

Alumnus Arthur McDonald wins Nobel Prize in Physics

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Caltech Media Relations

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Arthur B. McDonald (Ph.D. '70), director of the Sudbury Neutrino Observatory (SNO) in Ontario, Canada, and Takaaki Kajita, at the University of Tokyo, Kashiwa, Japan, have shared the 2015 Nobel Prize in Physics for the discovery that neutrinos can change their identities as they travel through space.

McDonald and Kajita lead two large research teams whose work has upended the standard model of particle physics and settled a debate that has raged since 1930, when the neutrino's existence was first proposed by physicist Wolfgang Pauli. Pauli initially devised the neutrino as a bookkeeping device—one to carry away surplus energy from nuclear reactions in stars and from radioactive decay processes on Earth. In order to make the math work, he gave it no charge, almost no mass, and only the weakest of interactions with ordinary matter. Billions of them are coursing through our bodies every second, and we are entirely unaware of them.

There are three types of neutrinos — electron, muon, and tau — and they were, for many years, assumed to be massless and immutable. The technology to detect electron neutrinos emerged in the 1950s,

and it slowly became apparent that as few as one-third of the neutrinos the theorists said the sun should be emitting were actually being observed. Various theories were proposed to explain the deficit, including the possibility that the detectable electron neutrinos were somehow transmuting into their undetectable kin en route to Earth.

Solving the mystery of the missing neutrinos would require extremely large detectors in order to catch enough of the elusive particles to get accurate statistics. Such sensitive detectors also require enormous amounts of shielding to avoid false readings.

The University of Tokyo's Super-Kamiokande neutrino detector, which came online in 1996, was built 1,000 meters underground in a zinc mine. Its detector, which counts muon neutrinos and records their direction of travel, found fewer cosmic-ray neutrinos coming up through the Earth than from any other direction. Since they should not be affected in any way by traveling through the 12,742-kilometer diameter of our

planet, Kajita and his colleagues concluded that the extra distance had given them a little extra time to change their identities.

McDonald's SNO, built 2,100 meters deep in a nickel mine, began taking data in 1999. It has two counting systems. One is exclusively sensitive to electron neutrinos,

The conclusion, for which McDonald and Kajita were awarded the Nobel Prize, was that neutrinos must have a nonzero mass. Quantum mechanics treats particles as waves, and the potentially differing masses associated with muons and taus gives them different wavelengths.

The probability waves of the three particle types are aligned when the particle is formed, but as they propagate they get out of sync. Therefore, there is a one-third chance of seeing any particular neutrino in its electron form. Because these particles have this nonzero mass, their gravitational effects on the large-scale behavior of the universe must be taken into account — a profound implication for cosmology.

McDonald came to Caltech in 1965 to pursue a Ph.D. in physics in the Kellogg Radiation Laboratory under the mentorship of the late Charles A. Barnes, professor of physics, emeritus, who passed away in August 2015. "Charlie Barnes was a great mentor who was very proud of his students," said Bradley W. Filippone, professor of physics and

a postdoctoral researcher under Barnes. "It is a shame that Charlie didn't get to see Art receive this tremendous honor."

A native of Sydney, Canada, McDonald received his bachelor of science and master's degrees, both in physics, from Dalhousie University in Halifax, Nova Scotia, in 1964 and 1965, respectively. After receiving his doctorate, he worked for the Chalk River Laboratories in Ontario until 1982, when he became a professor of physics at Princeton University. He left Princeton in 1989 and became a professor at Queen's University in Kingston, Canada; the same year, he became the director of the SNO. In 2006, he became the holder of the Gordon and Patricia Gray Chair in Particle Astrophysics, a position he held until his retirement in 2013.

Among many other awards and honors, McDonald is a fellow of the American Physical Society, the Royal Society of Canada and Great Britain's Royal Society. He is the recipient of the Killam Prize in the Natural Sciences; the Henry Marshall Tory Medal from the Royal Society of Canada, its highest award for scientific achievement; and the European Physics Society HEP Division Giuseppe Vanna Cocconi Prize for Particle Astrophysics.

To date, 34 Caltech alumni and faculty have won a total of 35 Nobel Prizes. Last year, alumnus Eric Betzig (B.S. '83) received the Nobel Prize in Chemistry.



Caltech alum Arthur B. McDonald (Ph.D. '70) was awarded the Nobel Prize in Physics this year.

Photo Courtesy of Queen's University

which are the type emitted by the sun; the other records all neutrinos but does not identify their types. The SNO also recorded only about one-third of the predicted number of solar electron-type neutrinos — but the aggregate of all three types measured by the other counting systems matched the theory.

Students present summer research at SURF Seminar Day

NEERA SHAH
CHING-YUN (CHLOE) HSU
Editor-in-Chief
Page Editor

On Oct. 17, undergraduates who were part of this year's Summer Undergraduate Research Fellowship (SURF) program presented their research at SURF Seminar Day. This annual event is open to the public and allows students to share their work with peers and community members.

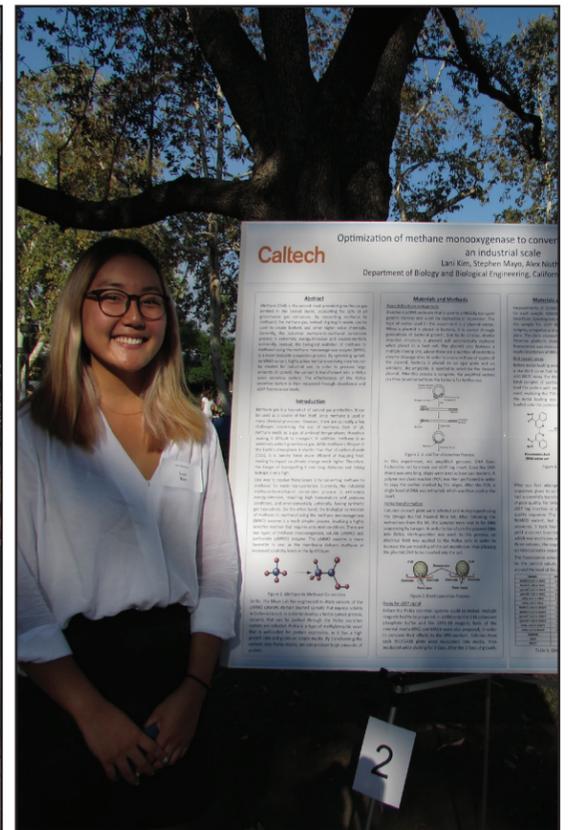
For many, this was their first SURF experience, while others are veterans of the research program. Sophomore Lani Kim described her first experience this year as a great learning experience. "In high school, I didn't have much lab experience, I got to get more experience in the wet lab here and I learned techniques like PCR," she said. While she is majoring in chemical engineering, her project was in bioengineering. Kim worked to make the conversion of methane gas to methanol better using

biological processes, such as those of yeast, so it is less harmful for the environment.

Sophomore Arjun Goswami is another first-timer who was able to gain exposure to his field and learn more about what research is like. He stayed true to his physics major and worked on a project designing a radiation shield for Angle-Resolved Photoemission Spectroscopy (ARPES). Goswami helped build a computer model of a shield that could shield black body radiation during measurements. Debugging and other constraints have prevented the group from implementing the model, but Goswami is continuing his SURF research to follow this project through.

When asked what his favorite part of his SURF project was, sophomore Arjun Bose paused for a while, as if mulling over his entire summer, and then there was his half-serious answer, "Perhaps writing the proposal." Although

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Sophomore Lani Kim completed her first SURF this year and studied the process of converting methane gas to methanol. Photos Courtesy of Ching-Yun (Chloe) Hsu and Neera Shah

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Caltech Y Column

CALTECH Y

The Caltech Y Column serves to inform students of upcoming events and volunteer opportunities. The list is compiled by Neera Shah from information given by the Caltech Y and its student leaders.

Founded by students in 1916, the Y was organized to provide extracurricular activities planned and implemented by students as an opportunity to learn leadership skills and discover themselves. The mission of today's Y remains the same—to provide opportunities that will prepare students to become engaged, responsible citizens of the world. The Y seeks to broaden students' worldviews, raise social, ethical, and cultural awareness through teamwork, community engagement, activism, and leadership. More information about the Caltech Y and its programs can be found at <https://caltechy.org>. The office is located at 505 S. Wilson Avenue.

Ongoing and past programs hosted by the Caltech Y:

Alternative Spring Breaks: Costa Rica, New York, Yosemite, San Diego, San Francisco

Make-A-Difference Day: Hillside Home for Children, LA County Arboretum and Botanic Garden, Children's Hospital Los Angeles (Coachart), Eaton Canyon, Lifeline for Pets

Explore LA: Lakers game, Next to Normal musical, Norton Simon Museum trip

RISE Tutoring program (an afterschool math and science-focused tutoring program that serves public school students between grades 8 and 12)

Upcoming Events

1. Community Service and Advocacy Fair

Friday | October 23rd | 12:00 - 1:00 PM | San Pasqual Walk

Join us on San Pasqual Walk and take the opportunity to find out about some of the many opportunities for community service and advocacy in our area. Talk with some of the groups represented and get a free boba drink while supplies last. For every organization you speak to, you'll receive a raffle ticket. Collect five raffle tickets to trade in for a free boba! Close to 30 organizations from the Pasadena area will be present. Both on-campus and off-campus organizations will be highlighted.

2. Profits in the Final Frontier: Entrepreneurial Pursuits in Space

Tuesday, October 27th | 8:00 PM | Hameetman Auditorium, Cahill Building

The Caltech Y Social Activism Speaker Series (SASS) and the Keck Institute for Space Studies (KISS) present a public panel on:

Profits in the Final Frontier: Entrepreneurial Pursuits in Space

With panelists:

Rob Hoyt, Tethers Unlimited, Inc.

Michael Rubel, Planet Labs

Chris Vorhees, Planetary Resources

Moderator: Sergio Pellegrino, California Institute of Technology

The past few years we have seen the emergence of several space startups private companies with the ability to make a profit while operating extraterrestrially. These companies can be divided into three categories: Earth-based companies developing products for space, space-based companies providing services back on earth, and companies that operate entirely off-world. All face challenges associated with the operating in space, but each has unique

difficulties when it comes to securing funding and developing a business plan.

Tethers Unlimited, Planet Labs, and Planetary Resources, who represent the entire spectrum of space startups, will discuss what is needed to succeed as a space company. Topics to explore include risks and rewards within each category, how to work with minimal existing infrastructure, and how to secure funding when the average return on investment timeline is much longer than for a typical startup.

No registration required, seating is available on a first come, first served basis. Visit www.kiss.caltech.edu for more information.

3. Adventure 101 - Great Hikes in the Greater LA Area

Wednesday | October 28th | 12:00 Noon to 1:00 PM | Lunch Provided, Space is limited
RSVP Required: <http://goo.gl/forms/pim9et9EMj>

Los Angeles has a vast array of great hiking - from the immediate San Gabriel Mountains or Griffith Park areas to the Santa Monica Mountains near the beach - there is a seemingly unending supply of hiking options. Come learn from student Y-Outdoors Leaders as they share from personal experience about some of the great venues you might want to explore on your own. Location details will be included in the confirmation.

4a. Pasadena LEARNS

Fridays | 3:00 - 5:00pm | Pasadena

Come volunteer at Madison and Jackson Elementary School! We are partnered with the Pasadena LEARNS program and work with their Science Olympiad team or do regular tutoring along with occasional hands-on science experiments. Transportation is provided. For more information and to RSVP, contact vkumar@caltech.edu. Eligible for Federal Work Study.

4b. Hathaway Sycamores

Wednesdays | 5:30-8:00pm | Highland Park

Volunteer at Hathaway-Sycamores, a group that supports local underprivileged but motivated high school students. There are a variety of ages and subjects being tutored. The service trip includes about an hour of travel time and 1.5 hours of tutoring. Transportation is included. For more info and to RSVP email Sherwood Richers at srichers@tapir.caltech.edu. Eligible for Federal Work Study.

Other Announcements - Beyond the Caltech Y

Kidspace Museum Pumpkin Festival

On October 17 and 18, 2015, Kidspace Children's Museum and the Circle of Friends will host the 21st Pumpkin Festival in Brookside Park, Pasadena, CA. During the course of the two days, the festival will host over 20,000 visitors and families to celebrate the fall in a safe and fun environment. We will provide entertainment, food, rides, games, crafts, and more! Participants will join costume parades, win prizes, and dance to festive music from around the world. To accomplish this great and wonderful task, we are seeking adult and youth volunteers (ages 13 years and older) to help staff the Pumpkin Festival. Volunteers are needed to work at least one three-hour shift during the weekend. If volunteers would like to give additional time, there are plenty of opportunities to volunteer for more than one shift! For more info see the volunteer flyer.

Students recognized at Seminar Day



Senior Chaitanya Malladi presents his research. Photo Courtesy of Ching-Yun (Chloe) Hsu

Continued from page 1

a sophomore, Bose has already spent two summers in the SURF program. His physics research used textured silicon as an antireflective treatment for microwave lenses.

While students enjoyed the opportunity to interact with their expert mentors, they also bonded with their peers and learned from each other. Sophomore Gloria Ha worked in the Shapiro Lab along with five other undergraduate students at Caltech, juniors Suchita Nety, Vasant Iyer and Jenny Sheng, and sophomores Jonathan Clements and Yiwei Jiang. Ha appreciated the collaborative lab environment where all the undergraduate students went through ups

and downs together, as friends rather than competitors.

Headed by Director Candace Rypisi, the Student-Faculty Programs office is responsible for administering the SURF program. This is the 37th consecutive year that the scholarship has been available for students. Continual donations and endowments maintain this scholarship fund that caters to more than 400 students each year.

Semifinalists* for the Perpall Speaking Competition:

Emily Meany

Alec Brenner

Heather Gold

Sean McKenna

Aishwarya Nene

Dominic Yurk

Alison Lui

Nicholas Zolman

Saaket Agrawal

Laura Shou

Andrew Romine

Nicholas Schiefer

*This list is incomplete. One semifinalist's name was not released at the time of publication and will be published next week.

The finalists for the Gee Family Poster Competition:

May Hui

Chaitanya Malladi

Hanzhi Lin

Ankit Kumar

Kayanè Dingilian

Beatriz Atsavapranee

Leo Zornberg

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Julia Holter's *Have You in My Wilderness* tells emotional stories

CRYSTAL LIANG
Contributing Writer

Julia Holter is an experimental pop artist who made her debut in 2007 with the ambient work *Tragedy* (inspired by the Greek play *Hippolytus*), establishing her erudite and aloof persona in the music world. Contrary to her reputation, she does not see her music as academic. Rather, her artistic intent is more in line with that of singer-songwriters: she wants to tell stories, relying more on intuition and the subconscious than any overly cerebral process. With her compositional skill and her ability to tap into intuition and emotion, Holter has produced music that is both melodic and intriguing, as in her acclaimed 2013 concept album *Loud City Song* on the disorientation that one feels in the heart of Los Angeles. With an eclectic choice of instruments, from the harpsichord to the jazzy string bass, she evoked all the grandeur and chaos, all the space and claustrophobia of her home city.

Her newest album, *Have You in My Wilderness*, released on Sept. 25, continues to draw on the elements of her past works while taking them in a more pop-like direction. As in *Loud City Song*, Holter assumes multiple personas and points of view to tell stories. But while *Loud City Song* was a novella, this new album is more like a collection of short stories with a handful of motifs: running away, finding freedom, one person calling to another across vast spaces, whether they be physical or psychological (the titular "wilderness").

The album opens with the gorgeous, impressionistic pop single "Feel You," ignited by a baroque flourish of a harpsichord. Holter's ethereal background vocals and lofty strings immerse us in the sunny, exhilarating atmosphere of the song. Her vocal delivery here is punchy, as she enunciates consonants with a light staccato. Taking on the persona of a flighty, absent-minded young woman, Holter sings of escape from the sun, "rush-hour car stares," and arriving to empty rooms. The last minute of the song gives way to an atmospheric, spoken-word section — the '60s-pop strings in the chorus now take on a marching, minimalist quality, and ambient church bells and blurred background vocals come to the fore. These elements remain as the song closes with a repetition of the chorus and the woman disappears into the urban oblivion.

"Feel You" proves to be the emotional high point of the album, as the rest of it explores darker territory and the psychological conflict within relationships. The next song, "Silhouette," is about obsession — it begins

with an easy-listening vibe, which grows unsettling until collapsing into a chaos of schizophrenic vocals, distortion and relentlessly sawing strings. Similarly, "Lucette Stranded on the Island" hides Lucette's trauma under layers of sonic gauze and dreams that gradually unravel. Holter shifts seamlessly from third person to first, singing distantly "Can anybody help her?" and later speaking in near-monotone and increasingly disturbing euphemisms as a fading Lucette. Meanwhile, the instrumentation darkens to match, and the background vocals grow to resemble sirens and distressed cries.

At the same time, the crispness of the vocals, brought to the spotlight for the first time, creates a feeling of immediacy, as if the characters are personally telling you their stories. Following the confusion of "Lucette" is a shock of clarity in the intrepid single "Sea Calls Me Home." Against a backdrop of jaunty harpsichord and doo-wop harmonies, the plucky protagonist sets out into newfound freedom, both exciting and terrifying. There's a brief moment of safety in a whistled interlude before plunging with the suddenness of a rollercoaster into a wild saxophone solo. As in "Feel You," the chorus repeats with new elements — the saxophone and dizzying, arpeggiating strings — that express the protagonist's vertigo.

The prominence of the vocals is also particularly effective in "Everytime Boots," an off-kilter banger, and "Betsy on the Roof," a soulful piano ballad. Featuring a punk-rock beat, "Everytime Boots" crackles with manic energy and a boldness unprecedented in Holter's work. The childlike quality of her voice serves her well here; singing of cattle rides, motorcycles,

vocals really shine here, conveying the narrator's desperation in addressing Betsy. The vocals falters in the end, however, as they lose some energy and the track becomes overlaid with distracting distortion.

The drama of "Betsy" is followed by "Vasquez," an epic tribute to the historical bandido. The electrifying synths that flash like lightning in

I was lost or if I was running away again" with disdainful apathy.

The title track forms bookends with the opener, providing a poignant answer to the latter. The instrumentation is stripped down in contrast to the dense soundscape of "Feel You." It begins with just Holter's voice, singing tenderly from the perspective of the woman's lover. Holter is accompanied only by what sounds like a choirboy in a cavernous church, perhaps to evoke the concept of prayer in relation to the subject of the song: calling out to someone who may or may not hear you or choose to hear you. As the piano and strings swell to a heartrending climax and the man sings in increasingly pained tones, "Tell me, why do I feel you running away?" we hear the airy voice of the woman coldly singing, "Oh, shut up." After their voices fade away, the last thing we hear is the choirboy singing a single note, perhaps to signify the futility of the man's prayer and his abandonment in his wilderness.

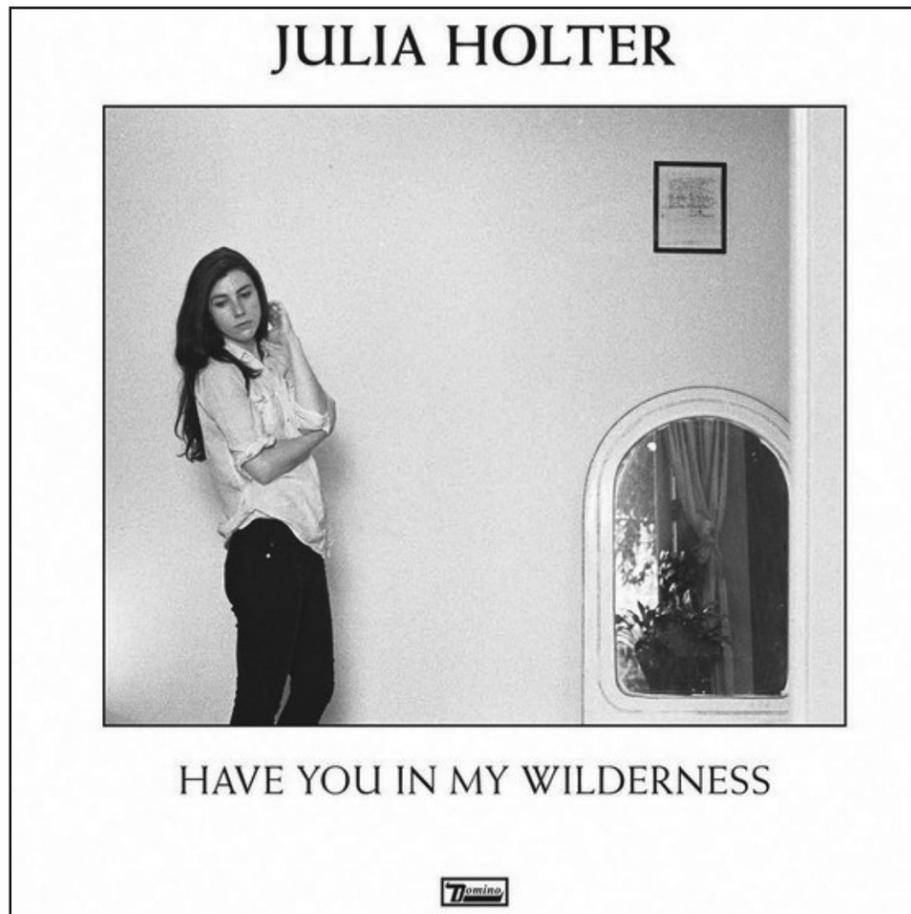
Have You in My Wilderness is a work of exquisite storytelling. Brimming with intricacies and lush instrumentation, it is definitely an album that requires multiple listens to be fully appreciated. All the musical details are allowed to shine fully thanks to the crisp and polished production of this album. Exploring greater

vistas of emotion with this new clarity and an ever expressive voice, Holter continues to evolve as an artist.

Best Tracks: "Feel You," "Vasquez," "Have You in My Wilderness"

Worst Tracks: "Night Song," "How Long?"

Overall Rating: 8/10



-<http://thefourohfive.com/>

and rattlesnakes, we can imagine the narrator starring as a restless gamine in a western film.

"Betsy on the Roof" is one of Holter's most overtly emotional songs and is one of the more conventional in melody, chord progression and piano arrangement, all of which Holter executes beautifully. With little to distract from them and much to complement them, Holter's

the chorus, the frenetic bluegrass strumming that accompanies a chase in the rocks and the soaring strings all add to the vast scope of the song and give us the sense that we are in a land of legend. Holter imaginatively takes on the voice of the bandido, at times amused and at others darkly resentful and sardonic, but always blasé. For example, she sings "Wasn't sure if

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Flying solo: Reflections on my SanPietro trip

LINDA CHIO
Contributing Writer

As the days whittled down to my departure for the Netherlands and Belgium, my excitement barely masked my trepidation. I was going to be traveling solo and in Europe for the first time. After three summers of research, this trip was going to be an awesome adventure, but what if I got lost? What if my hostels were uninhabitable? What if I'm not able to communicate with the locals? I spent the week between graduation and my flight learning Dutch on Duolingo, but all I could manage was "Spreekt tu Engels?" (Do you speak English?). It was surprising how quickly all these fears melted away; I now feel empowered by my SanPietro trip.

I began my journey in Amsterdam. Although the street signs are small and hidden against the walls of buildings, I learned to navigate the city by the many monuments and landmarks. I quickly learned that English was the most commonly spoken language, and I easily communicated with my roommates and locals.

I was surprised by the friendliness of everyone at the hostel and made the acquaintance of other solo travelers. On my first night, my Brazilian roommate offered to take me around the city on the bike she rented. She was not used to riding with a passenger, so the first time we tried riding, I was dropped from the back of the bike and landed squarely on my behind. However, we quickly hit a stride and I felt like a local cruising alongside the canals on the back of a bike. The city was a cultural center with art museums (don't miss the Van Gogh Museum!) and markets, and everyone was very friendly and laid-back.

My second stop was Utrecht, a city full of happy coincidences. The Tour de France was going to begin at Utrecht in early July. The excitement for the race made the town much more vibrant, and one of my roommates informed me that the roads were newly paved just for the race. I also learned that the cartoon character Miffy was having her 60th anniversary and that she originated from Utrecht, which explained why so many Miffy dolls were around the Netherlands. I was surprised at how many things I could learn while traveling and how even meticulous research cannot reveal everything about a location.

I ended my time in the Netherlands at Maastricht, the city where local Europeans vacationed. It is the Dutch city with the second highest number of historical buildings, and there were apartments carved out of fortress walls. Most of my evenings were spent on my hostel's terrace watching the sun set on the Meuse River and sharing

a Belgian beer with someone new I met that day. My acquaintances included German students, Dutch music instructors and pilots in training.

My next stop was Belgium, and I ventured into the French-speaking Wallonia region of the country with a stop at Namur. Here I practiced my intermediate French and learned to master the art of ordering food. Towering over the somnolent city (whose mascot is the snail) is the Citadel. Namur is in a strategic intersection of the Meuse and Sambre rivers and had been conquered 18 times.

There were not many other solo travelers in Namur, and I found it hard to make friends with people who often did not speak any English. Here solo travel became lonely, especially when I found no Americans with whom I could celebrate the Fourth of July.

However, I was quickly rejuvenated by my next stop, Ghent. Many other young travelers had stopped here to explore this hidden gem. The ornate buildings locked together perfectly with the daily rituals of the locals. Students would sit and drink wine on the steps leading to the Medieval Harbor. Commuters waited for the bus in front of the Gravensteen Castle that stood nonchalantly in the center of town. Here, more than any other stop, was where I felt the gravity of the history as more of an explorer than an observer. I spent a whole day in the Ghent city museum, STAM, taking in the history and growth of the city without being rushed or disturbed by other tourists. I sat in St. Bavo's Cathedral for an hour in front of one of the oldest oil paintings, the Ghent Altarpiece, taking in every detail with the narration of an audio tour. Here I felt at peace with my trip and appreciated the chance of being in the presence of history that was older than the entire United States.

My trip ended in Brussels, the bustling capital of Belgium. In one day I took a free walking tour of the city and had a quick food tour of the area as well. I had a €3 waffle piled high with strawberries and whipped cream. The most savory fries I ever had were at Café Georgette and had been double fried in beef fat. The quality of chocolate at Mary's explained why it is the only chocolate shop frequented by the Belgian royal family. And of course I did not miss out on my last chance for having Belgian beer with friends!

On one of my last nights in Brussels, a free Dutch music festival took place in the Grand Place. Here, in the shadows of the UNESCO-designated heritage site, there was a public art installation where people were invited to express themselves on a giant message board. My message there is one that summarizes my trip well: "This has been the best summer ever! Take chances, say yes, and travel alone!!!"



Linda Chio finds the Castle de Haar near Utrecht, Netherlands.

Photo Courtesy of Linda Chio

Humans of Caltech: Elvira Serpa

The California Tech brings you stories of Caltech community members



Elvira Serpa is a food service worker on campus. She is well-known among students for her warm and sweet personality.

Photo Courtesy of Katherine Guo

KATHERINE GUO
ALEXANDER HSU
Page Editor
Contributing Writer

What's a game that you played when you were young with your friends?

Skateboarding.

Do you still skateboard?

No... 61 years old too much.

Can you teach me to skateboard?

Ooh my god... haha.

Were you born here?

No, in Cuba.

What age did you come?

Twenty-eight.

Why did you come?

For freedom.

What's the best gift that you have ever gotten?

Life.

The following interview with Elvira was conducted with the help of Oswaldo Penalosa, another food service worker on campus, for translation.

What are some favorite foods you like to eat when you were young, or now?

Flour, and ground beef.

Dishes in particular?

A Cuban dish called arroz con pollo – "chicken with rice."

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Volleyball sweeps doubleheader against Mills

GOCALTECH.COM
Actual Sports Content Editor

PASADENA, Calif. (Oct. 11, 2015) – The Caltech volleyball team swept a doubleheader against Mills College by identical 3-0 scores on Sunday afternoon.

The Beavers recorded season highs in kills, digs, assists and aces in their first two victories of the season, improving to 2-14 overall.

Caltech 3, Mills 0

The Beavers came out on fire in the first set as they scored the first four points of the game, including two service aces by senior Meghana Pagadala. The Cyclones kept close until a kill by senior Cat Jamshidi led the Beavers to a six-point rally and eventual 25-18 victory.

The second set was a nail-biter right from the start. Mills shrugged off the first set to jump out to a 12-8 lead, but a kill by senior Amarise Little shifted the momentum in favor of the Beavers, who scored six unanswered points to take the 14-12 lead. An attack error by the Beavers did not change the momentum as they bounced back to run off another three straight

points, making the score 17-13. The Cyclones did not give up, though; after trading points, Mills went on a five-point run and took back the lead at 20-19.

Another Jamshidi kill tied the game at 20-20, where the Cyclones went on another three-point run to make the score 23-20. The Beavers did not give in, however, as yet another kill Jamshidi led the Beavers to a four-point run that turned the tables at 24-23. Down but not yet out, the Cyclones registered a kill and benefited from an attacking error, leading to set point.

An attack error by the Cyclones gave the Beavers another chance and they capitalized, with senior Harinee Maiyuran serving up a clutch ace and setting up Pagadala for the kill to clinch the exciting second set.

The third set stood in stark contrast to the second, with Mills surging ahead 10-5 before Caltech took over, scoring 20 of the final 26 points to seal the victory.

Jamshidi double-doubled for the first time this season, smacking a team-high 19 kills on a .292 hitting

percentage and leading the squad with 12 digs. Pagadala added six kills on a .294 hitting percentage while Maiyuran and junior Kate Lewis combined for 29 of the team's season-best 35 assists. Freshman Subhara Vetrivel and Jamshidi recorded five and four total blocks, respectively, as the team also set season highs in kills (38), digs (51) and blocks (8.0).

Caltech 3, Mills 0

Looking to improve from their first match, the Cyclones came out fired up as they took an early 8-6 lead in the first set. A Mills attack error keyed a 10-1 run, including six unanswered points, for the Beavers and Caltech rode the momentum to

a 25-18 victory. In the second set, the Beavers took the early lead at 14-5 and held the margin through

the edge, but Mills bounced right back to regain the lead and held it until midway through the set at

13-12, when the Beavers took the lead for good on four consecutive points and steadily outpaced the Cyclones en route to a 25-20 final.

Jamshidi again paced the Beavers with 13 kills, while Little added five and the pair each recorded two blocks. Senior Amy Hu posted her second double-digit



The volleyball players do their best rampaging dinosaur impressions for their victory celebration.

Photo Courtesy of Michael L. Wong

to a 25-19 win.

The third set was a true battle, with the Cyclones scoring the first two points of the set before a kill by Little woke up the Beavers. Caltech tallied four straight points to gain

dig total of the season with a team-high 10, while Jamshidi's five aces led Caltech to a season-high 19, with another four from Pagadala and three each from Maiyuran, Pagadala and Lewis.

Bradley regains SCIAC lead in split with Chaffey, Ventura

GOCALTECH.COM
Actual Sports Content Editor

RANCHO CUCAMONGA, Calif. (Oct. 10, 2015) – Junior Chris Bradley regained the SCIAC lead with 60 goals on the season thanks to a 13-goal haul as the Caltech men's water polo team split a pair of games at Chaffey College, 13-10, and against Ventura College, 10-12, on Saturday morning.

The Beavers are now 6-9 overall with one non-conference game remaining before SCIAC play begins.

Caltech 13, Chaffey 10

Caltech controlled play to pen the first game, limiting Chaffey to just two shots in the first quarter. That dominance led to three Beavers goals, with Bradley netting a brace and assisting senior James Blackwood, who returned the favor on Bradley's second goal. The Panthers converted their first attempt of the game at the 2:37 mark to cut the lead to two, but freshman Shaurya Gilani stuffed the second shot with 19 seconds remaining for the first of an eventual 12 saves – the first double-digit total of his career.

The Beavers extended the lead to four with goals from Blackwood and senior Patric Eck before the Panthers struck for their second. Bradley netted two more on consecutive possessions to make it 7-2 and Caltech followed Chaffey's third strike with two more before the quarter ended. In the last minute, another three Bradley attempts failed to find the back of the net as the halftime score read 9-3.

Blackwood opened the scoring again three minutes into the second half, but Chaffey began to rally with back-to-back goals and three straight between the late third and early fourth quarters, pulling within three at 11-8 with 5:20 remaining in the game. Eck assisted



Bradley winds up, undoubtedly to score another goal. He is the star of this article, but I'd like to take a moment in the caption to ask, what kind of city name is Rancho Cucamonga?

Photo Courtesy of Michael L. Wong

Bradley to break the eight-minute scoring drought with 3:32 on the clock, but Chaffey made one final push with goals at 3:12 and 1:54 to trim the deficit to two. The Panthers forced a turnover on the Beavers' next possession, but Bradley sealed the game with a steal, drawn exclusion and his season-high eighth goal on another Blackwood assist with 49 seconds left to play.

Bradley netted his eight goals on 18 attempts without committing a single turnover, while Blackwood amassed three goals and four assists. Eck drew six exclusions, scored twice and made two assists while freshman Eshan Govil built on his recent hot streak with two assists, three steals and two field blocks.

Ventura 12, Caltech 10

Just minutes after ending the first game, Caltech found itself on the opposite side of the coin in the second game, falling behind 4-1 midway through the first quarter before salvaging a second goal at the 2:20 mark. Bradley and Blackwood scored and assisted once each in the quarter as the offense

struggled to maintain possession and create open looks.

Blackwood would find Bradley again to cut the margin to one early in the second quarter, but Ventura opened up a four-goal lead before Caltech could get back on the board via a third Blackwood-to-Bradley connection. The Beavers pulled back within two at 7-5 and 8-6 over the first four minutes of the second half, but Ventura scored on three consecutive possessions to take a nearly insurmountable 11-6 lead with just 1:59 left in the third.

Caltech put together a rally down the stretch, outscoring Ventura 4-1 in the quarter, but could not capitalize on a breakaway opportunity to come within one in the final minute.

Bradley scored five goals on 10 attempts while Blackwood registered two goals and another four assists. Eck drew a season-high-tying seven exclusions as sophomore, Govil and junior Tomas Tusie netted once each. Freshmen John Lloyd and Charles Ross made a season-high 10 and six saves, respectively, in goal.

Reed scores two in first start at forward versus Whittier

GOCALTECH.COM
Actual Sports Content Editor

PASADENA, Calif. (Oct. 14, 2015) – Junior Schaeffer Reed bagged a brace to reward Head Coach Phil Murray's decision to field him as a forward for the first time in his career against Whittier College on Wednesday afternoon.

The Poets took an early lead and fended off a late first half challenge from the Beavers to claim the 5-2 victory. Whittier improves to 5-7-1 overall and 4-6-1 in the SCIAC while Caltech is now 0-11 (0-11).

Whittier threatened to take control from the outset, but Reed and the rest of the Beavers offense made a point of pushing up-field and the converted defender soon put the first of his and the team's

only three shots on target in the eighth minute to force a save.

Junior J.D. Feist made three saves before the Poets finally breached the defense for their first goal in the 20th minute and again in the 35th. Reed responded just three minutes later with a header off a free kick from freshman Jack Banaszak to halve the deficit heading into halftime.

The visitors gained some breathing room on a penalty shot thanks to a handball in the 49th minute and added another in the 66th to go ahead by three at 4-1. Reed, having sent another header just over the bar in the 63rd minute, hit his second goal on a header off Banaszak's corner to again halve the deficit. The Poets would seal the victory with their fifth goal in the 75th minute.



"Y U take the ball frm me & run away liek that?" -- Hilarious Expressions Guy, on right.

Photo Courtesy of Bob Palermini

ASCIT Minutes

ASCIT Board of Directors Meeting

Minutes for 13 October 2015. Taken by Phillip An.

Officers Present: Nima Badizadegan, Sean McKenna, Jay Palekar, Cat Jamshidi, Phillip An

Call to Order: 12:05 pm

Guests: Caltech Chinese Student Association

- Request for \$300 for the Chinese Student Association to hold New Year's banquet with food and performances. Yearly event with around 30-40% undergraduate turn-out.
- Quorum established, motion passed (4-0)

President's Report (Nima):

- Spoke to the Alumni Association Board about careers and the career center
- Going to be looking more into what career resources we want to improve in the coming weeks.

Officer's Reports:

- **V.P. of Academic Affairs (ARC Chair: Jay):**
 - Frosh should fill out survey asking them how many hours they're spending on their core class sets
- **V.P. of Non-Academic Affairs (IHC Chair: Cat):**
 - **BIG ANNOUNCEMENT:** The new Bechtel Residence is currently being designed. The architects are looking for input from students
 - The IHC will be meeting with them next week
 - Survey sent out to all undergrads
 - Tours through the Houses and House Dinners
 - Focus Groups for further discussions with a few reps from each house
 - Joe Shepherd is putting together an Ad-Hoc committee to discuss Caltech's Alcohol Policies. There will be several student reps, but these have not been decided yet.
- **Director of Operations (Sean):**
 - Club funding applications are coming in
- **Treasurer (Kalyn):**
 - Absent
- **Social Director (Robin):**
 - Absent
- **Secretary (Phillip):**
 - Meeting will be rescheduled for next week. Stay tuned with emails.

If anyone has any questions or concerns about a section of the minutes please email the appropriate officer. We are happy to answer any questions.

Meeting Adjourned: 12:30 pm

VICE PROVOST'S OFFICE HOURS

Vice Provost, Chief Diversity Officer and Professor of English, Cindy Weinstein, offers weekly office hours beginning Thursday, October 15, in Room 104 Parsons Gates. She views these hours as an opportunity for undergraduates, graduate students and postdocs to meet and discuss whatever you'd like to talk about. Professor Weinstein oversees the Council on Undergraduate Education, Caltech accreditation, the Staff and Faculty Consultation Center, Student-Faculty Programs, the Center for Teaching, Learning and Outreach, the Caltech Diversity Center and the libraries.

There are four appointments per hour, 15 min. each. Sign up the day of the meeting in 104 Parsons Gates, Vice Provosts' Offices (x6339).

Fall Term Hours:

Wednesday, Oct. 28, 12pm-1pm

Thursday, Nov. 5, 12pm-1pm

Tuesday, Nov. 10, 12pm-1pm

Thursday, Nov. 19, 12pm-1pm

Monday, Nov. 23, 12pm-1pm

Tuesday, Dec. 1, 12pm-1pm

Wednesday, Dec. 9, 12pm-1pm

The Caltech Glee Club and Chamber Singers present their Fall Concert on Saturday November 14th

The Caltech Glee Club and Chamber Singers, conducted by Nancy Sulahian and accompanied by William Schmidt, will present their Fall Concert of music from the Renaissance through the 21st Century. This event will take place on Saturday, Nov 14 at 8:00 pm in Caltech's Ramo Auditorium. The Glee Club will perform the music of Certon, Handel, Mozart, Mendelssohn, Pärt, Clausen, Kirchner and Whitacre. Admission is free and no tickets are required. For more information, please call (626) 395-3295.

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The advertising deadline is 5 PM Friday; all advertising should be submitted electronically or as camera-ready art, but *The Tech* can also do simple typesetting and arrangement. All advertising inquiries should be directed to the business manager at tech@caltech.edu. For subscription information, please send mail to "Subscriptions."

REMINDER FROM COUNSELING CENTER:

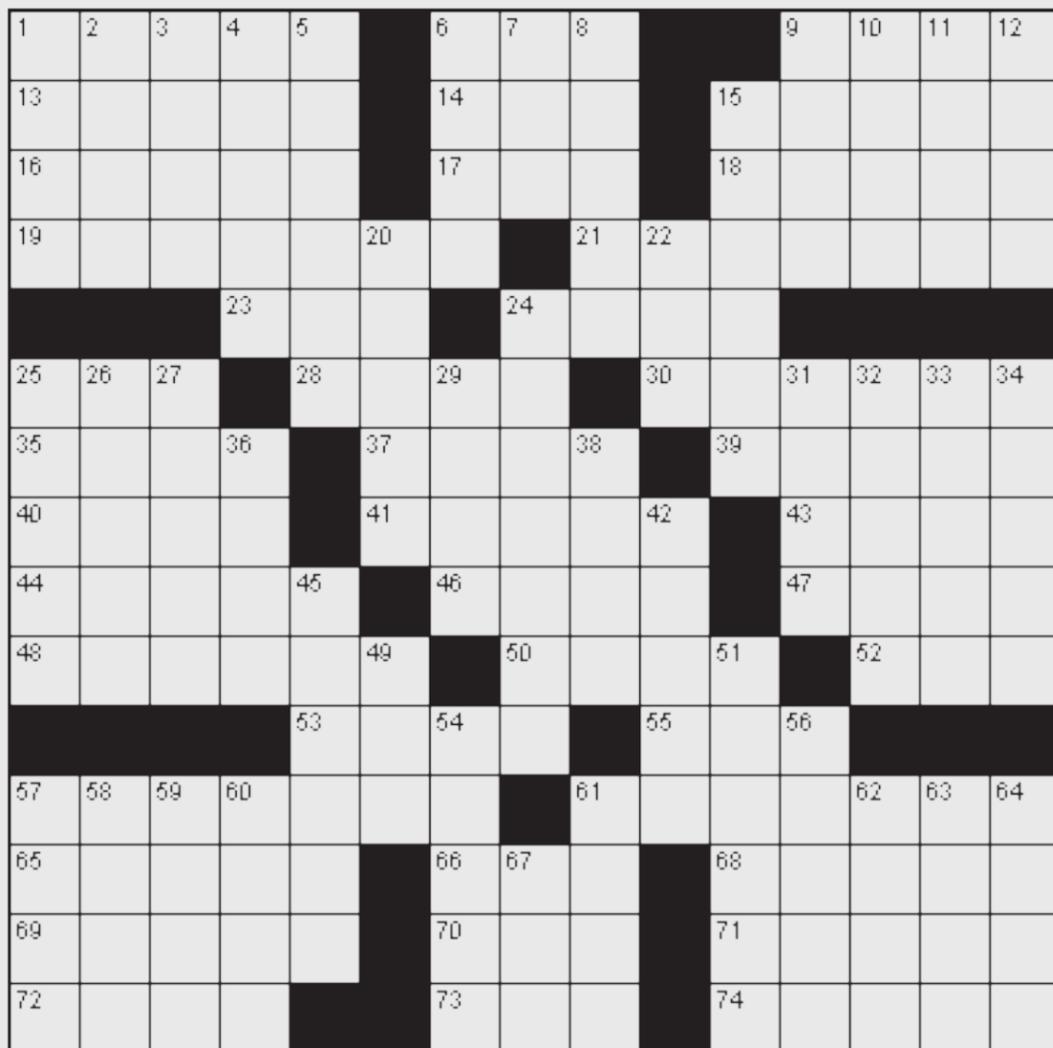
Meditation Mob

(drop-in mindfulness meditation group)

Meets every Tuesday, 12:00-12:50 p.m.

Bottom floor of Winnett

Crossword



-<http://puzzlechoice.com>

Across

1. Aromatic substance
6. By way of
9. Stream
13. Behemoth
14. The whole number or amount
15. Supporting structure
16. Warning signal
17. Snow runner
18. Tier
19. Compunction
21. Conspicuous
23. On the sheltered side
24. Stead
25. Old salt
28. Advance slowly
30. Financial gain
35. Musical composition
37. Waterless
39. Chiefly nocturnal ungulate
40. Part of the neck
41. Relating to the nose
43. Bill of fare
44. Avarice
46. Silent
47. Support
48. Two channel sound system
50. Intense anger
52. Creative activity
53. Coop

55. Egyptian cobra
57. Mythological fire-breathing she-monster
61. Intoxicant
65. Radioactive gaseous element
66. Mediterranean fruit tree
68. Small ovoid fruit
69. Choose by a vote
70. Enemy
71. Corvus Corax
72. Frail
73. Oddment
74. Vogue

Down

1. Principal actor
2. Heap
3. Detail
4. Religious song
5. Main course
6. Ornamental jar
7. Kind
8. Exculpation
9. Worry excessively
10. Molten volcanic rock
11. Presage
12. A raised mark on the skin
15. Display proudly
20. Closed litter for one passenger
22. Hawaiian garland
24. Time off
25. Gripping device
26. Separated
27. Currency of India
29. Metric unit of weight
31. Bivouac
32. Drama set to music
33. Limited in size or scope
34. Start abruptly
36. Oracle
38. Information
42. Licit
45. Polite or respectable
49. Paddle
51. Accompany
54. Faux pas
56. Diametric
57. Ship's company
58. In vigorous good health
59. Notion
60. Treat with contempt
61. Matured
62. Habitat for bees
63. Kitchen appliance
64. Give temporarily
67. Electrically charged particle

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