Cathay September 2018

www.cathayradio.org

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Mission: The Cathay Amateur Radio Club is basically an active social club of Ham Radio Operators and their spouses. We support local community requests for HAM emergency communications. Several of us are trained in CPR/ First Aid and are involved with community disaster preparedness.

Monday Night Net Time: 9 PM Local Time/PST,
Repeater: WB6TCS - RX 147.210, TX 147.810, Offset +0.6 MHz, CTCSS/Tone PL100 Hz

Please note: Repeater: N6MNV UHF 442.700 Mhz, Offset +5MHz, CTCSS/Tone PL 173.8 Hz in South San Francisco is cross linked every Monday Night Net at 9 p.m. to WB6TCS 2 meter repeater.

The CARC Monday night net is the best way to find out the latest club news. All check-ins are welcome.

Message from the President: George Chong, *W6BUR*

Hello CARC Members and Friends;

Many thanks to Mr. Denis L. Moore – WB6TCS for the use of his repeater for our CARC Monday Night Net.

Tech Article Introduction

After many years of work and waiting, the first ever detection of neutrinos identified from the point of origin in another galaxy has been detected.

A neutrino is a subatomic particle that has no charge and nearly massless. They typically pass through normal matter unimpeded and undetected. For those reasons it is been nicknamed: “The Ghost Particle”.

Neutrinos are the result of nuclear fusion and come in three flavor based upon the associated/related particle:

- electron neutrino   associated particle Electron
- muon neutrino   associated particle Muon, a heavier version of an electron
- tau neutrino   associated particle Tau, the heaviest version of an electron

The existence of Neutrinos was first postulated in 1931 by physicist Wofgang Pauli to account for the apparent loss of energy and momentum that he observed when studying radioactive beta decays. It wasn’t until 1959 that American physicists Clyde Cowan and Fred Reines finally found a particle that fit the description of the proposed neutrino by studying the particles created by the Savannah River nuclear power plant near Augusta, Georgia.

Everyday trillions of neutrinos traveling at the speed of light from our Sun literally pass through the earth with little interaction. So just being able to detect a small number of neutrinos from the cosmos has been a huge scientific challenge.

Electron neutrinos from the sun were not detected until 1968 with a detector placed at the underground 4,800ft level which was near the bottom of the Home Stake mine in Lead, S.D. It was necessary to place the detector deep in the mine to prevent stray comic radiation from giving a false reading.

In February 23, 1987 Super Nova 1987A in the Large Magellan cloud on the edge of the Milky Way Galaxy; the first burst of neutrinos from beyond our solar system was observed at three earth bound neutrino observatories. Those three neutrino observatories were: the Kamiokande II detector in Japan, the Irvine-Michigan-Brookhaven (IMB) detector in Ohio, USA and the Baksan Neutrino Observatory in Russia.

Now that you have been filled in on the background of the elusive neutrinos aka “The Ghost Particles”, please read the Tech Article on the recent discovery of a neutrinos emanating from a another galaxy.

Ham Tech Session Introduction

Edison Fong – *WB6IQN* is hosting his annual Ham Tech Session in Sunnyvale from 12-3pm on Saturday September 8, 2018. This HAM Tech Session will be well attended because it will be a HAM Radio Performance Evaluation.

Bring your portable HAM Radio and see how it compares to other commercially available Ham Radios

This event is open to all HAMs, guests, and interested parties. Free lunch will be provided along with a special learning/educational session that will be concluded with a fun raffle that you should not miss.

For more details, please read the **Ham Tech Session** that is in this newsletter.

CARC Final Wrap-up News

I wish to thank our CARC members that set aside their valuable time to participate in our Monday night's nets.

Chat sub s'em to all you CARC members!   - George W6BUR.

Public Service Announcements

HAM CRAM / HAM Licensing

For upcoming HAM Licensing locations please refer to:
http://www.arrl.org/find-an-amateur-radio-license-exam-session

Auxiliary Communications Service (ACS)

The Auxiliary Communications Service (ACS) was organized by the San Francisco Office of Emergency Services (OES) following the 1989 Loma Prieta Earthquake to support the communications needs of the City and County of San Francisco when responding to emergencies and special events.

The Auxiliary Communications Service holds General Meetings on the third Tuesday of each month at the San Francisco Emergency Operations Center, 1011 Turk Street (between Gough Street and Laguna Street), from 1900 hours to 2100 hours local time. All interested persons are welcome to attend.

The ACS Net begins at 1930 hours (7:30 p.m.) local time each Thursday evening, on the WA6GG repeater at 442.050 MHz, positive offset, tone 127.3 Hz. The purpose of this net is to practice Net Control skills, practice checking in with deployment status in a formal net, and to share information regarding upcoming ACS events. Guests are welcome to check in. ACS Members should perform Net Control duty on a regular basis. On the second Thursday of each month, the net will be conducted on the output frequency of the WA6GG repeater, 442.050 MHz no offset, tone 127.3 Hz, simplex.

For more information, please attend an ACS meeting or check in on a net, or call 415-558-2717.

Upcoming meetings: Tuesday 7pm, September 18, 2018
Tuesday 7pm, October 16, 2018
Tuesday 7pm, November 20, 2018

Gilbert Gin (KJ6HKD)

Free Disaster Preparedness Classes In Oakland:
http://www.oaklandnet.com/fire/core/index2.html

CORE is a free training program for individuals, neighborhood groups and community-based organizations in Oakland. The underlying premise is that a major disaster will overwhelm first responders, leaving many citizens on their own for the first 72 hours or longer after the emergency.

If you have questions about the recertification process, you may contact the CORE Coordinator at 510-238-6351 or core@oaklandnet.com.

Free Disaster Preparedness Classes In San Francisco – NERT Taught by San Francisco Fire Department (SFFD).

http://sf-fire.org/calendar-special-events

Upcoming events

September

8	2MCM Ham Radio practice
12	NERT Quarterly
15	NERT Training Day - Third Saturday
29	SFPD ALERT

October

13	2MCM Ham Radio practice
20	NERT Citywide Drill, NERT graduates and victims needed

November

7	NERT Quarterly Meeting – All NERTs Welcome
10	2MCM Ham Radio Practice Spreckels Lake in Golden Gate Part – no RSVP Needed
17	NERT Training Day – Third Saturday

RSVP to sffdnert@sfgov.org or call 415-970-2024 to register.

***SFFD DOT** is the Fire Department Division of Training. All participants walking, biking or driving **enter through the driveway gate on 19th St.** between Folsom and Shotwell. Parking is allowed along the back cinderblock wall.

Visit ***www.sfgov.org/sffdnert*** to learn more about the training, other locations, and register on line. Upcoming Special NERT Events.

San Francisco Police Department: Auxiliary Law Enforcement Response Team (ALERT)

The Auxiliary Law Enforcement Response Team (ALERT) is a citizen disaster preparedness program designed. The ALERT program is for volunteers 16 years of age or older, who live, work, or attend high school in San Francisco.

Graduates of the San Francisco Police Activities League (P.A.L) Law Enforcement Cadet Academy are also eligible to join.

ALERT volunteers will first complete the Fire Department's Neighborhood Emergency Response Team (NERT) (www.sfgov.org/sfnert) training and then graduate into an 8 hour Police Department course specifically designed for ALERT team members.

ALERT members will work closely with full-time and/or Reserve Police Officers in the event they are deployed after a disaster. The Basic ALERT volunteer will have no law enforcement powers other than those available to all citizens.

SFPD ALERT Training

The next SFPD ALERT training class has been scheduled for Saturday September 22, 2018. The class will be held at the San Francisco Police Academy, in the parking lot bungalow, from 8am-5pm (one hour lunch break) on Saturday.

** Class dates indicated in red are only for new members who have not completed either SFFD NERT training or the SFPD Community Police Academy.

IMPORTANT- All participants must complete the background interview process in order to be eligible to attend the ALERT training class.

Eligible ALERT participants may register for a training class by contacting the ALERT Program Coordinator, Mark Hernandez, at sfpdalert@sfgov.org, or by telephone at 415-401-4615.

SFPD ALERT Practice/Training Drill

All active/trained ALERT members are asked to join us for our next training drill, scheduled for an evening on Saturday November 3, 2018. Details will be emailed to active ALERT members, prior to the date of the exercise. Participation is not required, but strongly encouraged.

For more information on the San Francisco Police Department ALERT Program, email us at sfpdalert@sfgov.org, or call Sergeant Mark Hernandez (SFPD, Ret.), SFPD ALERT Program Coordinator, at (415) 401-4615.

For additional information on the web please refer to:
http://sf-police.org/index.aspx?page=4019

Ham Tech Session

Ham Tech Session in Sunnyvale Saturday September 8, 2018 (Includes Free Lunch) by Ed Fong - *WB6IQN*

Time: Saturday September 8, 2018 from 12 noon – 3PM

Subject: Evaluating Cheap Chinese Radios *(CCR)* – *Ed Fong WB6IQN*

Location: 1163 Quince Ave. Sunnyvale, 408-245-8210. If you need precise directions from where you are coming from, go to www.googlemaps.com. They seem to give the best directions or give me (Ed Fong) a call on the phone.

Optional: *Bring a dessert to share.*

Menu - lasagna, pizza, salad, drinks, and chips. Chocolate Mousse cake for dessert.

Cost: ***FREE*** *to ALL HAMS and Guest and Interested parties -* ***Raffle* Tickets*: $5 each***

Grand Prize - HP Elite 8470 – Quad Core i5 -6GB ram

2d Prize – Radio Oddity QB25 Quad Band Mobile

3rd Prize - Baofeng UV5R dual band hand held radio.

Description of the Tech Session

This event is after the Fry's Swap meet. Before going home, come on by and have a great lunch and meet new friends. Why pay for lunch after the swap. Drop by, save your money and have lunch and see whether your CCR (cheap Chinese Radio) really meets FCC Part 90 specifications.

One's of the biggest controversies among the HAM community today is whether these Cheap Imported Chinese made radios really meets the FCC Part 90 specifications. They are certainly cheap.

A BaoFeng UV5R with LiOn battery, smart drop in charger, rubber duck antenna, belt clip can be purchased for under $25. It has 200 memory capacity, comes with even an earphone- remote mic.

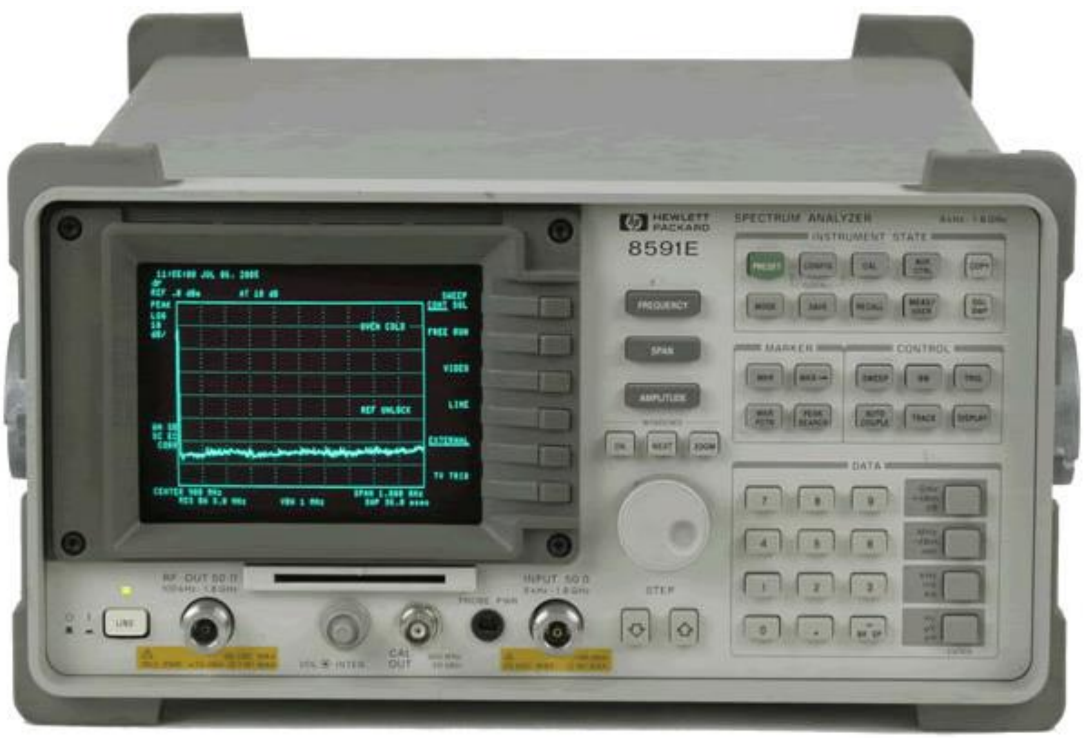
Before the Chinese invasion of these types of transceivers, the major Ham Radio manufacturers (Icom, Yaesu, Kenwood) were charging $200-300 per radio. Not to mention that accessories were: just that – accessories. Often the smart drop in charger had to be purchase separately.

Even the mobiles have gotten into the market. Take the Radioddity QB25. This is a quad band 25 watt mobile. In the USA, this radio operates on 2 meters, 220 MHz, and 70cm. It also operates on the 350 MHz band which is not a ham band in the US. Package comes with software and programming cable. All for about $100.

Are these radios for real or are they just cheap Chinese junk? Is there a reason why the ARRL does not allow advertisement of these radios in QST?

Come to the September meeting and find out. We will compare these radio for the all the major specs - spurious emissions, frequency accuracy, power out, power drain on transmit, standby receive, etc.

Bring your Motorola APX, your Icom, your Yaesu, and your Kenwood and let's do a live comparison.



We will have available the following Ham Radio testing equipment:

- HP (Keysight) lab grade 8591e spectrum analyzer for spurious test.
- Bird 43 lab quality watt meter.
- Fordham – lab quality frequency counter.

Raffle prizes – tickets are $5 each

1st Prize - **HP Elite 8470p** – Intel i5 Quad Core- 14 inch Professional Laptop 6GB of RAM - CNET rated this laptop a 4.5/5. This laptop scores a 2395 on the PC benchmark test. An i7 scores a 2886 (only slightly faster).

HP – quote

"The HP EliteBook 8470p blends modern design and precision engineering, yielding a beautiful product with a platinum color finish. This model's rugged design means this laptop can withstand the rigors of business travel. Additionally, the HP EliteBook 8470p (running the top of the line i5 Quad core) passes rigorous MIL-STD 810G testing for vibration, dust, altitude, temperature and drops".

PC – Magazine

“Strictly speaking, the HP EliteBook 8470p ($1,499 direct) is a business-class laptop. But that classification doesn't cover all of its capabilities. The EliteBook 8470p is a versatile all-around performer armed with enough firepower to double as a multimedia powerhouse and, to a lesser extent, gaming rig. For the most part, these attributes makes this computer a good system for anyone looking to work during the day and play by night.”

- Window 7 operating system
- 6GB of DDR3 ram (upgradable to 8GB) - 320 GB hard drive
- DVD reader/burner, SD reader slot, 4 USB ports
- Line in and headphone jack (most low end computer no longer have line-in)
- HDMI output

2nd Prize **Radioddity QB25** (same as the QYT 7900SD)

Quad Band Mobile 25 watt transceiver. This radio boast 200 memories, full software programmability, great bullet proof front end with 0.25 uV sensitivity, full FM broadcast radio, direct microphone key pad entry, absolutely the best color display out there and more. If you have been looking to get on 220 MHz, this is the latest and greatest. You will be a proud owner of one of these radios.

Comes with programming cable and programming software.

3rd Prize UV5R Baofeng dual band handie talkie

Baofeng UV5R - 200 memory channel

- VHF/UHF handie talkie 136-174 MHz 400-520 MHz
- 128 fully programmable channels
- LiOn 1800 mahr battery with smart charger
- Built in LED flashlight
- 4 watts output
- FM broadcast radio (65-108 MHz)

Tech Article:

IceCube
South Pole Neutrino Observatory

IceCube neutrinos point to long-sought cosmic ray accelerator

By the IceCube Collaboration, 12 Jul 2018 10:00 AM

https://icecube.wisc.edu/news/view/586

An international team of scientists has found the first evidence of a source of high-energy cosmic neutrinos, ghostly subatomic particles that can travel unhindered for billions of light years from the most extreme environments in the universe to Earth.

The observations, made by the IceCube Neutrino Observatory at the Amundsen–Scott South Pole Station and confirmed by telescopes around the globe and in Earth’s orbit, help resolve a more than a century-old riddle about what sends subatomic particles such as neutrinos and cosmic rays speeding through the universe.

Artist’s impression of the IceCube Neutrino Observatory in Antarctica. Spherical digital optical modules (DOMs), each about 35 cm in diameter, are positioned up to 2.5 km deep in the ice. More than 5000 DOMs make up a cubic-kilometer detector weighing more than a billion tons. The DOMs detect the faint flash of light created when a high-energy neutrino interacts with the ice. See pages 115, 146, and 147. Credit: Jamie Yang and Savannah Guthrie/IceCube/NSF

Since they were first detected over one hundred years ago, cosmic rays—highly energetic particles that continuously rain down on Earth from space—have posed an enduring mystery: What creates and launches these particles across such vast distances? Where do they come from?

Because cosmic rays are charged particles, their paths cannot be traced directly back to their sources due to the powerful magnetic fields that fill space and warp their trajectories. But the powerful cosmic accelerators that produce them will also produce neutrinos. Neutrinos are uncharged particles, unaffected by even the most powerful magnetic field. Because they rarely interact with matter and have almost no mass—hence their sobriquet "ghost particle"—neutrinos travel nearly undisturbed from their accelerators, giving scientists an almost direct pointer to their source.

Two papers published this week in the journal Science have for the first time provided evidence for a known blazar as a source of high-energy neutrinos detected by the National Science Foundation-supported IceCube observatory. This blazar, designated by astronomers as TXS 0506+056, was first singled out following a neutrino alert sent by IceCube on Sept. 22, 2017.

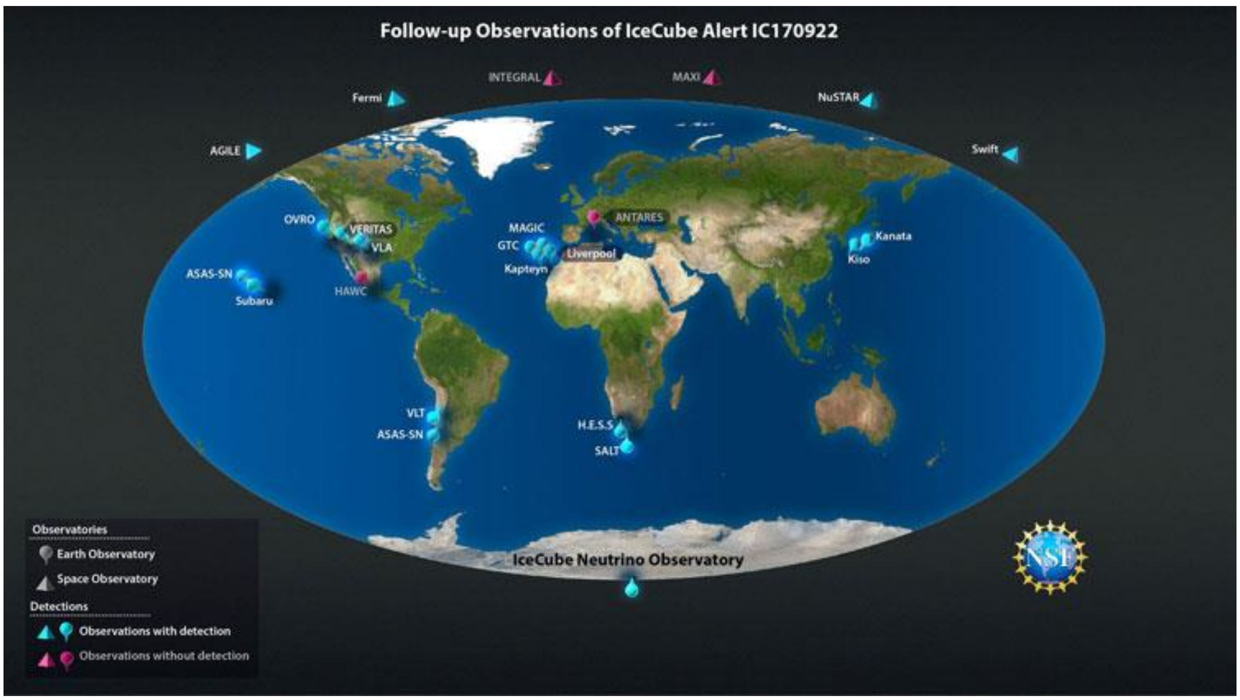
"The evidence for the observation of the first known source of high-energy neutrinos and cosmic rays is compelling," says Francis Halzen, a University of Wisconsin–Madison professor of physics and the lead scientist for the IceCube Neutrino Observatory.

"The era of multimessenger astrophysics is here," said NSF Director France Córdova. "Each messenger—from electromagnetic radiation, gravitational waves and now neutrinos—gives us a more complete understanding of the universe, and important new insights into the most powerful objects and events in the sky. Such breakthroughs are only possible through a long-term commitment to fundamental research and investment in superb research facilities."

In this artistic rendering, a blazar emits both neutrinos and gamma rays that could be detected by the IceCube Neutrino Observatory as well as by other telescopes on Earth and in space. Credit: IceCube/NASA

A blazar is a giant elliptical galaxy with a massive, rapidly spinning black hole at its core. A signature feature of blazars is that twin jets of light and elementary particles, one of which is pointing to Earth, are emitted from the poles along the axis of the black hole's rotation. This blazar is situated in the night sky just off the left shoulder of the constellation Orion and is about 4 billion light years from Earth.

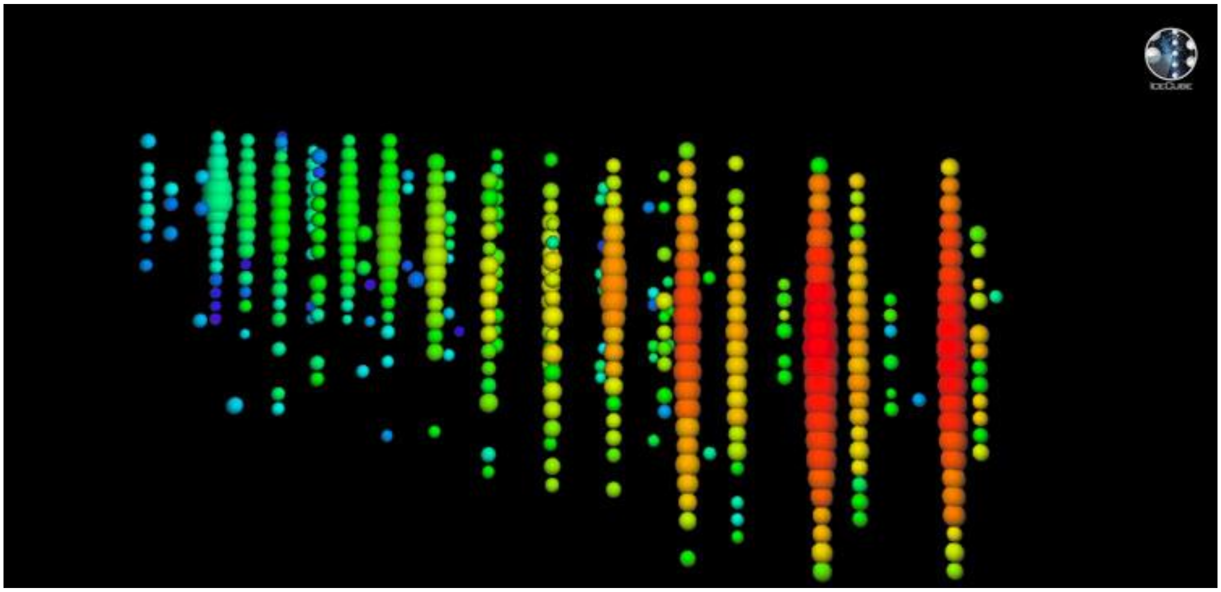
Equipped with a nearly real-time alert system—triggered when a very high-energy neutrino collides with an atomic nucleus in the Antarctic ice in or near the IceCube detector—the observatory broadcast coordinates of the Sept. 22 neutrino alert to telescopes worldwide for follow-up observations. Gamma-ray observatories, including NASA's orbiting Fermi Gamma-ray Space Telescope and the Major Atmospheric Gamma Imaging Cherenkov Telescope, or MAGIC, in the Canary Islands, detected a flare of high-energy gamma rays associated with TXS 0506+056, a convergence of observations that convincingly implicated the blazar as the most likely source.



On Sept. 22, 2017, IceCube alerted the international astronomy community about the detection of a high-energy neutrino. About 20 observatories on Earth and in space made follow-up observations, which allowed idenification of what scientists deem to be a source of very high energy neutrinos and, thus, of cosmic rays. Besides neutrinos, the observations made across the electromagnetic spectrum included gamma-rays, X-rays, and optical and radio radiation. These observatories are run by international teams with a total of more than one thousand scientists supported by funding agencies in countries around the world. Credit: Nicolle R. Fuller/NSF/IceCube

Fermi was the first telescope to identify enhanced gamma-ray activity from TXS 0506+056 within 0.06 degrees of the IceCube neutrino direction. In a decade of Fermi observations of this source, this was the strongest flare in gamma rays, the highest-energy photons. A later follow-up by MAGIC detected gamma rays of even higher energies.

These observations prove that TXS 056+056 is one of the most luminous sources in the known universe and, thus, add support to a multimessenger observation of a cosmic engine powerful enough to accelerate high-energy cosmic rays and produce the associated neutrinos. Only one of these neutrinos, out of many millions that sailed through Antarctica's ice, was detected by IceCube on Sept. 22.



This event display, from the high-energy neutrino detected by IceCube on Sept. 22, 2017, shows a muon, created by the interaction of a neutrino with the ice very close to IceCube, which leaves a track of light while crossing the detector. In this display, the light collected by each sensor is shown with a colored sphere. The color gradient, from red to green/blue, show the time sequence. Credit: IceCube Collaboration

Bolstering these observations are coincident measurements from other instruments, including optical, radio, and X-ray telescopes. "The ability to globally marshal telescopes to make a discovery using a variety of wavelengths in cooperation with a neutrino detector like IceCube marks a milestone in what scientists call multimessenger astronomy," says Halzen

"These intriguing results also represent the remarkable culmination of thousands of human years of intensive activities by the IceCube Collaboration to bring the dream of neutrino astronomy to reality," says Darren Grant, a professor of physics at the University of Alberta and the spokesperson of the IceCube Collaboration, an international team with over 300 scientists in 12 countries.

Austrian physicist Victor Hess proved in 1912 that the ionizing particles scientists were detecting in the atmosphere were coming from space. Cosmic rays are the highest energy particles ever observed, with energies up to a hundred million times the energies of particles in the Large Hadron Collider at CERN in Switzerland, the most powerful human-made particle accelerator. These extremely high energy cosmic rays can only be created outside our galaxy and their sources have remained a mystery until now. Scientists had speculated that the most violent objects in the cosmos, things like supernova remnants, colliding galaxies, and the energetic black hole cores of galaxies known as active galactic nuclei, such as blazars, could be the sources.

“Fermi has been monitoring some 2,000 blazars for a decade, which is how we were able to identify this blazar as the neutrino source,” says Regina Caputo, the analysis coordinator for the Fermi Large Area Telescope collaboration. “High-energy gamma rays can be produced either by accelerated electrons or protons. The observation of a neutrino, which is a hallmark of proton interactions, is the first definitive evidence of proton acceleration by black holes.”

“Now, we have identified at least one source of cosmic rays because it produces cosmic neutrinos. Neutrinos are the decay products of pions. In order to produce them, you need a proton accelerator,” says Halzen.

Cosmic rays are mostly protons and are sent speeding across the universe because the places where they are created act in the same way as particle accelerators on Earth, only they are far more powerful. “Theories predict that the emission of neutrinos will be accompanied by the release of gamma rays,” explains Razmik Mirzoyan, the spokesperson of the MAGIC Collaboration. But there are still a lot of questions on how blazars could accelerate particles to such high energies. “Gamma radiation provides information on how the ‘power plants’ in supermassive black holes work,” adds Mirzoyan.

As the latest astrophysical messenger to enter the game, neutrinos bring crucial new information to uncovering the inner workings of these cosmic ray accelerators. In particular, measurements of neutrinos can reveal the mechanisms for particle acceleration of the proton beam in the densest environments that even high-energy gamma rays may not escape.

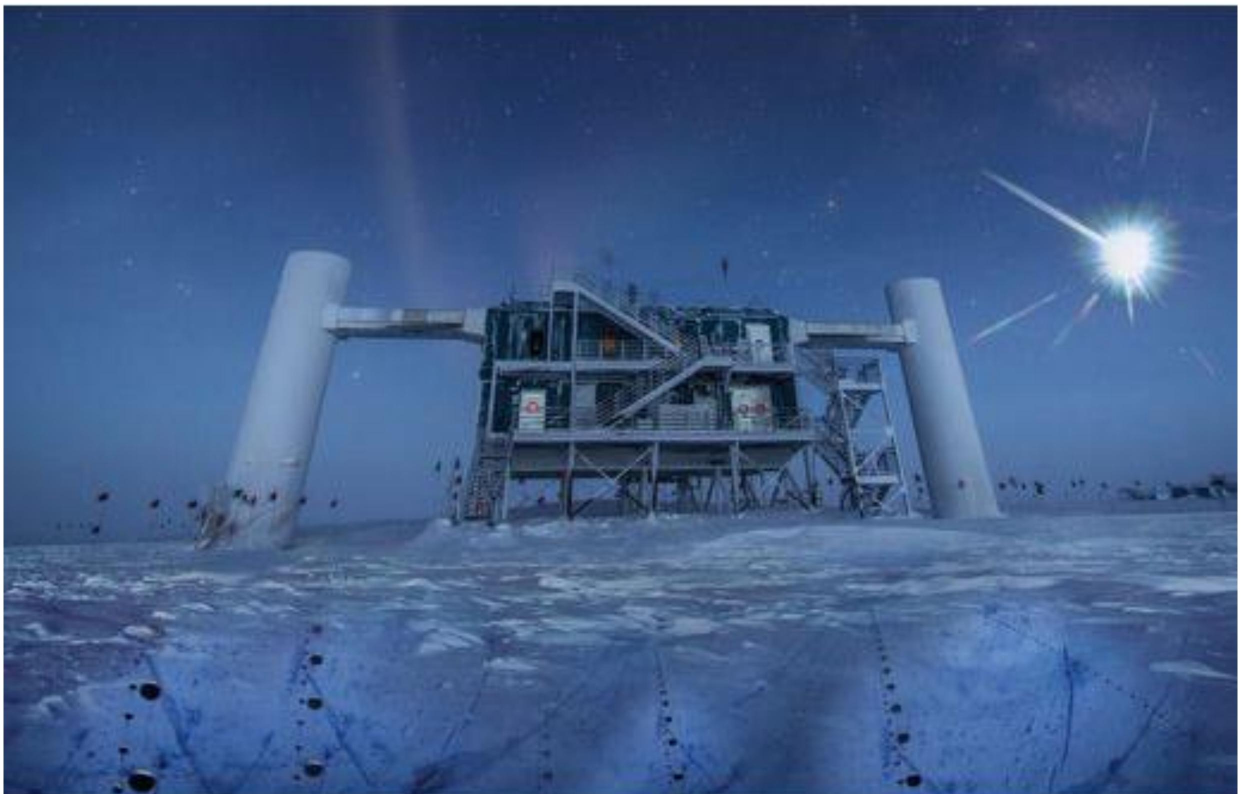
Following the Sept. 22 detection, the IceCube team quickly scoured the detector’s archival data and discovered a flare of over a dozen astrophysical neutrinos detected in late 2014 and early 2015, coincident with the same blazar, TXS 0506+056. This independent observation greatly strengthens the initial detection of a single high-energy neutrino and adds to a growing body of data that indicates TXS 0506+056 is the first known accelerator of the highest energy neutrinos and cosmic rays.

Detecting the highest energy neutrinos requires a massive particle detector, and IceCube is by volume the world’s largest. Encompassing a cubic kilometer of deep, pristine ice a mile beneath the surface at the South Pole, the detector is composed of more than 5,000 light sensors arranged in a grid. When a neutrino interacts with the nucleus of an atom, it creates a secondary charged particle, which, in turn, produces a characteristic cone of blue light that is detected by IceCube and mapped through the detector’s grid of photomultiplier tubes. Because the charged particle and light it creates stay essentially true to the neutrino’s direction, they give scientists a path to follow back to the source.

IceCube continuously monitors the sky, including through the Earth to the Northern Hemisphere, and detects a neutrino every few minutes. Most of the neutrinos it detects, however, are low energy, created by more common phenomena, such as the showers of subatomic particles stemming from cosmic ray particles crashing into atomic nuclei in the Earth’s atmosphere.

Particles of particular interest to the IceCube team pack a more energetic punch. The neutrino that alerted telescopes around the world had an energy of approximately 300 TeV. (The energy of the protons circulating in the 26.7-kilometer ring of the Large Hadron Collider is 6.5 TeV.)

IceCube was built specifically to identify and track high-energy neutrinos. In 2013, the collaboration announced the detection of the first neutrinos from beyond our galaxy and since has made numerous fundamental measurements in the emerging field of neutrino astronomy. The IceCube team also analyzes lower energy neutrinos, with outstanding results that are helping scientists make sense of matter in its most elementary forms.



An artist's conception, based on a real image of the IceCube Lab at the South Pole, a distant source emits neutrinos that are detected below the ice by IceCube sensors.
(Photo: IceCube/NSF)

The IceCube Neutrino Observatory is funded primarily by the National Science Foundation and is operated by a team headquartered at the University of Wisconsin–Madison. IceCube construction was also funded with significant contributions from the National Fund for Scientific Research (FNRS & FWO) in Belgium; the Federal Ministry of Education and Research (BMBF) and the German Research Foundation (DFG) in Germany; the Knut and Alice Wallenberg Foundation, the Swedish Polar Research Secretariat, and the Swedish Research Council in Sweden; and the Department of Energy and the University of Wisconsin–Madison Research Fund in the U.S.

The IceCube Collaboration, with over 300 scientists in 49 institutions from around the world, runs an extensive scientific program that has established the foundations of neutrino astronomy. Their research efforts, including critical contributions to the detector operation, are funded by funding agencies in Australia, Belgium, Canada, Denmark, Germany, Japan, New Zealand, Republic of Korea, Sweden, Switzerland, the United Kingdom, and the U.S. https://icecube.wisc.edu/collaboration/institutions

About 20 observatories on Earth and in space have participated in the identification of what scientists deem to be a source of very high energy neutrinos and, thus, of cosmic rays. The observations across the electromagnetic spectrum, listed alphabetically by project for the given wavelength, include: gamma-rays by the space missions AGILE, INTEGRAL, and Fermi and ground-based telescopes HAWC in Mexico, H.E.S.S. in Namibia, MAGIC in Spain, and VERITAS in the U.S.; X-rays, optical, and radio radiation by space missions MAXI, NuSTAR, and Swift and ground-based observatories ASAS-SN in Chile and the U.S., GTC in Spain, Kanata in Japan, Kapteyn in Spain and the U.S, Kiso in Japan, Liverpool in Spain, OVRO in the U.S., SALT in South Africa, Subaru in Japan, and VLA in the U.S; and neutrinos by ANTARES in France. These observatories are run by international teams with a total of over a thousand scientists supported by funding agencies in countries around the world. Several follow-up observations are detailed in a few other papers that are also released today (see link below).

+ info "Multimessenger observations of a flaring blazar coincident with high-energy neutrino IceCube-170922A," The IceCube, Fermi-LAT, MAGIC, AGILE, ASAS-SN, HAWC, H.E.S.S, INTEGRAL, Kanata, Kiso, Kapteyn, Liverpool telescope, Subaru, Swift/NuSTAR, VERITAS, and VLA/17B-403 teams. *Science* 361, eaat1378 (2018). DOI:10.1126/science.aat1378, arXiv

+ info "Neutrino emission from the direction of the blazar TXS 0506+056 prior to the IceCube-170922A alert," IceCube Collaboration: M.G. Aartsen et al. *Science* 361, 147-151 (2018). DOI:10.1126/science.aat2890, arXiv

• Watch the press conference here

• Ask questions of IceCube scientists on Reddit, starting at 11:30 am U.S. CDT.

• Related papers and data here

• Images and videos here

• FAQ here

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