Aloha VHEPA participant, Welcome to Hawaii!

Thanks a lot for joining the 9th VHEPA workshop. This workshop focuses on future projects to measure very high energy particles and cosmic rays including the NTA (Neutrino Telescope Array) proposal for the Big Island of Hawaii, ANITA, ARA, ARIANNA, AUGER, CTA, GRAND, HAWC, IceCube-Gen 2, JEM-EUSO, KM3NET, and TA. In particular, following the observation of astrophysical neutrinos by IceCube, there is world-wide interest in measuring neutrinos in the energy range above IceCube and below the range covered by Auger, TA and other experiments. Although ANITA observed ultra-high energy cosmic rays, neutrinos in the GZK energy range have not yet been detected either. There are no confirmed point sources of neutrinos or high energy cosmic rays.

Best regards,

Philip von Doetinchem (chair)
Veronica Bindi
Tom Browder
Peter Gorham
Francis Halzen
George Hou
Tadashi Kifune
Jason Kumar
John Learned
Danny Marfatia
Bob Morse
Alan Watson
Jan Bruce
Jacky Li
Josie Nanao
Meeting location

The meeting takes place on the campus of the University of Hawaii at Manoa.

East-West Center (EWC)
Hawaii Imin International Conference Center
Jefferson Hall
Pacific room
1777 East-West Road
Honolulu, HI 96848

Please find a map with driving and bus directions attached.

Parking

We will have a limited number of on-campus parking passes on a first-come first-served basis. Parking on campus will be $18 total for three day. More parking is available in the general parking structure (no. 20). Daily parking is only $5. Please find a campus map with the parking structure location attached.

Wireless

Username: energy17
Password: 17energy

Campus food options for Thursday and Friday

As the semester has not started yet, the options are a little limited, but the following options will serve us well enough on Thursday and Friday:

Food trucks:

Toko Express at Krauss Hall
Uahi Island Grill at Kennedy Theater

Paradise Palms Cafe:
  • The Curb
  • India Cafe
  • Panda Express
  • L&L

On Saturday we will have catered sandwich boxes (included in the conference fee).

Reception

The welcome reception will be held Thursday from 6-8pm in the garden of the EWC.
**Banquet**

The banquet will be held at the Honolulu Elks Lodge on Friday from 5:30-10pm. We will organize carpools/transport from campus to the Elks lodge. Sunset is at 6:05pm. We will try to make it down there before.

Address:

Elks lodge
2933 Kalakaua Ave
Honolulu, HI 96815

Please find a map with driving and bus directions attached.
Thursday, 7 January 2016

08:30 Coffee

08:45 Welcome - Philip von Doetinchem (University of Hawaii)

08:50 Welcome by Dean Kristin Kumashiro

09:00 Cosmic high-energy neutrinos: theoretical perspectives and multimessenger implications - Kohta Murase (Penn State)

The origin of cosmic high-energy neutrinos is a new mystery in astroparticle physics. I review various theoretical scenarios and general implications that have been obtained, showing the importance of multi-messenger data.

09:45 NTA: Towards Survey of Astro-nu_tau Sources - George W.S. Hou (National Taiwan University)

With PeV astro-neutrinos observed by IceCube, the natural thought is: what if one had better sensitivity and better pointing accuracy? That would be the genuine start of high energy neutrino astronomy. The Earth-skimming nu_\tau method meets this purpose. Starting at PeV energy and higher, the nu_\tau is unique in that a mountain becomes a nu_\tau to tau conversion target, and a subsequent valley becomes the shower volume for tau decay. The technique has been applied for the first time by Ashra-1. A new proposal, the Neutrino Telescope Array (NTA), would consist of the three sites of Mauna Loa, Mauna Kea and Mt. Hualalai, on the Hawaii Big Island, with detector design scaled from Ashra-1. Combining Cherenkov detection and the fluorescence ability of a central site, the NTA would be able to collect PeV nu_\tau point sources within two billion light years, and would provide independent confirmation of IceCube PeV neutrinos. International collaboration issues would be touched upon.

10:30 Coffee

11:00 IceCube: The Discovery of High-Energy Cosmic Neutrinos - Francis Halzen (WIPAC University of Wisconsin-Madison)

The IceCube project has transformed one cubic kilometer of natural Antarctic ice into a neutrino detector. The instrument detects more than 100,000 neutrinos per year in the GeV to PeV energy range. Among those, we have recently isolated a flux of high-energy cosmic neutrinos. I will discuss the instrument, the analysis of the data, and the significance of the discovery of cosmic neutrinos. The high cosmic neutrino flux observed indicates that proton accelerators generate a significant fraction of the radiation in the non-thermal universe.

11:45 Lunch on campus
13:15 IceCube Gen2 - Kael HANSON (University of Wisconsin – Madison)

The existence of high-energy neutrinos from astrophysical sources is now fact. An excess of events at energies above 100 TeV was discovered by the IceCube collaboration in 2013; the sample of events grows by some dozen per year of operation. The originators of these neutrinos, however, continue to elude us and to date no sources have been conclusively identified. An expanded IceCube collaboration seeks to design, construct, and operate a larger instrument that will push beyond discovery into the study of sources. The instrument, based on proven engineering and operational experience gained from the IceCube Neutrino Observatory, nevertheless requires new techniques to achieve an order of magnitude increase in effective volume at PeV energies and reach out to the EeV energy scales. This presentation will describe the scientific mission to understand the sources of high energy neutrinos and will describe the conceptual-level designs under evaluation. Technical aspects such as advances in photodetection and detection via RF sensors are then covered along with associated electronics. Drilling and logistics make up a significant portion of the total project: new designs and strategies for large scale drilling and construction activities in an environment different from that of the IceCube construction merit close attention. The presentation concludes with project-level concerns such as cost, schedule, and the mobilization of large financial and human resources across the globe.

14:00 GeV and TeV gamma-rays in the era of multi-messenger synergy - Amanda Weinstein (Iowa State University)

The past decade and a half have seen the commissioning of four new ground based gamma-ray observatories (VERITAS, HESS, MAGIC, and HAWC) that have fundamentally changed our view of the gamma-ray sky above 100 GeV. It has also seen the launch of the Fermi Gamma-ray Space Telescope, which dramatically altered our view of the gamma-ray universe between 30 MeV and 300 GeV and is gathering an increasing number of detections out to 1 TeV. Together these instruments have revealed new classes of gamma-ray sources, shed light on long-standing mysteries, and forced us to revise or abandon long-held assumptions. Some of the most recent advances from this watershed period in gamma-ray astronomy will be reviewed, primarily in the context of galactic and extragalactic cosmic rays. Special attention will be paid to the interplay with cosmic ray and neutrino observatories, as well as to new approaches for exploiting the rich synergy between the three US observatories—VERITAS, Fermi, and HAWC—currently in simultaneous operation and providing unprecedented gamma-ray coverage of the northern sky between 30 MeV and 100 TeV.

14:45 Coffee
15:15 High-Energy Gamma Rays with the Cherenkov Telescope Array - Nepomuk Otte (Georgia Institute of Technology)

The Cherenkov Telescope Array (CTA) will be a new observatory for the study of very-high-energy gamma-ray sources, designed to achieve an order of magnitude improvement in sensitivity in the ~30 GeV to ~100 TeV energy band compared to currently operating instruments: VERITAS, MAGIC, and H.E.S.S. CTA will probe known sources with unprecedented sensitivity, angular resolution, and spectral coverage, while also detecting hundreds of new sources. This presentation will describe the status of the CTA project and the development of a novel dual-mirror Cherenkov telescope led by the CTA-US group.

16:00 The Cherenkov Telescope Array: Key Science Projects & Connections to Neutrinos - Brian Humensky (Columbia University)

The Cherenkov Telescope Array (CTA) will build on the success of the current generation of imaging air Cherenkov telescopes, H.E.S.S., MAGIC, and VERITAS, by providing an order of magnitude improvement in sensitivity in the core of its energy range (0.1 – 10 TeV), as well as covering a broader (30 GeV – 200 TeV) energy range with improved angular and energy resolution. The CTA Consortium is developing a set of Key Science Projects (KSPs) that will form a significant portion of the observatory’s legacy, including a survey of the entire Galactic plane, a deep study of the Large Magellanic Cloud, and a survey of ¼ of the sky to provide an unbiased sample of active galaxies. Additional KSPs focus on targeted studies of the Galactic center, transients, pevatrons, star-forming systems, active galactic nuclei, and clusters of galaxies. The search for signatures of dark matter annihilation or decay crosses KSP boundaries. This talk will provide an overview of the rich science opportunities available within CTA’s key science, with a particular emphasis on connections to understanding the origins of astrophysical neutrinos.

16:45 Status of HAWC and Preliminary Results - Tolga Yapici (Michigan State University)

The High Altitude Water Cherenkov (HAWC) Observatory is an extensive air shower array in the state of Puebla, Mexico at an altitude of 4100m. With its 22,000 m^2 instrumented area, wide field of view (~2 sr), and >95% uptime, HAWC present unique facility to study extremely high energy cosmic-ray sources such as studies active galaxies, gamma-ray bursts, supernova remnants and pulsar wind nebulae, searches for regions of extended gamma-ray emission, to identify transient phenomena. HAWC will also provide tests for several fundamental physics phenomena such as dark matter annihilation and primordial black hole evaporation. This talk will discuss the status of the experiment and first results from analysis of the data.

18:00 Reception
**Friday, 8 January 2016**

**08:30 Coffee**

**09:00 Recent Results from the Pierre Auger Observatory - Michael Unger (KIT & NYU)**  
We will present recent results from the Pierre Auger Observatory and discuss in particular measurements related to the mass composition of cosmic rays and to hadronic interactions at ultra-high energies.

**09:45 AugerPrime: The Upgrade of the Pierre Auger Observatory - James Beatty (Ohio State)**  
The Auger collaboration is proposing an upgrade to elucidate mass composition and the origin of the flux suppression at the highest energies, search for a flux contribution from protons at the highest energies, and explore hadronic interactions at energies beyond those accessible at man-made accelerators. The upgrade consists of a surface scintillator detector (SSD) at each water Cherenkov detector (WCD) site to improve muon discrimination, an upgrade of the electronics to accommodate the SSD and enhance the WCD performance, underground muon detectors in the infilled region of the array to calibrate and verify muon measurements, and an enhancement of the duty cycle of the fluorescence detector. The motivation for the upgrade and its expected performance will be discussed.

**10:30 Coffee**

**11:00 Observational Prospects for Quark Nugget Dark Matter - Kyle Lawson (University of British Columbia)**  
I will discuss a novel dark matter model in which the dark matter is not a new fundamental particle but consists of macroscopic composite objects composed of standard model quarks and antiquarks. These objects are referred to as quark “nuggets”. In this model the dark matter is not fundamentally weakly interacting, instead its interactions are strongly suppressed by the nuggets' small cross-section to mass ratio and their resultantly small number density. I will first give a brief overview of the basic properties of this model and then focus on its observational consequences. In particular I will highlight the ability of current and planned cosmic ray detectors to place strong constraints across much of the allowed nugget parameter space. These types of detectors are particularly important in the context of very high mass dark matter candidates as conventional dark matter searches are not sensitive to their very low flux. These types of direct searches are also strongly complementary to indirect astrophysical observations.

**11:45 Lunch on Campus**

**13:15 KM3NeT - the next-generation neutrino telescope in the Mediterranean Sea - Uli Katz (ECAP / University Erlangen)**  
Building on the pioneering success of ANTARES, the next-generation deep-sea neutrino telescope KM3NeT will be constructed in the Mediterranean Sea. It will comprise two
installations, one for neutrino astronomy with high-energy cosmic neutinos and one concentrating on neutrino physics using oscillations of the lower-energy neutinos created in cosmic-ray interactions in the atmosphere. The presentation will discuss the technical design of KM3NeT; show initial preliminary results of the first detector unit deployed in December 2015; highlight selected results from the sensitivity studies for a cubic-kilometre installation; and summarise the next steps and future plans.

14:00 A Review of UHE Neutrino Detection using the Askaryan Effect - Jordan Hanson (Ohio State University)

Interaction of the highest energy cosmic rays with the cosmic microwave background would produce neutinos with energies of ~1 EeV. The spectrum of these cosmogenic neutinos is now being constrained, and a generation of experiments based on the Askaryan effect are underway. We review the creation of high-energy cascades created in dielectric materials by electroweak interactions, and discuss how the Askaryan effect in this situation leads to a radio-frequency electromagnetic pulse. Further, we have studied two corrections to the basic approach: the Landau-Pomeranchuk-Migdal (LPM) effect, and the shower form factor. Both effects modify the electromagnetic pulse, and we present an open-source code that attempts to include these effects. A future direction for this work includes using the form factor technique to model the radio emission from extensive air-showers.

14:45 Coffee

15:15 Direct measurements of cosmic-rays in GeV-TeV - Sadakazu Haino (Institute of Physics, Academia Sinica)

Energy spectra of cosmic-rays in GeV-TeV region have been directly measured by balloons and in space. Particularly cosmic-ray antiparticles can provide unique opportunity to study fundamental physics such as indirect searches for Dark Matter and understanding of its nature. More than four years after AMS (Alpha Magnetic Spectrometer) start taking data on the ISS (International Space Station), the precision has been decreasing to % level. In my talk brief history of direct measurements is summarized and the latest AMS results and their physics implications are discussed.
Cosmogenic neutrinos, produced in interactions of ultra-high-energy cosmic rays (UHECRs) with cosmological background photons, should exist above 100 PeV, but remain undetected. Their flux depends on the uncertain composition and maximum energy of UHECRs. Pessimistic predictions, of $10^{-10}$ GeV cm$^{-2}$ s$^{-1}$ sr$^{-1}$ or lower, are beyond reach of existing detectors after reasonable exposure times. The planned Giant Radio Array for Neutrino Detection (GRAND) addresses this possibility: its main goal is the assured discovery of cosmogenic neutrinos, even in pessimistic flux scenarios. It will detect the coherent radio emission from extensive air showers triggered by the decay of taus produced in interactions of cosmogenic $\nu_{\tau}$'s in rock. By densely instrumenting a very large area --200 000 km$^2$ with $10^5$ small radio antennas-- GRAND could reach an exquisite sensitivity of $3 \times 10^{-11}$ GeV cm$^{-2}$ s$^{-1}$ sr$^{-1}$ above 30 PeV in 3 years, corresponding to a handful of events per year. More reasonable flux scenarios predict up to 100 events per year. A precise angular resolution of 0.1° will allow to test isotropy and source correlations. I will discuss these and other science goals of GRAND, the status of the prototype array, and future prospects.

17:45 Banquet at Elks Lodge
Saturday, 9 January 2016

08:30 Coffee

09:00 Blazar neutrino emission models under scrutiny in wake of observational constraints - Uli Katz (ECAP / University Erlangen)

Here, we infer the number of neutrinos expected in IceCube based on the calorimetric energy output of flat-spectrum radio quasars from X-rays to gamma rays. We consider quasars positionally coincident with the most energetic events detected by IceCube, taking into account their variable emission during the IceCube exposure time. Our findings support the conclusion that the observed neutrinos are consistent with originating from flat-spectrum radio quasars. In particular, a major outburst of PKS B1424-418 coincident with the detection of the Big Bird event at 2 PeV renders this blazar having a very low probability for a chance association. We also report on constraints on the neutrino spectrum using Antares data.

09:45 Recent Results from the Telescope Array Experiment - I - Gordon Thomson (University of Utah)

The Telescope Array (TA) experiment is a large experiment located in Utah, USA, to study ultrahigh energy cosmic rays. TA is a hybrid experiment, consisting of a surface detector and a fluorescence detector. In this, the first TA talk, G. Thomson will cover the spectrum of cosmic rays from log(E) of 15.6 to 20.3, several anisotropy results including the TA Hotspot, and plans for the TAx4 project to increase the experiment's aperture by a factor of 4. The second talk will be given by J. Belz.

10:30 Coffee

11:00 Recent Results from the Telescope Array Experiment - II - John Belz (University of Utah)

This talk will begin with a discussion of issues related to the composition of the highest energy cosmic rays. We describe measurements of the distribution of air shower maximum, and evaluate these in the context of modern hadronic interaction models and the uncertainties associated with extrapolating low-energy cross sections to the UHECR regime. We present results of proton-air cross-section measurements at these energies. Also, Telescope Array has a rich program of affiliated experiments which we will describe. These include the TARA project's searches for the radar echoes of Extensive Air Showers, and efforts to study the connections between lightning and high-energy particles within the Earth's atmosphere.

11:45 Catered Lunch
13:15 **The Extreme Universe Space Observatory super pressure balloon mission** - Lawrence Wiencke (Colorado School of Mines)

The Extreme Universe Space Observatory on a super pressure balloon (EUSO-SPB) mission will make the first fluorescence observations of high energy cosmic ray extensive air showers by looking down on the atmosphere from near space. EUSO-SPB follows a successful overnight flight in August 2014 of the JEM-EUSO prototype mission named EUSO-Balloon. EUSO-Balloon recorded artificial tracks and pulses that were generated by a laser and optical flashers that were flown in a helicopter under the balloon. Preparations are underway for EUSO-SPB with the potential for a flight of 50 days duration. The planned launch site is Wanaka, New Zealand. We describe the mission, the updated instrument, and expected detection rates of extensive air showers events produced by cosmic primaries.

14:00 **ANITA - Peter Gorham (Department of Physics and Astronomy, Univ. of Hawaii)**

The Antarctic Impulsive Transient Antenna is a long-duration NASA payload with a goal of the detection of the cosmogenic ultra-high energy neutrino flux. In this talk we will describe the payload and report on the third ANITA flight, completed in early 2015, as well as plans for the fourth flight later this year.

14:45 **Coffee**

15:15 **Askaryan Radio Array: Status and recent results.** - Albrecht Karle (University of Wisconsin-Madison)

Neutrino astronomy at energies beyond the highest energy IceCube events requires very large detection volumes. The Askaryan Radio Array (ARA) is designed to utilize the coherent emission of radio waves from neutrino-induced cascades of energies beyond ~30 PeV in the South Pole ice. Three ARA detector stations have been deployed in 2011/12 and 2012/13 polar seasons. The stations are in operation and data are transmitted on a daily basis via satellite. I will describe the detector, calibration strategies and data reduction to distinguish the rare radio signals from backgrounds. Using data from only two stations over a short exposure time of 10 months, a neutrino flux limit of $3 \cdot 10^{-6}$ GeV/(cm$^2$ s sr) is obtained at an energy of $10^{18}$ eV, which offers promise for the full ARA detector. Future plans will be discussed briefly.

16:00 **ASHRA - Makoto Sasaki (ICRR, The University of Tokyo)**

TBA

16:45 **Closing remarks - Francis Halzen (UW-Madison)**

17:15 **Good Bye - Philip von Doetinchem (University of Hawaii)**
Touristic information

Oahu offers plenty of opportunities to have a great time. Please find a small selection below:

- **Waikiki**
  
  Is the touristic hub of Hawaii and Oahu. Don't be too shocked by the big crowds. With every mile you leave Waikiki behind the crowds will fall off steeply. This doesn't mean that Waikiki cannot be enjoyed. For instance, you find plenty of nice beach bars. For good MaiTais in a nice environment I recommend checking out the bars in the Moana Surf Rider and Royal Hawaiian hotels. Affordable food is in most bars and restaurants of average quality.

- **Hanauma Bay**
  
  Great for snorkeling: It gets busy in the mornings and the parking lot will close down. Going in the afternoon when people are leaving is recommended. You will have to watch an educational video before being allowed to go to the beach. Among other sea creatures, you have a good chance to see sea turtles while snorkeling. Please keep a safe distance. They are protected and touching them results in a high fine.

- **Waimanalo Beach**
  
  Most likely the nicest beach on Oahu and maybe in the whole island chain (people debate this question regularly).

- **Kailua**
  
  Another very nice beach with fine white sand and turquoise water. Please be aware that wind and rain are typically coming from the east side. Therefore, if it looks like overcast in Honolulu most of the time the weather is already rainy on the Waimanalo and Kailua side.

- **North Shore**
  
  Waves are getting big at the North Shore during winter time. The famous Triple Crown surf contest just concluded before Christmas. Certainly not for anybody who is not close to be a professional surfer, but great to watch.

  There is also a good spot to see turtles basking in the sun at the North Shore at a beach called Laniakea.

  The small town of Haleiwa is worth a visit.
Kaena Point State Park at the north-western tip is home to monk seals and albatross. At this time of the year albatross should be breeding. This is a nice half-day hike.

• Pearl Harbor

An interesting historic site that explains the attack of the Japanese on Pearl Harbor. If you would like to see the Arizona Memorial and have not reserved well in advance you might have a chance if you go to the harbor very early (~7am).

• Bishop Museum

is the largest museum in Hawaii and has the world's largest collection of Polynesian cultural artifacts and natural history specimens.
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Meeting room

East-West Center Campus

Published on East-West Center | www.eastwestcenter.org (http://www.eastwestcenter.org)

Home > About > Campus Map > East-West Center Campus

**East-West Center Campus**

The East-West Center was established by the U.S. Congress in May 1960. The goal of the East-West Center is to promote better relations and understanding between the United States and the nations of Asia and the Pacific region.

**KEY**

A Abraham Lincoln Hall
B Hana Hauhine
C Thai Pavilion
D Conference Parking
E Japanese Tea House
F Japanese Garden
G Hawaii Iimin Intenational Conference Center at Jefferson Hall
H Hale Manoa
I Hale Hualalai
J John A. Burns Hall
K East-West Center Gallery

EastWestCenter.org 1601 East-West Road, Honolulu, HI 96848 USA. Established 1960.
Drive to campus from the Honolulu Zoo in Waikiki

Honolulu Zoo to Jefferson Hall - Google Maps https://www.google.com/maps/dir/Honolulu+Zoo...
Bus to campus from the Honolulu Zoo in Waikiki

Honolulu Zoo to Jefferson Hall - Google Maps  https://www.google.com/maps/dir/Honolulu+Zoo...
Honolulu Zoo to Jefferson Hall - Google Maps

Walk
About 1 mile, 403 ft.
Use caution - may involve errors or sections not suited for walking
Head east on Ode St toward East-West Rd
Turn left onto East-West Rd
Destination will be on the right

Jefferson Hall
1777 East-West Rd, Honolulu, HI 96846

Cost: $2.00
Tickets and information
TheBus

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.
Drive from campus to the Elks lodge

Jefferson Hall to 2933 Kalakaua Ave, Honolulu, HI 96815

https://www.google.com/maps/dir/Jefferson+Hall...
1. Turn left onto Kamakahi Ave
   1 mi (1.6 km)

2. Follow Kapahulu Ave to Kalakaua Ave
   10 min (20 mi)

3. Turn right onto Kapahulu Ave
   1.3 mi

4. Turn left onto Kalakaua Ave
   11 fl

5. Keep right to stay on Kalakaua Ave
   Destination will be on the right
   0.7 mi

2933 Kalakaua Ave
Honolulu, HI 96815

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