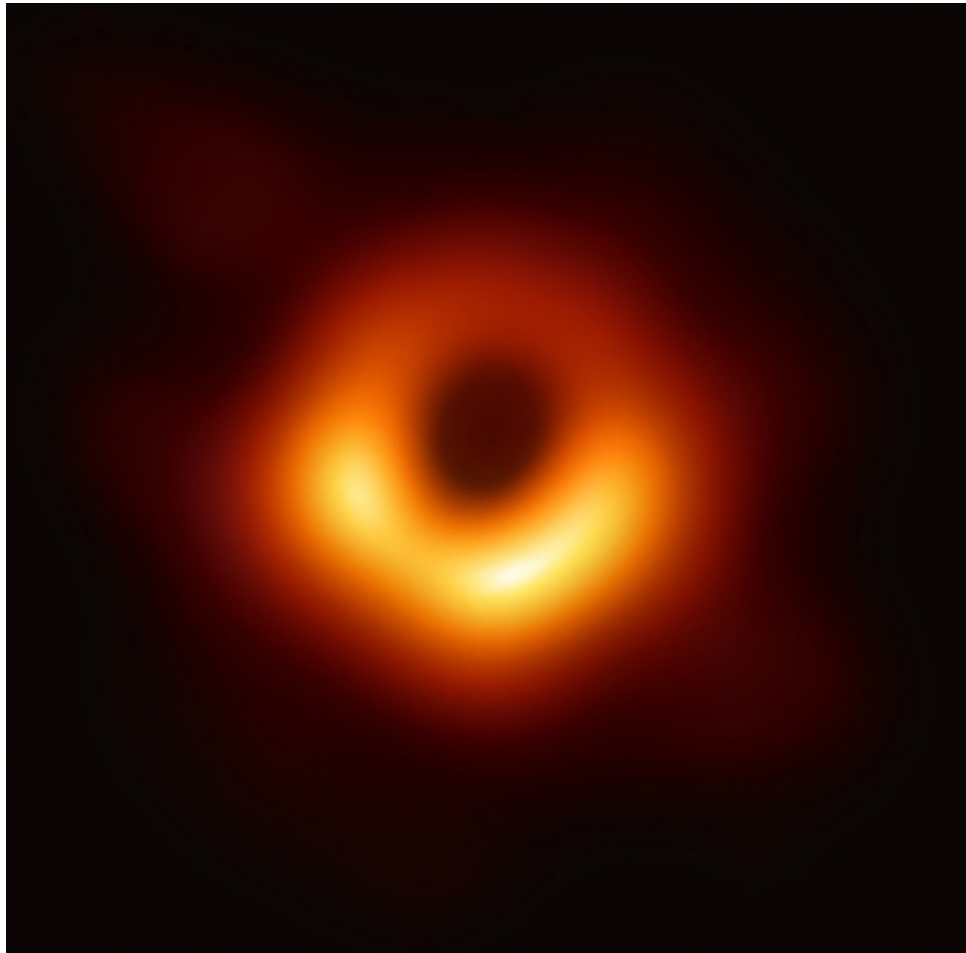# ARTIST'S CONCEPTION NO MORE: BLACK HOLE IMAGED

Angelica Zhou | Reporter

On Wednesday, April 10, 2019, an image of a supermassive black hole centered in the Messier 87 galaxy was released to the public. This was perfect timing, as 2019 marks the centennial of the eclipse that first validated Einstein's general theory of relativity. After many generations of anticipation since these mathematical and physical enigmas were first theorized, we have finally supplanted inadequate artist renditions with the first image of a black hole warping spacetime. To celebrate, we have an exclusive interview with the Nobel Prize Physicist behind the Interstellar black hole, Professor Kip Thorne, who was thrilled to witness the release of the image. But first, let's have a brief recap on how this image was produced.

A decade-long project led by Sheperd Doeleman was conducted with the Event Horizon Telescope (EHT) and over 200 researchers across the world. The EHT is actually an array of more than eight telescopes scattered over the planet, from Greenland to volcano peaks in Hawaii all the way down to Antarctica. Combining the light gathering power of multiple telescopes through the process of very-long-baseline interferometry

Event Horizon Telescope | Wikimedia Creative Commons 3.0

The first-ever image of a black hole, clearly showing the hole.

DEMYSTIFYING THE IHC

Alicia Tirone | IHC Secretary

What does the IHC do? This is a question I have been asking friends lately in an attempt to understand how much the Caltech community actually understands about the IHC's role. The answers I've received have been varied, ranging from "midnight donuts" to "I have no idea" to "Rotation" all the way to variations on "acts as a negotiating body with the administration." These responses are true in part. The IHC negotiates with administrators and handles Rotation. However, none of these responses are all encompassing or capture the scope or importance of the IHC in general. (For the record, the IHC is not responsible for donuts of any kind.)

Such confusion about what the actual role of the IHC is and what issues the IHC actually deals with has been on my mind lately. There isn't one long document that details everything the IHC does. Even if it existed, I wouldn't read it. And some of what the IHC does is necessarily kept secret, often for good reasons like student privacy. This is not an excuse for the current lack of

BARR TESTIFIES TO CONGRESS ON MUELLER REPORT

Alejandro López | Reporter

Speaking to the U.S. House of Representatives Appropriations Committee's Subcommittee on Commerce, Justice, Science, and Related Agencies, on Tuesday the 9th of April, U.S. Attorney General William Barr stated that he plans to release a redacted version of Special Counsel Robert Mueller's report on his investigation into Russian interference in the 2016 US Presidential Election by this week. Barr appeared before the subcommittee for a hearing on the Justice Department's budget request for the 2020 fiscal year. Members of the subcommittee questioned the attorney general on a variety of topics including the Justice Department's actions and budget with regards to civil rights cases, immigration enforcement, and gun control, but as Chair Rep. José Serrano, D-N.Y., noted "the elephant in the room" was the Mueller report.

The Justice Department plans to release only a redacted version of the report, which has become a point of contention between democrats and the republican attorney general. Democrats have expressed concerns about the potential for misuse of the redactions process to prevent the release of information potentially damaging to President Donald Trump. Rep. Edward Case, D-Hawaii, said to Barr "We're sitting here, from my perspective, with virtually unlimited discretion for you to redact from that document. And maybe if I trusted my government more, I would
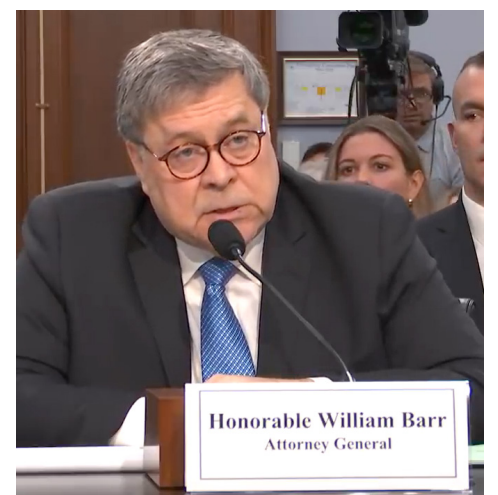
be comfortable with that." Barr stated that he would limit redactions to four categories of information that he believes should be kept from public view: information about the proceedings of grand juries which is kept confidential under the Federal Rules of Criminal Procedure 6(e), information which could reveal sources and methods used to obtain intelligence on Russia, information that could interfere with ongoing prosecution (including other investigations spun off from the Special Counsel's investigation), and information that "implicates the privacy or reputational interests of peripheral players" who were not charged in the investigation. Barr also noted that the redactions will be color-coded according to each of the four categories and that the redactions will include notes describing the reason for redaction. Democrats have said that Barr could request the release of grand jury material by court order or exercise discretion on certain exceptions granted by 6(e).

Several democrats asked Barr about whether the Special Counsel's office helped prepare the March 24th letter to the heads of the House and Senate Judiciary Committees. Barr said they had not, but stated that he had offered to allow Mueller's team to review the letter prior to its release, but that they had declined. This is in light of reports by The New York Times that several members of the Special Counsel's team have expressed that the contents of the Mueller report are more damaging to Trump than Barr's letter implied.

On Wednesday, Barr appeared before the U.S. Senate Appropriations Committee's Subcommittee on Commerce,

Justice, Science, and related agencies to testify on the 2020 budget request. As in the House, the hearing also greatly focused on the Mueller report. Senator John Kennedy, R-Ala., said to Barr "I don't intend to talk much about your budget, I think we both know Congress will make sure you're adequately funded. I want to talk a little bit about the Mueller Report." Vice Chair Senator Patrick Leahy, D-Vt., noted that grand jury material was made available to Congress after both the Watergate investigation and Special Counsel Kenneth Starr investigation on President Clinton. Kennedy asked about the risk of releasing the full report to Congress without redactions, saying there was a risk of it leaking. Barr agreed that similar material released to Congress has "occasionally" been known to leak. Several senators from both parties also asked Barr about his position on defending the Affordable Care Act. Dianne Feinstein, D-Calif., noted "the Supreme Court did uphold the law - the ACA - and now the attorney general is saying we will not defend it, regardless. It seems to me that that's a problem. Something that's duly passed and upheld as legal, that the attorney general has a duty to defend it."

Barr has said that he is also willing to appear before the House and Senate Judiciary Committees to speak specifically about the Mueller Report in early May. On April 3rd, the House Judiciary Committee voted 24-17, along party lines, to authorize subpoenas for the full report and underlying evidence.

CSPAN

Barr testifies in front of Congress.
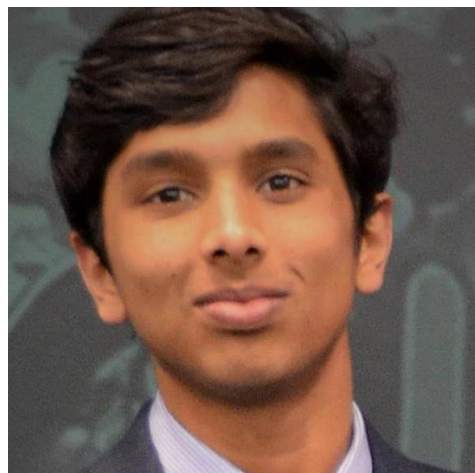
TOWN HALL ANNOUNCEMENT

There will be a town hall for the ASCIT candidates on Friday, April 19th at 7:30 pm in Feynman Lecture Hall in Bridge - the east door will be unlocked. The candidates will make short statements and then there will be a Q & A portion. Questions can be submitted online beforehand and during at sli.do event #M201.

INSIDE THIS ISSUE

ASCIT CANDIDATE STATEMENTS 2019

Candidates for President (3)

Varun Shanker

Hi everyone,

My name is Varun Shanker and I am running for ASCIT President this upcoming year. Over the past couple of years, I've had the privilege of serving as Interim Treasurer and Director of Operations (current position). Through these experiences on the Board of Directors, I have been fortunate to be a part of the implementation of several successful changes. However, I have also had a unique vantage point to see where ASCIT can be more effective in tackling challenging issues that directly impact student life at Caltech. I would cherish the opportunity to take on these issues and represent the student body for another year. In recent years, ASCIT has invested significant effort into revitalizing social events on campus. While the impact of this has been undeniably successful in facilitating inter-house student interactions and campus-wide student engagement, I am strongly interested in also improving support for student groups and clubs. This previous year, ASCIT was only able to fund 1/3 of the total funds requested by clubs in annual club funding. Moving forward, I would like to focus on reaching out to find additional external sources of funding to provide clubs here at Caltech the financial support they require to be successful without raising dues. As Director of Operations, I worked closely with both the previous and new Tech Editors to find effective and sustainable solutions to improve the quality of our newspaper. I believe that The Tech plays a strong role in engaging the entire student body in relevant discussions and will be fully committed to long-term growth of the organization in order to help them become a positive cornerstone of our campus. At the residential level, I would like to work with the IHC and ACRL in refining the new rotation process. I would like to reevaluate the allocation of frosh bed spaces between the houses and Bechtel to ensure that frosh indicating a preference to live in a house are not forced to move into Bechtel during their first year here. While students should have that option, I believe that frosh who would like to participate in the house system and experience many of the same great things we did living in a house our freshman year shouldn't be required to forgo this chance. I also plan to push for several smaller changes in Bechtel, like adding card readers to all external doors, that will improve convenience for all residents. Above all, it is the principal responsibility of the ASCIT President to represent all perspectives of the undergraduate student body. As the primary liaison between students and administration/faculty, I promise to always advocate for the best interests of all students in implementing change while protecting the unique parts of Caltech culture and tradition. Over the past year, I, along with the other members of the BoD, have truly valued getting student feedback on major projects, and took subsequent steps to remedy the concerns. As a representative of student voice, I will make concerted efforts to get feedback from members of every house and ensure ASCIT is working on issues that matter and positively impact every student. I am genuinely passionate about Caltech and would be humbled to serve as your ASCIT President. Please don't hesitate to contact me at vshanker@caltech.edu, if you have any other questions, comments, or general input.

Craig Worley

Craig Worley is running for ASCIT President. He is doing this entirely voluntarily, without coercion. Craig's sole goal as ASCIT President is to ensure that the ticket revenue from ASCIT formal covers at least fifty percent of the cost of the event. In recent years, the formal has been a major expense for ASCIT, but has been attended by only a third of the student body. Because ASCIT is funded through dues paid by the entire student body, it should aim to provide events that benefit the entire undergraduate population. Rather than spending a large amount of money on a single event for a fraction of the campus, Craig proposes to spend more of the ASCIT budget supporting clubs, hovse events, and ditch day, which reach a much greater proportion of ASCIT members. He will also reluctantly go to purchase the ASCIT donuts, despite not having a car.

Craig is also an outsider, not an inside-the-beltway member of Big ASCIT. This gives him a unique perspective, not beholden to special interests, that will allow him to Drain The Swamp. He will also be able to re-negotiate crucial ASCIT trade deals, leveraging his extensive relations with Winchill's to achieve the bigliest reduction in donut prices ever.

Craig reads all the news, so Craig knows about the latest administration controversies. Craig is aware of the problematic changes to roompicks and other campus policies. However, Craig feels that all of these issues affecting the undergraduate population as a whole should continue to be entirely delegated to the IHC, so that he can focus on the more important things. This includes a better scheduling system for the ASCIT screening room, to reduce the likelihood of walking in on a couple. Craig has his eye on the real problems on campus, and won't let administrators distract him. Craig understands the depths and complexity of the problems facing the student body, and that he alone can fix them.

Craig has layers. Like an onion. While Craig is a fearless negotiator who will make the biggest deals with admin, Craig is not a part of the admin-lackey elite; he understands the concerns of the common student. Craig will find only the best people to fill out ASCIT committees and continue to represent Real Techers. Neither Craig nor any of his appointees have had contact with Russian intelligence agencies, and if they did, it wasn't illegal. No collusion. Big ASCIT will try to scare you away from Craig, because they fear a return to True Techer Values. Do not fear. Craig is love, Craig is life.

No jumper cables were used in the writing of this statement.

"Drive fast, eat ASCIT."

Alejandro López

Hello Caltech!

I'm Alejandro, a junior ChemE in Ricketts running for ASCIT President. I believe student government and the honor code are essential to Caltech and I understand that we face complex issues and challenges, academic or otherwise. I've served as IHC Secretary, as Ricketts Secretary, on the ASCIT review committee (including as chair), the ARC, two SFC committees, a COUCH subcommittee, and several faculty committees. For the past few terms I have regularly attended ASCIT BoD meetings. From my experience I've learned a lot about the fascinating but strange worlds of Caltech student government and administration and I want to do everything I can to give back to students. I've worked and built relationships with administrators like Felicia Hunt, Joe Shepherd, Dean Gilmartin, Tom Mannion, Vanessa the RLC, and chief of security Victor Clay. If I've learned anything, it's that Caltech cannot operate without help from students, and we can't afford to get it wrong. ASCIT is more than donuts and bagels, it has to provide services and social events and represent students to administration and faculty. I want to use my expertise to make ASCIT an organization we can truly be proud of.

On the ASCIT Social Budget

Like 40 other students I ended up on the waiting list for ASCIT formal yet still contributed $18 worth of dues for it. I plan to uphold priority for those on the waiting list. ASCIT tried to cut costs by replacing an open bar with drink tickets, but the popularity of the venue kept some students from attending. My plan will be to conduct surveys to find out what students want most and distribute costs between the venue and alcohol accordingly. For other ASCIT social events, house social chairs know best what events students want, so I will encourage the board to work with the ESC, which includes social officers from all the Houses and Bechtel, to determine which social events get funding priority. This year, I am aware that Caltech provided less funding for ASCIT social events, including movie night, because money was used for other purposes. In the future I would plan ahead for unexpected changes in revenue.

Work with IHC to preserve and improve the House System

For many students, the house system provides a home and a family in an academically rigorous environment. After a year on the IHC, I am well aware of challenges the house system faces and have worked with IHC Chair Sarah and House Presidents. I plan to support the IHC in their efforts by highlighting improvements students have made and the need to respect student leadership in any changes, especially rotation and roompicks. The ACRL had a rocky history and now faces a change in membership; I will work with Joe Shepherd to ensure a fair process for selecting student members of the ACRL.

Advocate to Administration for supporting students

Tensions between administration and students place unnecessary burdens on everyone. Consider recent tension between security and students; conversations between student government and security have been an encouraging first step. I have experience speaking to Chief Clay on the IHC, but I think ASCIT could step up to represent the rights of all students on campus. Even when student government makes improvements, they are communicated incompletely, therefore I would plan to host ASCIT sponsored town hall events with administrators.

ASCIT also has a duty to work to improve the social environment of students at Caltech. April is sexual assault awareness month and I think ASCIT can help spread awareness of events like Take Back the Night through campus-wide emails, while working with the Title IX and Equity Office to provide funding. I also plan to advocate strongly for Caltech to improve mental health resources and to make fair accommodations to students, including emotional support animals, and a fairer board system. ASCIT can also play a larger role in issues beyond the Caltech bubble, as it did this year in raising money for California wildfire victims.

Support the ARC in advocating for academics

ASCIT has a part in improving the academic experience at Caltech. Thankfully, Caltech faculty are willing to listen to students on academic issues; I have seen students actually propose classes and curriculum changes that entered the catalog. I worked on SFC committees this year and plan to support the proposals to improve the BoC and the honour code. As a former ARC member, I know the ARC does much work and hosts events with less funding than was originally allocated to donuts, bagels, and pizza this year. Therefore, I plan to work with the new ARC chair to ensure adequate funding.

Keep Improving ASCIT Publications

I am truly inspired by the remarkable improvements to *the California Tech*. An independent but accurate student newspaper is vital. However, the Tech is $4000 in debt in a position similar to one the Big T yearbook found itself in just a few years ago. I would work to ensure adequate funding for the Tech the way the Big T is funded. I would also work with the editors to appoint a business manager to increase advertising revenue. Donut is also essential; students use it to plan their classes and to vote. This is Caltech, we should be able to run a reliable and aesthetic website. One idea I have is to pay students to work on individual web development projects for Donut.

Improve Transparency

I'm not a fan of buzzwords, but transparency means a lot to me. I worked hard for transparency on IHC, and for ASCIT my goal is to bring transparency to the budget. Sometimes certain budget items go over budget but more often not all money allocated gets spent. I would plan to release a summary of actual spending by category and breakdown of revenue sources. I would also be willing to hold office hours for students or encourage people to come to public ASCIT meetings.

Feel free to email me at allopez@caltech.edu.

Director of Operations (1)

Rachel Sun

Hi everyone!

My name is Rachel Sun and I am a sophomore MechE in Fleming. Over the past year, I have had the privilege of serving as ASCIT Secretary. In this position, I learned about the responsibilities of each ASCIT position, experienced how the ASCIT Board of Directors functioned as a group, and have gotten the opportunity to speak directly with administrators. I have taken minutes for every ASCIT meeting, and as a result, have listened to and weighed in on discussions involving the important decisions the Board of Directors has made in the past year, from whether to hold End of Rotation Party to making changes to the Tech. I am running for Director of Operations because I want to enhance student life at Caltech. If I get this position, I plan to continue to be a liaison between students and administration while looking out for the student body's needs and interests. My goals are bolded below.

Transition of Facilities and Maintenance of Equipment

I currently serve as the Fleming Social Director. Through this position, I have developed my leadership and organizational skills and have learned the ins and outs of administrative procedure at Caltech. These skills will translate to the Director of Operations' responsibility of managing club funding, student facilities, and equipment. I plan to continue the transition of facilities from the SAC to Hameetman while properly accommodating clubs' needs, continue to renovate the ASCIT Screening Room, and better organize and inventory ASCIT's equipment.

Prioritize Clubs and Publications in the ASCIT Budget

ASCIT's budget has been greatly discussed as to the lack of clarity of the published budget and why ASCIT spends $10,000 on donuts and bagels while clubs and the Tech are underfunded. I will continue to listen to students' opinions and reach a compromise in the budget such that more money can be allocated to clubs and publications.

Continue to Help Improve Publications

Managing publications such as the Tech and Big T is a large responsibility of the Director of Operations. Recently, the Caltech community has turned its attention to the lack of journalistic quality of the Tech. I will continue to work with the editors of the Tech and Big T to improve the overall quality of their respective publications while fighting to maintain the voice of the student body. This involves providing adequate resources such as better workspaces, more money, and proper instruction to ensure continued improvement.

After serving in student government for over a year, I have learned that it plays a large role in student life. In the coming year and in the midst of a variety of sudden changes, Director of Operations will be a hefty role with a lot of responsibilities, but it comes with an opportunity to make substantial improvements for the student body. As Director of Operations, I hope to make strides in improving student life at Caltech and ensure that students' voices are heard.

If you have any questions, feel free to contact me via Facebook Messenger or email at rmsun@caltech.edu.

Treasurer (2)

Yuying Lin

One Friday morning as I was walking toward the Olive Walk with another frosh, I told her that I was going to get a donut from the chess table. She surprised me by telling me she didn't know that ASCIT put free donuts out every Friday morning – she never needed to walk that direction in the mornings. This exchange reinforced in my mind that if I became the ASCIT treasurer, I would allocate the budget on projects more accessible to all Caltech undergrads, not just those who live in the South Hovses and happen to pass by the chess table every day. After all, the ASCIT budget comes from our money – and we should all benefit from its use.

My previous experiences in student government will aid me in delivering an ASCIT budget most valuable to all undergrads. Having served on my high school student council as both the social director and vice president, I have organized large scale events involving nearly 400 guests as well as overnight retreats. These events demanded extensive budgeting; in a high school with a lower-than-average student family income, I ensured the event ticket prices were accessible while delivering quality events and staying within budget. I will apply these skills to maximize your enjoyment in ASCIT events, both financially and tangibly.

For the past terms that I have been at Caltech, I've swam and played water polo on the intercollegiate teams and played piano with Caltech chamber music – all the while without exploiting the freshman Pass-Fail to its full potential. I'm able to balance all kinds of things – I can balance my time, balance my health and academics, and most importantly, balance our money.

Alex Krotz

My name is Alex Krotz, I'm a junior in Ricketts studying chemistry. My main point of focus for the Office of the Treasurer is to increase transparency on the sources of funding provided to ASCIT. While I understand the motivation for keeping certain pieces of information private, I think it is important also to recognize how Caltech administration, or other entities, may exert influence in ASCIT without formal representation. Furthermore, I intend to use my vote on the board to advocate for frugal spending and to justify large expenditures with well worded surveys to as fairly as possibly gauge student interest.

With these goals in mind I hope to bring a newfound transparency to ASCIT, thank you for your consideration.

ARC Chair (3)

Daniel Neamati

Dear Fellow Caltech Students,

My name is Daniel Neamati and I am a Sophomore studying Mechanical Engineering and Planetary Science. I have served both as an At-Large ARC Rep and as the Ruddock House ARC Rep. I have organized peer advising and managed Caltech's Course Compliments page. This winter, Tarini Singh and I began working on a new Research Page for the ARC. This long term project, which we plan to debut in the fall, is a brand new resource to connect students to academic research during the year. In both representative roles, I consistently surveyed students both in and out of my house.

My passion for education and my enthusiasm for academic policy is not new. In high school, I founded and lead a team for the Project XQ Super School Competition. This was a nationwide initiative to push schools to use modern teaching and grading techniques.

In the following three years, my high school's administration overhauled its grading system, put more resources into mental health, and hosted events for students to provide input on policy decisions. A group of students, teachers, and I even had the opportunity to present our changes to the Michigan Board of Education.

The ARC has the unique position of sitting at the intersection of Academics and Research. In the past, the ARC has focused primarily on the Academic side. However, my time on the ARC has been more evenly split between academics and research:

- Academic
  - Curriculum Committee (students and faculty)
    - Representative on this committee that oversees changes in the catalog and academic petitions. (See https://oof.caltech.edu/committees/1013/)
  - Peer Advising
    - Enables Underclassmen and Upperclassmen communication that is extremely valuable in making informed academic decisions.
- Course Compliments
  - A unique opportunity to congratulate the TAs, Profs, and Lecturers who are passionate about their teaching. (See arc.caltech.edu > Programs > Course Compliments)
- Research
  - ARC Research Page
    - This new resource is being developed by Tarini Singh and I. It is expected to debut in the fall. Our primary goal is to help students of all years navigate the research landscape on campus throughout the academic year.

Equipped with these experiences, I am comfortable in reaching out to professors and administrators to make changes a reality. As an ARC Chair, there are three topics that I would passionately champion.

1. Moodle and Piazza
   1. A modern institution requires 21st-century technologies. This means pushing professors to adopt digital teaching platforms. Too often students are left in the dark about their grades. It is shocking that many of our high schools had more transparent and advanced grading and teaching platforms than our institution.
2. Student Faculty Conference (SFC) Changes in Advising and Collaboration Policy Requirements

   This year's SFC covered two topics: Honor Code and Option Advising. Both committees brought concrete changes that will carry into the following year. As ARC Chair I would further drive changes, such as
   i. Begin piloting the new advising program to better connect students to our 3:1 Faculty Student Ratio.
   ii. Ensuring that profs are required to submit collaboration tables for each class.
1. Accessibility of ARC Resources
   ARC already has a lot of available resources and I want to better connect Caltech students to those resources.
   a. I have begun these challenges with the new ARC research page and I will champion this shift in the future.

If you have further questions and comments, please reach out to me via email (dneamati@caltech.edu) or messenger.

Thank you for your time and consideration,
Daniel Neamati
Photo Credit: Jack Nguyen

ARC Chair, con't

Arushi Gupta

Hey! I'm Arushi Gupta, a sophomore math major in Dabney. I've had the pleasure of serving as the Dabney House ARC rep and the ARC secretary, and I would love to be able to continue my work as ARC Chair.

Through serving on the ARC, both as a representative and as part of leadership, I have come to know the intricacies of the organization. I was involved with the start of the Course Compliments program, and created the protocol for posting submissions on the ARC website. As a member of the Course Concerns team, I have worked extensively with the Center for Teaching, Learning, and Outreach (CTLO). I am also involved in creating an Introduction to Research FAQ.

As secretary, I have assisted with many of the behind-the-scenes parts of being ARC Chair. From arranging meetings with the provost's office about Course Capture to sending last-minute emails to ensure the Student-Faculty Lunches run smoothly, I have worked on almost all of the ARC's programs. After realizing that the ARC budget wasn't being properly monitored, I took responsibility of tracking the ARC's finances. I have met with many administrators, including the registrar and the deans, to discuss ARC initiatives, and have attended Faculty Board and Faculty Board Committee meetings. I have a good working relationship with the faculty and administrators who can help enact ARC plans, and I can easily act as a liaison between students and faculty. Since I am already so heavily involved, the transition from being secretary to being chair would be smooth and natural, and I could get right to work.

Some of my goals, if I'm elected:

1. Implementing Changes from the SFC (Student Faculty Conference)

I played a significant role in both the Option Advising and Honor Code SFC committees, and I want to make sure that we (and admin) follow through on the proposals that came out of these discussions.

I helped draft the proposals of the Option Advising committee and participated in all the relevant meetings with faculty and the deans. The main proposition is to create two new types of advisors, curriculum advisors (who are very familiar with option requirements and can sign add/drop cards) and interest advisors (who have signed up to talk to students about their research and interests), to supplement the existing faculty advisor system. I hope to pilot this system in an option (maybe physics) next year, and if it is successful, expand it to more options the year after that.

I was also very involved in the Honor Code committee. I helped create the academic honor code survey (thanks again to everyone who filled it out!) and helped analyze the data. The main proposals are creating faculty liaisons to the BoC, requiring collaboration guidelines for all courses, having more administrative/secretarial support for BoC leadership, and increasing general awareness about the BoC process. These changes should be implemented as soon as possible.

I presented the proposed changes at the latest Faculty Board meeting, along with Erika Salzman (the current ARC Chair) and Kavya Sreedhar (the former ARC Chair), and I will continue having such dialogue with admin. I have also already started thinking about the next SFC (which would be held in two years, during my senior year), and want to start planning it early.

2. Adding a Computation Requirement to Core

I want to follow through on the 2017 proposal to add a computation requirement to Core. I am a member of the Core Curriculum Steering Committee, and I participated in a discussion of this proposal at the last meeting. The proposal was mentioned at the last Faculty Board Meeting, and Erika, Kavya, and I were invited to present the proposal at the next Steering Committee meeting. I am optimistic that, with continued involvement from the ARC, the proposal may be implemented soon.

3. Creating an Option Buddy Program

I want to create a program that matches underclassmen with upperclassmen in their major to share advice and discuss major-related topics. This program would be especially helpful for smaller majors, where there may not always be someone in your house who shares your major. I started work on this program last spring as ARC secretary, and I hope to roll it out this year.

I am familiar with the role of the ARC Chair and am well-positioned to effectively and efficiently get the work done. I care about the ARC and improving everyone's academic experience. I have loved all the time I have spent working for the ARC and would be honored to lead this amazing group of people!

If you have any questions, or want to talk about anything ARC-related, please feel free to message me on Facebook or email me at agupta3@caltech.edu! Thanks for reading!

ARC TIP OF THE WEEK

Add day is this Friday (4/19). You need the professor's signature to add classes, but not if you are dropping the class before add day. You still need your advisor's signature, though!

Michael Yao

MICHAEL YAO FOR ARC CHAIR

Who am I?

Hi everyone! My name is Michael Yao and I am running for ARC Chair. A little bit about myself: I'm a current sophomore in Avery studying Applied Physics, and come from up north in the Bay Area. Fig. 1 shows a picture of my face.

Why me?

I have been a part of the Academics and Research Committee since the beginning of my frosh year. I have previously served as Frosh Rep ('17-'18) and Avery House Rep ('18-'19), and currently serve on the Core Curriculum Steering Committee ('18-'19).

My tenure working with the ARC has been centered around one central goal: promoting positive student-faculty interaction. I have directed the Student-Faculty Lunches to encourage students and professors to get to know each other outside the classroom setting. I also helped start the Course Compliments program on campus, where we have supported students to take their teachers and TAs out for dinner on a one-on-one basis. I believe that these programs are critical in helping spread positivity around campus through bridging the gap between Techers and their professors.

Other programs that I have been involved with include speaking at the How to Succeed Panel during freshman orientation (Fall '18) and Course Concerns, which helps address the academic issues that students collectively share. Last year, I also helped with the WASC Accreditation Process. I am also helping revamp the current research resources available for students seeking SURFs and other research opportunities (spoiler alert!), in addition to trying to revamp the quality and format of the TQFR Surveys.

Fig. 1: A Picture of ARC Chair Candidate Michael Yao While I may look laid back in this photo, I take my work with the ARC very seriously.

What can you expect?

In addition to continuing and improving on the ARC's current programs, my campaign is centered around four central objectives:

1. Work with the departments on campus to revise the Course Catalog so that option requirements are reflective of the actual course requirements and suggested course schedules.

2. Finalize and release our in-progress Research Mentorship Program, which would help set up frosh and sophomores with upperclassmen to help navigate the confusing arena of research and laboratory work.

3. Revising core classes to best foster a strong, foundational knowledge in all the sciences. In particular, I want to focus on addressing confusions about the biology requirement (Bi1 vs Bi8/Bi9), and work on improvements to standardizing the curriculum in Ma1b and Ma2. I would also like to work on adding CS1 to the core requirements, which have been discussed in Student Faculty Conferences and Core Curriculum Meetings for many years now.

4. Improve transparency and student-body knowledge on ARC affairs. I plan on holding public, weekly office hours for students to be able to talk to me face-to-face and express any concerns or questions they have about academic and research affairs.

What next?

I believe that the ARC stands as a keystone student group, critical to enlivening the academic life at Caltech. With almost two years of experience working with the ARC, I am knowledgeable about the ARC's many programs and activities in pursuit of this goal. I hope that with your support, I will be able to continue supporting these efforts and effect progressive change for you as ARC Chair next year.

If you have any questions about me or my platform, I'm happy to discuss with you individually! Additionally, I'll be coming to house dinners, so feel free to get in touch with me then as well. You can also reach me via Facebook, or email at myao@caltech.edu.

Cheers!

ARC MEETING MINUTES

Present: Erika Salzman, Arushi Gupta, Olivia Grabowsky, Schuyler Dick, Eric Smith, Maggie Lee, Daniel Neamati, Michael Yao, Amy Wang, Nathan Suri, Alice Jin

Upcoming elections and appointments: Elections for a new ARC chair will be held on Monday, April 22nd. The ARC highly encourages everyone to vote! Additionally, appointments for new at-large representatives will be happening in May.

Program updates: Ideally, the software seminar (on GDB) should happen next weekend, but we still need to find someone to run it. We are planning it on a weekend so that people are more free.

Course concerns will be having a meeting on Monday to discuss concerns and how to better handle them. We are hoping to schedule ombuds training for end of this week or beginning of next week, if there is enough interest in attending one.

We are also working on a list of FAQs people starting off with research may have. Members of the ARC are currently working on reviewing and editing a draft of the list, and we hope to publish it in the upcoming weeks!

We discussed the possibility of moving the option advising sessions to week 7 or 8 of winter term or week 1 of spring term, so that it is more useful for freshmen who haven't yet decided on their major.

Submitted by: Arushi Gupta

Director of Social Activities (3)

Irene Chang

Hi everyone! I'm Irene Chang, and I'm running to be your ASCIT Social Director.

A little bit about me: I'm a rising sophomore and Peer Advocate in Fleming and some of my hobbies include SoulCycling and volunteering with the Caltech Y. I am running for the position of ASCIT Social Director because I love planning exciting events and hope to play an active role in enhancing student life.

During winter term of this year, I served as Interim ASCIT Treasurer. I believe that my experience in this role will give me a unique edge as social director because I am already knowledgeable of the responsibilities of the BoD positions, familiar with how our ASCIT budget works, and fully aware of ongoing BoD operations. That being said, I realize that the social budget may be tighter than usual because the BoD will be more focused on other aspects of student life. As interim treasurer, I was able to work with many student organizations on their pitches and staying within budget; I am confident that I will be able to operate under a tighter budget while still planning fun events for everyone to enjoy.
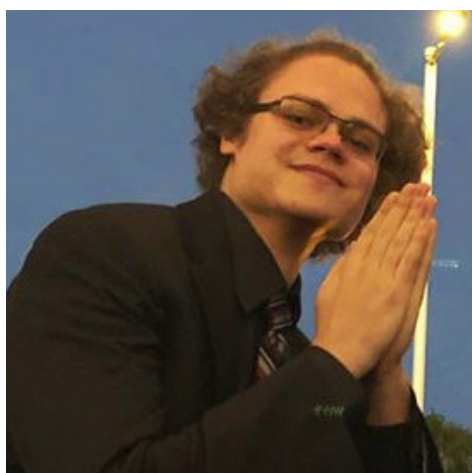
As social director, I will focus on the following goals:

1. Improve ASCIT Event Planning Unfortunately due to the limited attendance for Formal, many could not attend even though it's advertised as a campus wide event, and I completely understand this frustration. As social director, I will do my best to balance interest level and venue restrictions for events, as I firmly believe that every student who wishes to attend should have the ability to. Through the usage of surveys and forms, I will gauge interest and plan accordingly so that no one is left out. As interim treasurer, I created and implemented the usage of Impact Reports not only as a method of centralizing the reimbursement process, but also to better understand how the BoD could improve and support event funding. I hope to create a similar mechanism for constant feedback as Social Director so that I may better serve the student body.

2. Re-form the ESC (Executive Social Committee) Currently, there are different event planning concerns with administration—specifically with them being difficult about approving house events—and I plan to address these issues head on through strengthening the ESC. I will work together with the Social Directors of each house so that we are all on the same page regarding problems with admin. The ESC will also be a space for social directors to plan and coordinate events to minimize conflicts, and a means for a more all-inclusive say on student affairs, which I believe will promote more diverse events—something I'd love to see happen. I would also like to use my position on the ESC to serve as a liaison for the social chairs, and to voice any and all concerns at meetings with administration.

3. Plan Fun Events On top of continuing traditional ASCIT events such as Be a Kid Again Day and Movie Night, I hope to introduce more events as well—such as subsidized LA trips, campus scavenger hunts, DIY/arts and crafts events, and decompression events perhaps with yoga and dogs. Because of my involvement with the Y, I would also like to work with them to host joint events for students, which would alleviate operating under a strict budget and keep the number of activities high. I am passionate about our students' mental health and social well being, and would love to hear suggestions you all have in bringing people together!

In just one term of being in student government and one year being at Caltech, I've learned how important both are to me, and I'd love the chance to be your ASCIT Social Director. If you have any questions, suggestions, or would just like to say hi, please reach out to me in person or via email (ichang@caltech.edu). Let's make next year the best one yet!

Simon Lequar

Hi all, I'm Simon, a frosh in Dabney house, and I'd like to be the next Social Director for ASCIT.

ASCIT events bring together the entire campus for an evening, be it on a boat, at a movie, or eating donuts on the olive walk at midnight. However, these events occasionally hit a few snags, like the limited number of tickets for ASCIT formal this past weekend. The events were well thought out, but they were based on data from years past and not as fully reflective of the current student climate and interest.

As the ASCIT Social Director, I would seek input from the whole of campus on events via a survey before the start of each term to gauge interest before planning venues and timing of events. I would keep all the old favorites like Movie Night but I would try to add new cultural experiences or fun trips around the LA area as well. The new multihouse events started this year have been exciting and fun, and I would try to expand upon the tradition of cross-campus events, as is the spirit of ASCIT social planning.

If you have any questions, feel free to email me at simon@caltech.edu, and I hope that you'll support me as ASCIT Social Director.

Jeff Ma

Several of the social events thrown by ASCIT helped me feel right at home, even before I even committed to Caltech. On my first prospective visit to campus, I enjoyed an ASCIT Movie Night screening of Thor Ragnarok in a theatre full of Techers, and hearing about the wide availability of ASCIT organized events like these is one of the reasons that drew me to commit here.

However, while smaller events like Movie Nights are generally well-received, a large issue that arose this year was with how tickets were sold for ASCIT Formal this year. Compared to previous years, this year's event had an unanticipated uptick in interest, preventing many from attending. For some, this was a lose-lose, with those who weren't able to get tickets upset and with attendees upset that many of their friends could not be in attendance.

If elected Vice President of Social Activities, I would work to address the immediate issues present with Formal, an event that historically has been well received, as well as work to make ASCIT social events as a whole more accessible.

An idea floated last term was for ASCIT to collaborate more with the social teams from each house. Again, a large reason Formal was poorly received was due to an unexpected increase in student interest. As a possible solution, ASCIT could work with the Social Chairs of each house to properly gauge interest in events from their housemates.

Furthermore, since the limitations of ASCIT's social budget sometimes lead to events that not all are able to attend, if elected Social Director, I would work with house Social Teams to use ASCIT's social budget also as a way to enhance the ability of current house Social Teams. Throwing collaborative events would be a great way for ASCIT to bring more accessible and larger scale events to campus with the same level of funding.

Even though I am relatively new to the Caltech community, I have always appreciated the work ASCIT does, and I would love the opportunity to serve the student body in this regard. If you have any questions, or anything that I can clarify for you, please let me know through email at jma@caltech.edu. Thank you for your time.
- Jeff Ma

ASCIT BOARD OF DIRECTORS MEETING

Minutes for 14 April 2019. Taken by Rachel Sun.

Officers Present: Sakthi Vetrivel, Erika Salzman, Sarah Crucilla, Alice Zhai, Dana He, Rachel Sun

Guests: Alejandro Lopez, Albert Nazeeri

Call to Order: 8:07 PM

President's Report (Sakthi):
Midnight Donuts is happening on the Tuesday Wednesday (4/16-4/17) interface during PFE. ASCIT Elections are coming up and candidacy statements will be announced on the Tech tomorrow 4/14.

Officer's Reports:

V.P. of Academic Affairs (Erika):
Add Day is this Friday 4/19. Presenting the ARC proposal to the Faculty Board Steering Committee tomorrow 4/15. See ARC Minutes for more details.

V.P. of Non-Academic Affairs (Sarah):
IHC is starting a column in the Tech written by the IHC secretary about what the IHC is working on. IHC minutes will be posted on the IHC website. Room picks: The Bechtel lottery is on 4/18 and there is a housing survey that has not gone out that is due this Tuesday 4/16 and the IHC has been working on getting the survey sent out ASAP. Bed allocations had changed from what was announced last week; new numbers are on the housing website. Lloyd Interhouse was last night. There were a lot of security reports, and the IHC has been discussing them today. The IHC has been discussing how to have safer parties. See the IHC minutes for more details. IHC is making a schedule with deadlines for things that they want to do.

Director of Operations (Varun):
Not present. Nothing to report.

Treasurer (Dana):
Nothing to report.

Social Director (Alice):
The Lloyd Interhouse alternate event happened at Tom's yesterday 4/13. ASCIT will be paying for popcorn at ASCIT Movie Night. Met with the ESC and got a list of all the events happening this term. Members of the ESC brought up concerns. Scheduling a Color-Me-Mine event for this weekend or next weekend. Details will be sent out soon.

Secretary (Rachel):
Nothing to report.

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: 8:45 PM

Voting opens Monday, April 22 at 10 am and will close at midnight.

BLACK HOLE IMAGED

(VLBI) allows us to achieve unprecedented optical precision. The particular angular resolution of the EHT in imaging M87 was 20 micro-arcseconds, which is sharp enough for a person to read a newspaper in New York City from a café in Paris. Light was consistently captured by each telescope over a long span of time, but needed to be synthesized into one coherent image free of interference from accretion flow changes. The immense amounts of data were first temporally synchronized by atomic clocks and then transported to supercomputers at the Max Planck Institute for Radio Astronomy and MIT Haystack Observatory. MIT Postdoctoral student Katie Bouman created the code that eventually assembled the data points into an image, mending the gaps to reconstruct the light outlining the shadow of the event horizon.

So if black holes are black, what exactly are we seeing? Let us first take a moment to fail to wrap our brains around large numbers: the M87 black hole is 6.5 million solar masses and 55 million light years away, with an event horizon at a radius of about 10^{13} meters. This is also its Schwarzschild radius, or the distance at which even light cannot escape its extreme gravitational pull. Conventional matter orbits the black hole at around 3 Schwarzschild radii, but the effectively massless photons orbit at around 1.5 Schwarzschild radii. If a human risked spaghettification to reach this photon sphere, they would be able to see the back of their head, which may or may not be a pleasant way to die.

But the real sweet-spot orbit outlined in the shadow of the image released on Wednesday is at neither of these locations. Around the black hole, spacetime is uncannily warped, so that even

light from behind the black hole can get twisted to emerge from the front from our perspective, eventually reaching our telescopes on Earth. As a result, it is at 2.6 radii that a light ray does not spiral into the event horizon during its orbit; it narrowly escapes through the photon sphere. Again due to warping, light from around and behind the event horizon actually gets repeatedly bent into successive rings inscribed into the shadow. As a whole, the image of the black hole obtained from the EHT matched physicists' expectations.

Caltech Professor Kip Thorne was more thrilled than most to see the final product for the first time on Wednesday. He is optimistic that this is "just the beginning," since improvements in instrumentation and processing will be able to capture higher frequencies and shorter wavelengths. Thorne is even more "eager to see the one at the center of our own galaxy." The EHT team is also working on producing an image of our Sagittarius A black hole, which is more difficult to refine due to its proximity: interstellar dust blocks light in our line of sight.

When comparing M87 to the black hole that Kip Thorne detailed for the graphics in the Interstellar movie, two main differences appear that are easily explicable upon inspection. Gargantuan from Interstellar has a prominent bar of emission across its center. Its accretion flow is in a thin disk assumed to be like the rings of Saturn, with optically thick, strongly emitting gas. On the other hand, Thorne explains that the accretion flow of M87 may not be in the form of a such disk. The surrounding gas is likely optically thin and extends to high latitudes. The emission from the gas in front of the event horizon is too weak to be seen clearly, so the donut-shaped bar is not visible in the image. When we look through the sides of the black

hole, which, for optical purposes can be treated as a hollow sphere encapsulated by the light just beyond event horizon, there is a lot more gas to see through than when peering directly into the surface. Thus, the emission in the ring around the black hole is much brighter in the anatomy of the image. Overall, there is really nothing surprising about M87.

Kip Thorne's contribution to the science of Interstellar catalyzed the production of a film that not only awed science fiction fanatics, but also restored hope for those who were understandably disappointed in the feasibility of most futuristic fiction. Thorne is grateful that "with Interstellar, everyone involved in the movie was really enthusiastic about basing it on real science," from the director to "the guy who parked [his] car when [he] went to the studio." His role in the entertainment industry, however, is far from over. A couple of years ago, Thorne co-authored treatment for a another film with Stephen Hawking and producer Lynda Obst, who also worked with Carl Sagan on the 1997 film Contact. Their work has been developed into a screenplay, but the studio is still searching for a director. Thorne remains patient as this is a process that took two

and a half years for Interstellar.

But his pursuits have not come to a halt during this apparent film hiatus: Thorne recently appeared as himself on an episode of the Big Bang Theory that aired on April 4th 2019. On his first acting endeavor, Thorne admits, "It was particularly fun because I got to do this with Frances Arnold, who is a superb scientist and a good friend. We spent half a day on set filming and really enjoyed it." Professor Arnold of Caltech is the most recent recipient of the Nobel Prize in Chemistry and was introduced as the first female character to be acting as herself the entirety of the show's first twelve seasons. The two scientists boldly ventured out from the demanding world of academics into the daunting world of entertainment, and Thorne recalls the experience humbly: "They did a good job on the episode. I've been told my acting was great but it was not my acting, it was the directing, and they edited out the parts I did badly." We may never know exactly how much of his acting needed editing, but for now we can admire the indelible scientific impact that Thorne, Arnold, and EHT scientists have made in both the academic and entertainment world.

Kip Thorne and Interstellar | Wikimedia Creative Commons 3.0

Kip Thorne speaking about the black holes in *Interstellar* at Starmus 2016.

DEMYSTIFYING THE IHC

transparency, so I'm going to start writing a weekly column for the Tech in an effort to detail what the IHC has been up to every week in general terms. In the past, IHC minutes have been printed in the Tech, and I never read them. Hopefully this format is one that will encourage students to take 10 minutes to be a little more informed about issues that matter.

This week the IHC has dealt primarily with roompicks issues. It is still unclear how the Bechtel lottery will work, and the survey to opt in to the Bechtel lottery is not currently out. We have had meetings this week to discuss the roompicks issues and express concerns over the timeline of roompicks. Bed space allocations for the incoming frosh class are currently set and were released on the housing website but not sent out to students (see chart below). Houses have been meeting individually to determine the final roompicks procedures for each house. Only one house is still waiting on approval. Currently the only house not approved is Ricketts.

The second topic this week for the IHC has been Lloyd Interhouse. The party was shut down at 1:40 AM. There were a high number of concerns on Saturday, including a large number of unregistered parties in rooms around campus, as well as an unconfirmed number of transports. Although the IHC does not have complete information about all incidents on Saturday, it is sufficient to say they were numerous. These incidents were not confined to Lloyd, occurring across campus. This level of incidence is unsustainable without consequences for

the whole student body.

We have also been working on setting a timeline of negotiations for the coming year with Felicia Hunt. We have run into the issue that we are often acting more reactively instead of proactively, leading to last minute meetings and large time commitments all at once rather than adhering to a more reasonable discussion timetable. Some issues for the coming school year include the alcohol policy, changes to Orange Watch, Interhouse dates/schedule, and Rotation and associated videos/events.

If you have comments, you can now submit feedback at bit.ly/IHCFeedback and leave your name if you want me to get back to you. You can also email 2019ihc@googlegroups.com or email me directly at atirone@caltech.edu. Open IHC meetings are 12PM every Sunday in SAC 13.

EDITORS' NOTES

Alex Krotz's statement was submitted in OpenDocuments Text document (.odt) format and written using the LibreOffice Suite.

We are all very, very tired.

We apologize for the simultaneous excess and dearth of content. We too are saddened.

On behalf of future Tech editors, we beg the candidates to submit shorter, more concise, and uniquely identifying statements.
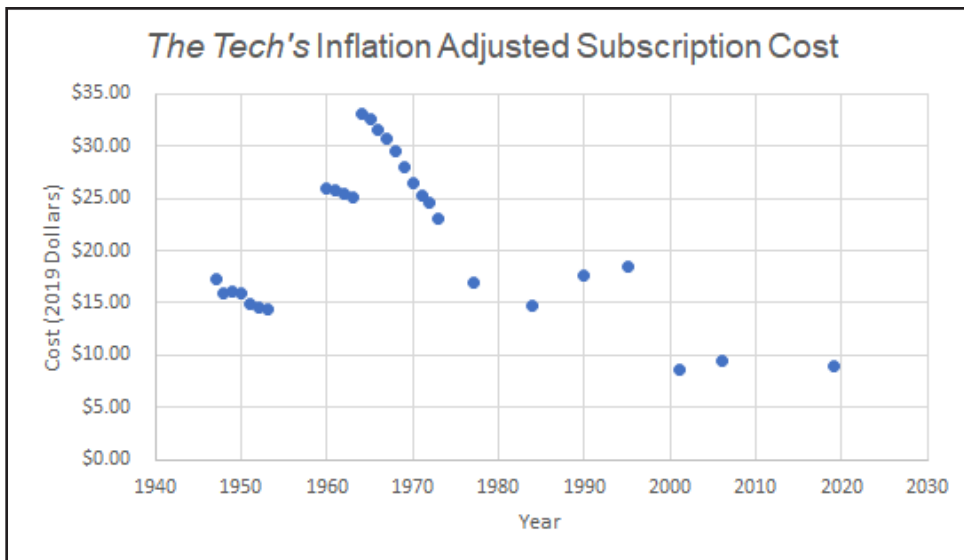
THE PRICE OF STUDENT JOURNALISM

UMESH PADIA & ALBERT NAZEERI | EDITORS-IN-CHIEF

The financial situation of *The California Tech* is dire. When we assumed control of *The Tech* this April, the paper was almost 4,000 dollars in debt. The last editors incurred this debt through printing costs and their token salary. The problem is that *The Tech* expends approximately 16,000 dollars in printing and distribution costs, but only gets about 9,000 dollars per year from ASCIT. This budget was unsustainable for last year's *Tech*, but with our hiring of ten staff, the need for money has become pressing.

Historically *The Tech* has received an average of 22 inflation adjusted dollars per student for a yearly subscription, but in the late 1990's *The Tech*'s budget was tied to ten percent of the ASCIT budget. With ASCIT dues not rising as fast as inflation, and print costs rising much faster, The California Tech's budget for employees has been squeezed out. We believe that the decades long decline in quality of The Tech is closely related to the decline in permanent, paid staff positions. In our quest to improve The Tech we have hired a reasonably large staff of writers, reporters and editors; this staff expansion has come at an increase of 12,000 dollars per year in salaries.

The next ASCIT BoD will have to make some hard choices when it comes to their budget. In order to properly fund The Tech, the BoD will have to allocate on the order of 20,000 additional dollars. Money could be found by cutting back on ASCIT formal and social events, but at the end of the day dues will probably have to be increased to keep the quality of this newspaper up.

The Tech's Inflation Adjusted Subscription Cost

SINCERELY,

Beginning of spring term is a time of change. The sun's out, the flowers are blooming, and more importantly, the sweet bliss of spring break gives way for what some may call the quintessential Caltech experience: sets. Lots and lots of sets. It is times like these where you can form new habits and really make the most of the term. Finding a good space for sets is just as important as doing the set itself. It can help relieve stress, promote efficient work, and provide a much needed change of pace. In order to help you find the place that's right for you and any of your study partners, we have studied in many places around Caltech and summarized our findings.

1. Your dorm room
It's comfortable if you're not a slob, usually very private and you can even put on some music if you want. But sometimes your roommate might be there and you really can't get the privacy you need. Plus, it always sucks to have to mess up your own space. 5/10.

2. Your friend's dorm room
Just like your room, but worse. This time you get to mess up someone else's space instead, but your friend will most likely be pissed that they missed out. 4/10

3. Your House's lounge
You can only really do it late at night because it's annoying to study in a crowded area, but the couches are usually pretty comfortable and there might even be snacks you can use. 6/10

4. SFL
How many times have you worked here already? Move on. 3/10

5. ASCIT Screening room
Very private; very quiet. Nice projector and loud speakers for some educational videos (ever watched DONG?). Couches are a bit greasy though. We're not quite sure how many people have studied there. 7/10.

6. Your hallway shower
When was the last time this was even cleaned? A little quirky though, plus the locks on the doors give some nice privacy. The water might get in the way. 1/10

7. Your house's nice shower
Just a little bit more space. Always too far away to be practical. 2/10.

8. Feynman Lecture Hall
Iconic. It's interesting to think about all the great minds that might have come before you in this room. However, it's hard to get into after hours and the tiny desks make it hard to really get down to work. 9/10.

Caltech Confessions not cutting it? You can always write us instead. We might just be able to give you the unique perspective you need. All inquiries to dearsincerelycomma@gmail.com.

Sincerely,

PUZZLE: SAMURAI SUDOKU

Difficulty: medium

Puzzle and instructions from samurai-sudoku.com

Samurai sudoku puzzles consist of five overlapping sudoku grids. Standard sudoku rules apply to each 9×9 grid. Place digits from 1 to 9 in each empty cell. Every row, every column and every 3×3 box should contain one of each digit.

Where's Joe Bennethum?
Find the Assistant Director of Undergraduate Housing, Joe Bennethum, to help the IHC make roompicks actually happen. Hopefully he's not out to lunch.

THEN — "I WOULD LIKE YOU TO NOT TAKE MY PICTURE BECAUSE I AM NOT DOING ANYTHING PUBLICLY."

NOW — I WOULD LIKE YOU TO NOT TAKE MY PICTURE BECAUSE I AM NOT EMITTING LIGHT PUBLICLY