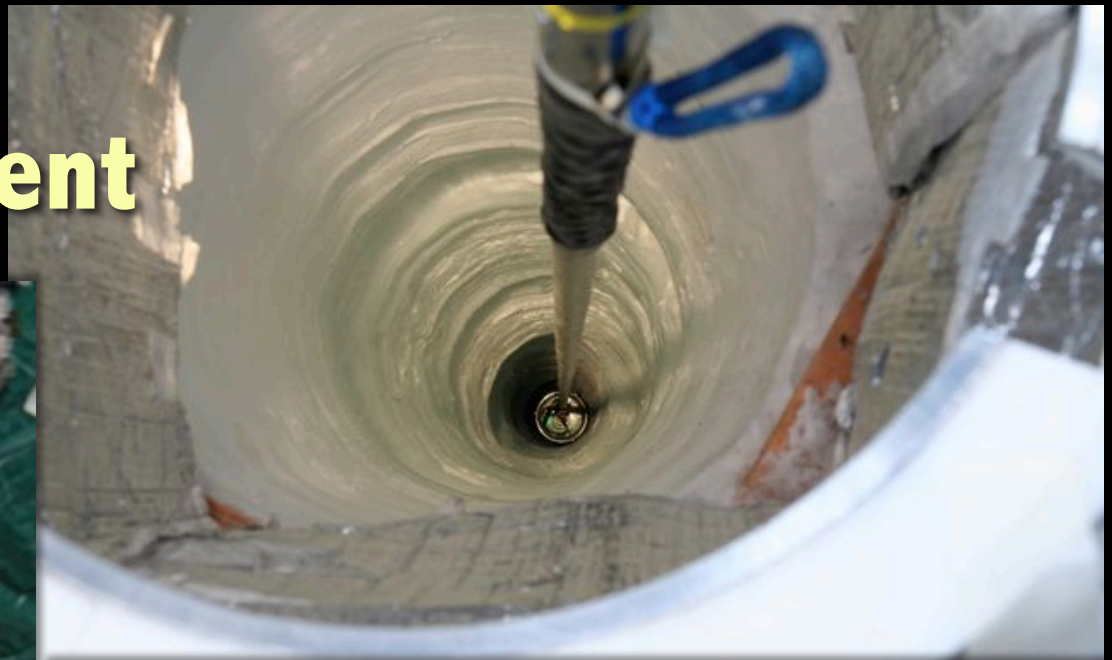
4. Muon enters ice and leaves light trail



5. DOMS detect light trail.
Timing and location show
energy and direction



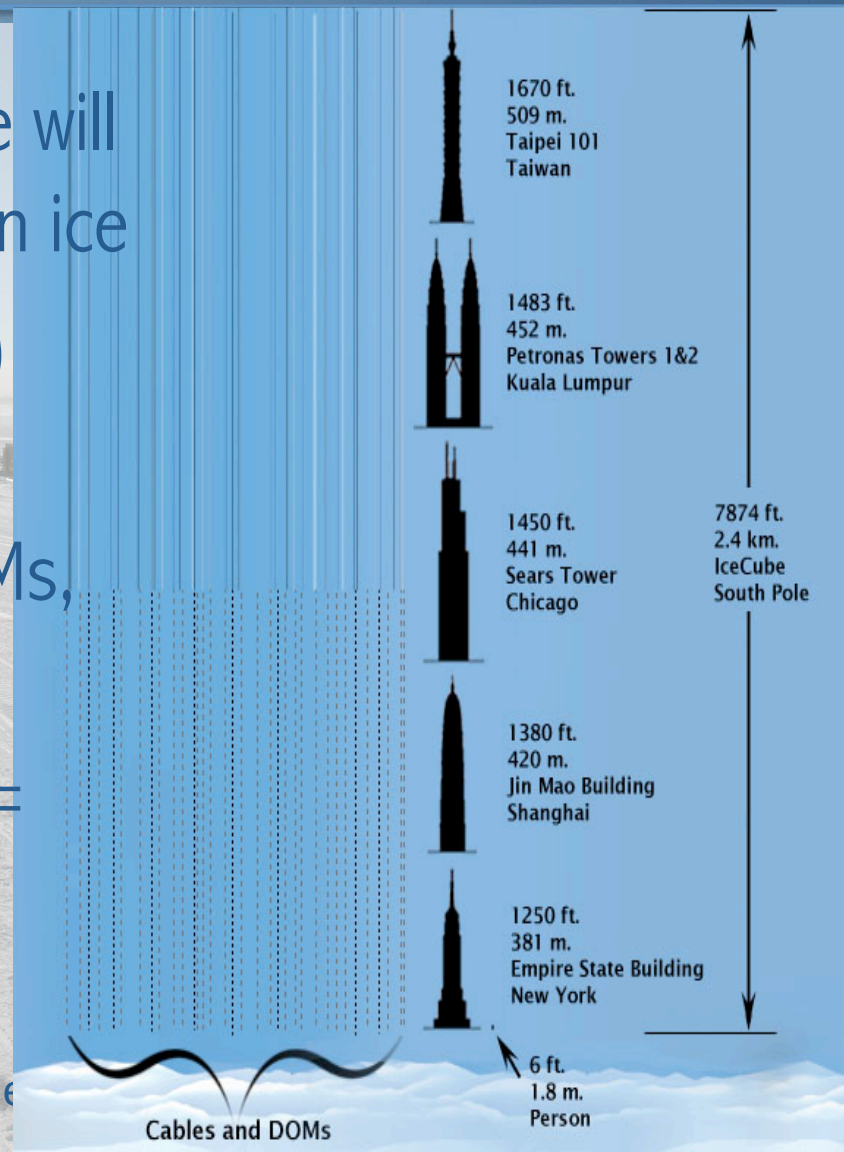
DOM deployment



IceCube Overview

- When completed in 2011, there will be 86 strings of DOMs buried in ice
- Each hole is 2.5 km (1.5 miles) deep!
- The bottom 1 km holds 60 DOMs, spaced out 17m apart
- 86 holes, each with 60 DOMs = more than 5000 DOMs!

www.polartrec.com IceCube In-Ice Antarctic Tele



IceTop Cosmic Ray detector

- IceTop array detects cosmic rays
 - Protons, helium nuclei, other space junk
 - Hits atmospheric atoms and creates showers of muons, protons, more junk
- DOMs embedded in surface ice detect the debris from cosmic rays just like they detect muons from neutrinos

IceTop Deployment



IceTop Deployment



IceTop and IceCube

IceTop looks for cosmic ray showers from above

Surface tanks: IceTop DOMs (red dots)

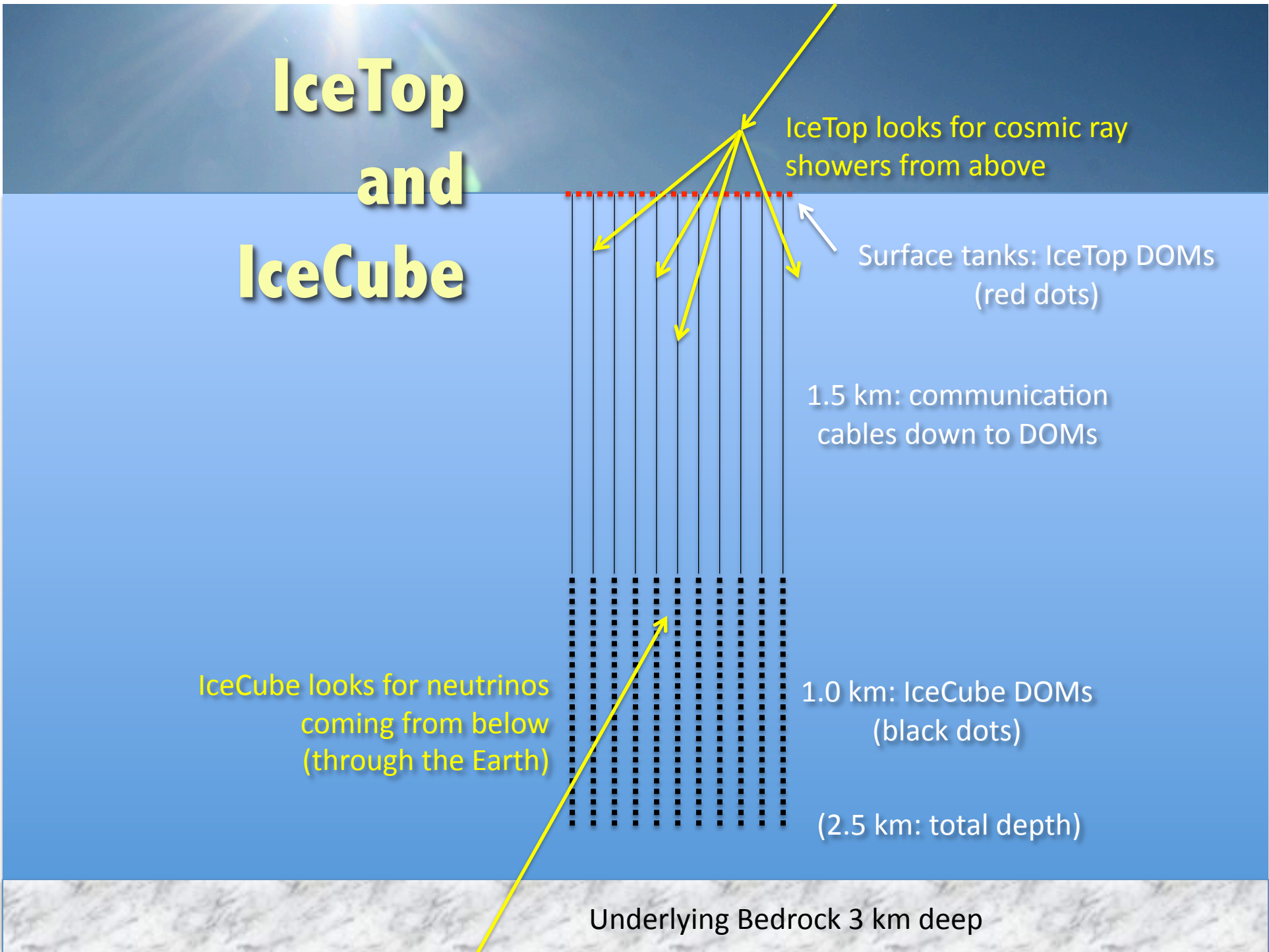
1.5 km: communication cables down to DOMs

IceCube looks for neutrinos coming from below (through the Earth)

1.0 km: IceCube DOMs (black dots)

(2.5 km: total depth)

Underlying Bedrock 3 km deep



Other South Pole Research

- SPT (South Pole 10-Meter Telescope)
 - 10 meters across (33 feet!)
 - Detects cosmic microwave background (CMB) radiation from the Big Bang
 - They search for “dips” in CMB that relate to galactic clusters blocking out the CMB
- BICEP (Background Imaging of Cosmic Extragalactic Polarization – no wonder they made an acronym!)
 - Searches for same basic thing, except they filter data differently
 - By filtering data, they hope to get better resolution but in a narrower field

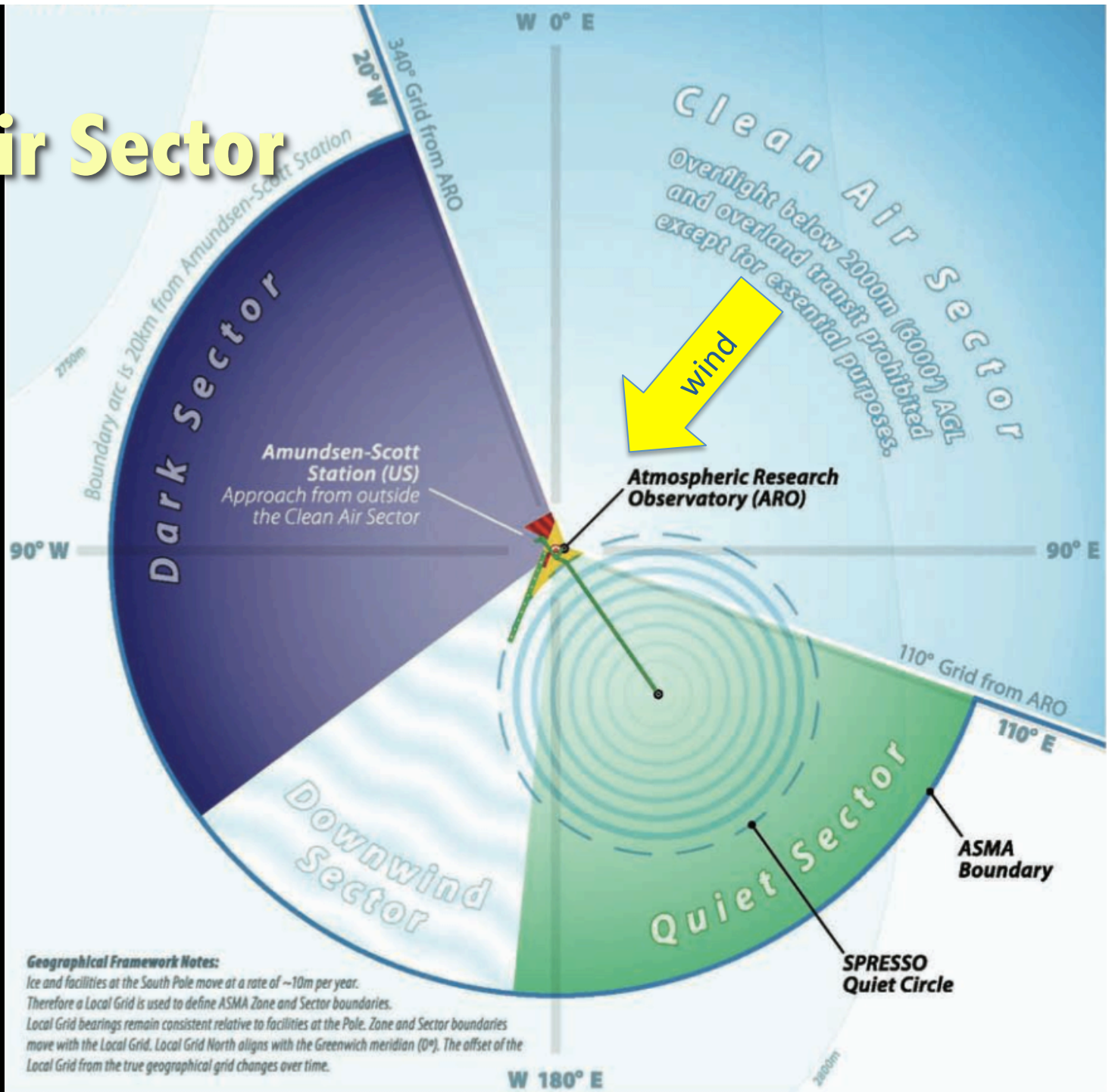
South Pole Telescope



Other South Pole Research

- Atmospheric Research Observatory
 - Part of NOAA (National Oceanic and Atmospheric Administration)
 - Studies air composition and pollutants
 - CO₂, other greenhouse gases (N₂O, CH₄, SF₆, etc)
 - Ozone layer and things that damage it
 - South Pole: cleanest air in the world!
 - They compare their air to other stations around the world to help with climate change research

Clean Air Sector



Side Experiments

- How does extreme environment affect me?
 - Homeostasis: blood pressure, heart rate, temperature
 - Reaction time
 - Beard growth rate
- Making ice cream: Yummy?
- Read my journals for videos and data sets

Life at the Pole

- Food? Yes, they have it!
 - Galley serves 4 meals a day (including MidRats)
 - Freshies weekly during summer
 - Everything else? Frozen months in advance!



Teles

Life at the Pole

- Fun? Yes, they have it!
 - Game rooms: pool, foosball
 - Gyms and weight rooms: yoga, soccer, pilates, basketball
 - Lounges, book libraries and DVD “rentals”
 - Music room
 - All kinds of instruments
 - Many bands play for special events
 - Sauna, growth room, arts and crafts, SPIFF, trivia night
 - Kiteboarding, off-base excursions

South Pole recreation



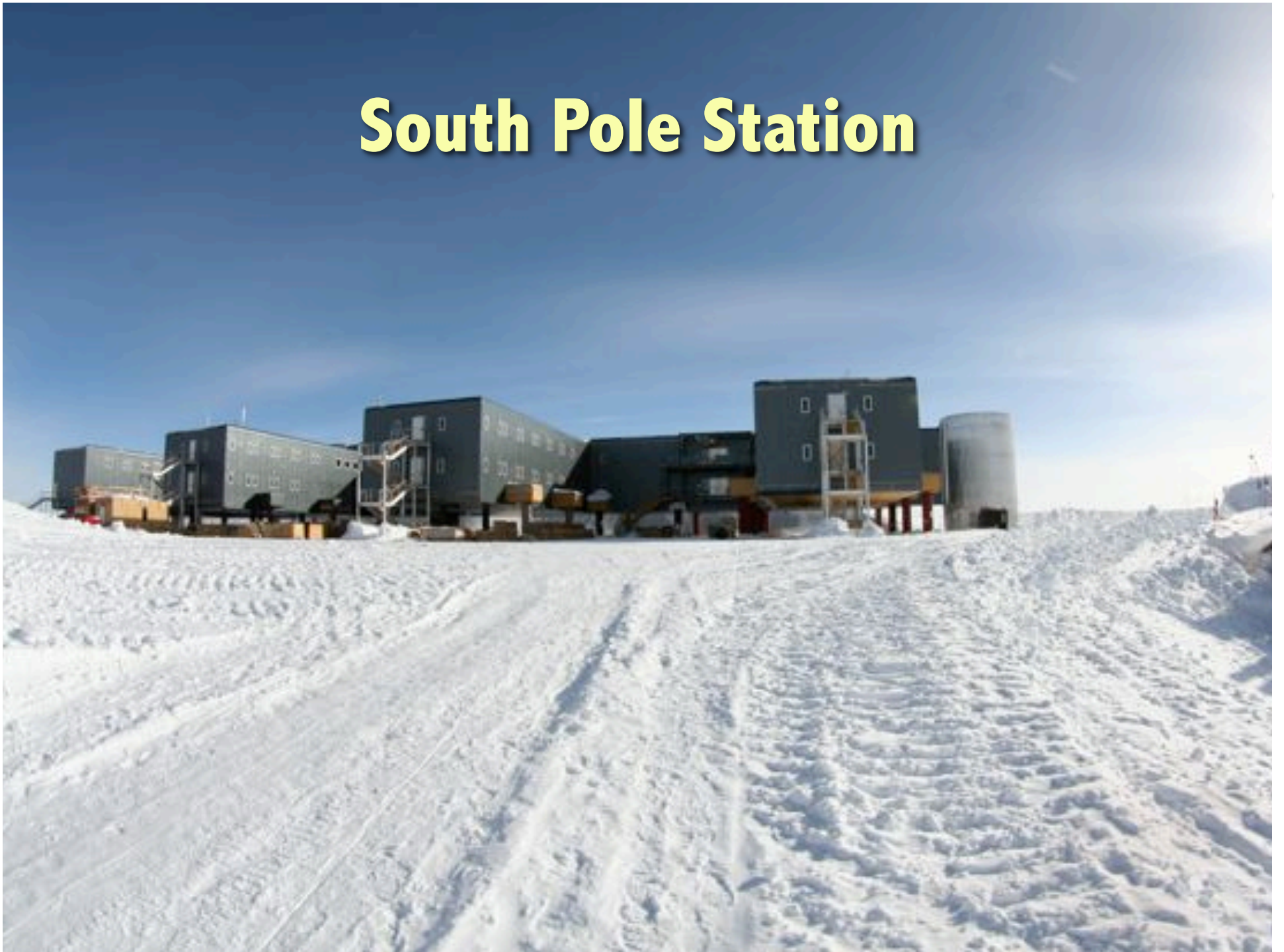
Life at the Pole

- Resources? No, they fly it in and conserve it!
 - \$30/gallon for fuel
 - Electricity, water (esp hot water)
 - Water conservation: 2-minute showers, twice a week
 - Also: 1 load laundry/week
 - Exceptions: drinking water and hand-washing
 - All waste products are supposed to be sent back to US for disposal
 - Recycling: paper, plastic, glass, food, non-sterile, light & heavy ferrous metal, non-ferrous metal, and so on... to non-recyclable

C-17 "Herc"



South Pole Station



The Dome



Spoolhenge



Halos and Sundogs



South Pole makes you go crazy?

“It’s a harsh continent...”

- Questions?





Live from IPY!

Register for Upcoming Live Events at :
www.polarartrec.com!

Thank You!

The archive of this event will be available shortly at: www.polartrec.com!

If you have further questions, please contact us at:
info@polartrec.com or call 1-907-474-1600

