



# SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

## 2015-2016 SPS Annual Chapter Report Template

Please remember to update your Chapter Information at [membership.spsnational.org](http://membership.spsnational.org)  
Login with username spschapter####

School Name

**University of California, Berkeley**

Chapter Advisor

**Zi Qiang Qiu**

Name of person(s)  
responsible for  
preparing the  
report, Title

**Joe Costello (2016-17 President), Sabrina Berger (2016-17 Co-Vice President), Mayia Vranas (2016-17 Co-Vice President), Katie Latimer (2015-17 Outreach), Stanley Liu (2016-17 Secretary)**

**Now, use the following guide to tell us your story!**

*Tell us who you are, what you did, and give us enough details to brag about your SPS Chapter and to share your work and great ideas with other chapters!*

Use as many pages as you need and include photos (with captions) if you have them.

Please be as specific and quantitative as possible.

Thank you very much for submitting your report!

## Part 1: Our chapter's interactions and participation in SPS National Programs.

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In this section, tell us about ...

...your chapter's participation in SPS National Office programs; e.g., applications for awards, scholarships, internships, chapter awards, advisor awards

...your chapter's participation in SPS governance—nominees for Associate Zone Councilor or Zone councilor, or other elected SPS office?

(remember-these are just ideas—feel free to elaborate and expand)

Did your chapter vote in the 2015 SPS National Council election? Yes  No

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### A. Participation – Past and Future

As an outstanding chapter award winner last year and the year before, we are striving to make our SPS chapter a great resource for all physics undergraduates at UC Berkeley. We have consistently been providing social and learning events for students to improve their time at Berkeley and make new friends. Our chapter applied for a Science Outreach Catalyst Kit (SOCK) but unfortunately did not receive one. However, we were still able to put on several successful outreach events at multiple local schools (see Part 4).

Although our chapter did not participate in any SPS governance this year, we are striving to improve our participation next year and hope to even nominate members for Zone councilor or another elected SPS governance position. We will also vote in the 2016 SPS National Council election next year.

## Part 2: Our chapter's interactions in our campus community

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|  |         |                             |
|--|---------|-----------------------------|
| Did your chapter meet regularly this year? | Yes     | No                          |
| How Frequently?                            | Weekly  | Bi-Weekly Monthly Quarterly |
| About how many people attended?            | 20      |                             |
| What is your Chapter's budget?             | ~\$1000 |                             |
| Do you fund raise?                         | Yes     | No                          |
| Do you receive funds from your school?     | Yes     | No                          |
| How many people are SPS National members?  | 30      |                             |

### A. Meetings

Weekly Meetings

We held meetings once a week, 5 PM on Thursdays in the fall semester and Fridays in the spring semester. We alternated between professional and social meetings. All meetings would begin with a short message from Anastasia, the SPS president for 2015-2016, on the state of the club with announcements for upcoming events. After this message, we would simply provide snacks and let members socialize for social meetings. Professional meetings consisted of experienced SPS members giving presentations on various subjects helpful to physics students. Examples of professional meeting topics include “How to Get Research”, “An Introduction to LaTeX and Mathematica”, and presentations by various upperclassmen on their research.

Future Meetings

Going forward, we plan to alter the format of the meetings by blending the ideas of social and professional meetings, having a shorter professional segment every week with some sort of relaxing social time. We are also planning on introducing stand alone social events to increase club cohesiveness.

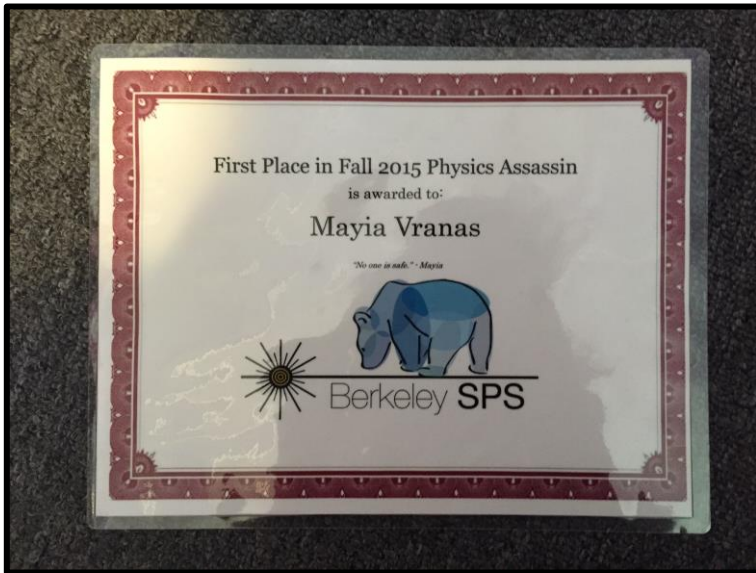
## B. Social Events

Barbecues

Roughly once a month SPS would gather in the LeConte courtyard and hold a BBQ, open to undergraduates, graduate students, and faculty alike. This provided an opportunity for all of the different people in the department to mingle, take a break from research or classwork, and grab a quick meal. One of the more notable BBQ's was put on to welcome prospective Berkeley graduate students as they toured the department. The money made from the BBQs was put towards funding other SPS projects. Notably, the department renovated the LeConte courtyard, and replaced the old charcoal BBQ with new propane equipment.

Secret Schrödinger

Following one of the more festive SPS traditions here at Berkeley, we held a Secret Schrodinger at the end of the fall semester. Secret Schrodinger is a fun physics spin on the more familiar Secret Santa. It consists of SPS members secretly buying gifts for each other, and presenting these gifts at the last SPS meeting of the fall semester. Each person would then “collapse their gift wavefunction”, to complete the Quantum Mechanics analogy, and receive their gift. The gifts were small, candies, school supplies, coffee mugs, but the spirit of giving was large as SPS members took one last break before final examinations.



### Martian Movie Trip

In the fall semester, our SPS went to a screening of the Martian, the sci-fi film of the year. There was a high turnout, and afterwards we gathered in the movie theater to applaud the movie’s cinematography and criticize its scientific accuracy.

### Assassin Game

As a way for SPS members of different years to interact, we hosted a game of Assassin. Each participant was given a target, whom they were to find in secret and poke in the back with a blunt object, thereby “killing” the member and acquiring their

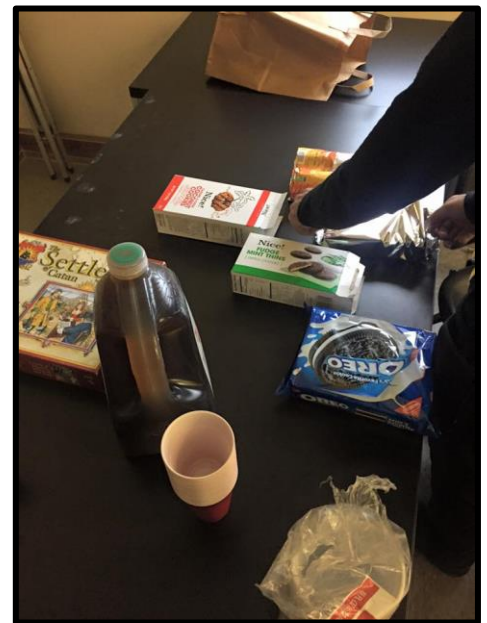
target. Each kill was posted on the SPS facebook group, with creative descriptions of the event, and the winners were awarded with certificates and SPS T-shirts. Many physics students were lost, and many friendships were made.

### Dinner at House of Curries

For one of our spring meetings, in the spirit of previous years, SPS took a group and went to dinner at a local Indian restaurant, House of Curries. There we took a few hours to relax and distress from the tension of studying for midterms and talked about life, both inside and outside of physics.

### Board Game Nights

For several meetings, SPS hosted board game nights. Members would come together and play Settlers of Catan, Cards Against Humanity, and diplomacy over cookies and iced tea. It was a great way for us to get to know each other better, and a (sometimes heated) diversion from physics problem sets.



## C. Science Events

### Workshops – Wolfram Alpha and LaTeX

Our chapter held professional meetings open to the general physics community that focused on providing useful information such as introductory information for new students. These short 30 minute talks are designed to introduce students to information that is useful, but not covered in general classwork. In some talks, the basics of useful programs such as Mathematica and LaTeX were introduced with examples, along with resources for further learning. Other talks featured advice from upperclassmen on how to prepare for the future through preparing for graduate school and advice on how to get a research position.

### Undergraduate Research Talks

One topic of our chapter's professional meetings was Undergraduate Research talks, where one of our club members would give a short talk on their research, what their research is like, and how they got that position. Talks were given by Goni Halevi on Supernova Astronomy, Anastasia Bizyaeva on Nonlinear Dynamic systems, Kelly Backes on Axion Dark Matter, and Joe Costello on 2D Materials and Graphene.



## D. Recruitment/Retention – Promoting Membership



### Mentorship/Peer Advice

We set up a mentorship program, where new students could pick from a list of upperclassmen to have as a mentor. Mentors would then meet with their mentees and give advice about research, class schedule, and how to succeed in Berkeley physics.

### Local SPS Membership

In terms of local SPS membership, we advertised to the lower division physics classes, and hosted our meetings during the first semester in the undergraduate reading room, where many physics students come together to work on their problem sets. We also had a booth at Calpalooza, the annual club fair at Cal.

### National SPS Membership

This year, we offered free Cal SPS T-shirts to anyone who submitted an application for membership in national SPS. We also offered to distribute, collect, and mail paper applications in order to make the process as easy as possible for our chapter.

## E. Departmental Outreach and Interactions

### Cal Day

“Cal Day” is a day of fanfare, festivities, and fun, which is open to the public and designed to encourage prospective students (undergraduate and graduate) to choose Berkeley. SPS members were a critical component of the Berkeley Physics Department’s Cal Day events and promotions, staffing an information booth and a hands-on physics demo table, and speaking as panelists for question-and-answer sessions.



### Faculty-Student Lunches

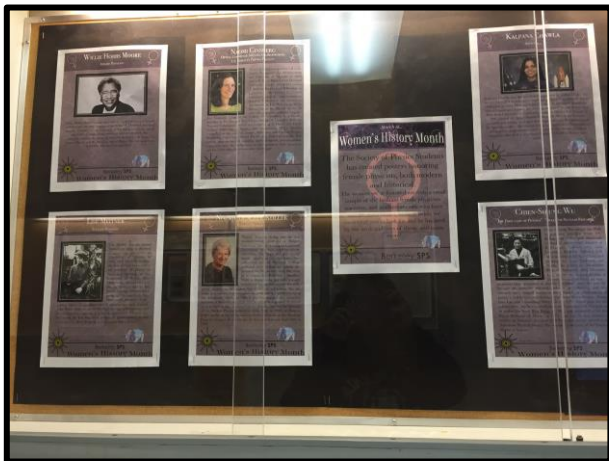
Our chapter continued the Faculty-Student Lunch program in which we invited professors to talk about their research, their background in physics, and any advice that they had for undergraduate students over pizza. The objective of this program was to connect professors with undergraduates outside the formal classroom and office settings. Attendance of these lunches average fifteen students to one professor each meeting, and opened up research opportunities for many of the students. Below is a schedule of our past year’s Faculty Student Lunches.

| Date     | Day of Week | Professor         | Field of Research  |
|----------|-------------|-------------------|--|
| 9/10/15  | Thursday    | Surjeet Rajendran | Particle   |
| 9/18/15  | Friday      | Richard Packard   | Condensed Matter   |
| 9/22/15  | Tuesday     | Matt Pyle         | Astrophysics/Nuclear                                     |
| 9/30/15  | Wednesday   | Bernard Sadoulet  | Astrophysics   |
| 10/9/15  | Friday      | Dan Stamper-Kurn  | Atomic, Molecular, Optical/Condensed Matter              |
| 10/20/15 | Tuesday     | Steve Boggs       | Astrophysics/Nuclear                                     |
| 10/30/15 | Friday      | Roger Falcone     | Atomic, Molecular, Optical/Plasma and NonLinear Dynamics |
| 11/4/15  | Wednesday   | Bob Jacobsen      | Particle   |
| 11/17/15 | Tuesday     | Mary Gaillard     | Particle   |
| 12/4/15  | Friday      | Marjorie Shapiro  | Particle   |
| 2/17/16  | Wednesday   | Gibor Basri       | Astrophysics   |
| 2/25/16  | Thursday    | Kam-Biu Luk       | Particle   |
| 3/1/16   | Tuesday     | Dan McKinsey      | Astrophysics   |
| 3/9/16   | Wednesday   | Chris McKee       | Astrophysics   |
| 3/15/16  | Tuesday     | Naomi Ginsberg    | Atomic, Molecular, Optical/Biophysics/Condensed Matter   |
| 3/17/16  | Thursday    | Edgar Knobloch    | Plasma and NonLinear Dynamics                            |
| 4/8/16   | Friday      | Jonathan Wurtele  | Plasma and NonLinear Dynamics                            |
| 4/15/16  | Friday      | Frances Hellman   | Condensed Matter   |
| 4/26/16  | Tuesday     | Alex Filippenko   | Astrophysics   |

Monday Pre-Colloquium Teas

Every Monday, the Berkeley physics department hosted a professor to give a Colloquium talk. The department set aside a half hour for SPS members so that undergraduate students would get special chance to interact with the physics department’s colloquium speakers. This would be an opportunity for SPS members to speak candidly in small groups with professors from diverse backgrounds in physics. The department provided tea and cookies to spur on spirited discussion.

| Date     | Professor             | University             | Colloquium Topic             |
|----------|-----------------------|------------------------|------------------------------|
| 9/14/15  | Peter Fisher          | MIT                    | Dark matter detection        |
| 9/28/15  | John Cardy            | Oxford                 | Theoretical condensed matter |
| 10/16/15 | Yury Kolomensky       | UC Berkeley            | Neutrinos                    |
| 10/23/15 | Shamit Kachru         | Stanford               | String theory                |
| 1/25/16  | Barbara Kam-Biu Luk   | UC Berkeley            | Neutrino oscillations        |
| 2/22/16  | Nadya Mason           | University of Illinois | Superconductivity            |
| 3/7/16   | Steven Furlanetto     | UCLA                   | Cosmic reionization          |
| 3/28/16  | Albert James Hudspeth | Rockefeller University | Biophysics                   |



Women in Physics – Women’s History Month

For the first national women’s history month, SPS created posters to post around LeConte Hall, our physics building, highlighting the achievements of many prominent female physicists whose work has been overlooked or ignored over the years. We also included our own eight female physics faculty members. Each poster had a picture and description of the woman’s contribution, with the intention of presenting role models to and helping foster a more welcoming environment for the female physicists in our community.



## F. Funding

UC Berkeley SPS budget is centered on funding from the on-campus student government (ASUC), departmental fundraisers, and student services such as department barbecues and sales of coffee and snacks. Expenditures consist of supplies costs for the BBQ's as well as restocking the "Snack Shack" with overall small net revenue from sales allowing the club to function as a self-sufficient entity. Excess revenue is set aside for future purchases as well as a projects fund. In the last academic year UC Berkeley SPS maintained an acting budget of ~\$1,000 with an additional \$500 provided by UC Berkeley ASUC. We would like to note the ASUC funds are only accessed post-payment via a reimbursement system, making this ineffective for larger purchases. Expenditures reached approximately \$700 combined for the two departmental BBQ's and \$ 800 for restocking the SPS "Snack Shack". Reasonable pricing margins allowed for recoupment of expenditures with small net revenue. In addition to this, via a UC Berkeley social media funding campaign called the "Big Give", the physics department awarded UC Berkeley SPS



with approximately \$900 in a departmental account to be used exclusively to fund "SPS Faculty Lunches". As a whole UC Berkeley SPS has maintained its state of self-sufficiency but will be looking into additional funding sources in the upcoming academic year as a means to supplement future "projects" expenditures.

## G. Alumni Interactions

### Reading Room Opening Ceremony

On Thursday, February 25, 2016 the physics department celebrated the opening of the Harry H. Bingham Physics Reading and Collaboration Room. Donors, Alumni, and Emeriti faculty were brought back to celebrate the opening of the new room, where undergraduate students could work together on homework. SPS members took the distinguished alumni and donors on tours of LeConte, culminating with the new reading room itself. Members then worked out physics problems with the guests, to give them a taste of what the reading room experience would be like. The room was dedicated to Professor Harry Bingham, a beloved member of the Berkeley Physics community who passed away in 1994. Friends, family, and former students of Professor Bingham gave speeches in honor of him at the presentation. Afterwards a dinner reception was held in the Berkeley Faculty Club, allowing SPS members, donors, alumni, and professors to mingle and share their excitement over the new room.



### Department Holiday Party

Every year our SPS community is invited to the physics department's annual holiday party, a festive event where the whole department, including graduate and undergraduate students, professors, faculty, and some alumni, gather to enjoy a dinner, raffle, and performances put on by members of the department. SPS performed our annual skit, which depicted the experience of taking a physics test and the different characters in our classes (such as the caffeine addict and the student who sleeps through the test). We received many laughs, and enjoyed our time interacting with the community outside of the usual academic environment.

## H. Interactions with Other Student Organizations

### SACNAS Meeting

We collaborated with the Cal chapter of SACNAS (Society for the Advancement of Chicanos and Native Americans in Science) to put on a social mixer in March of 2016. Both organizations pitched in about \$20 in club funds to purchase snacks, and we had a fun time discussing our various experiences in the STEM fields at Berkeley (most of their members were in biology or engineering). One SACNAS member also joined us to judge at the Think College Now science fair (see Part 4).

## Part 3: Our Chapter's interactions with the professional physics community outside the college/university

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### A. Conference for Undergraduate Women in Physics at UCSD

#### Conference

Many SPS members attended the American Physical Society's Conference for Undergraduate Women in Physics at the University of California, San Diego this January. Attendees engaged in workshops ranging in topics from confidence building to GRE preparation skills and saw many talks from esteemed female physicists. A few members also presented posters at the conference.

*SPS UCB Attendees:* Jordan Sullivan, Malena Rice, Goni Halevi, Ana Bulas Cruz, Laura Brandt, Anna de Graaf, Karen Yu, Doris Lee, Hongling Lu, Sabrina Berger, Liu Lulu

#### SPS Poster Presenters and Abstracts

- ***Energetic Particles in Star Forming Galaxies* by Cee Gould** (UC Berkeley) and Tonia Venters: An exciting result from the Fermi Gamma-ray Space Telescope is the detection of star-forming galaxies at gamma-ray energies. In star-forming galaxies, gamma rays are produced through the interactions of highly energetic cosmic rays with interstellar gas and radiation. Nearby star-forming galaxies, such as NGC 253, have been the subject of multi-wavelength observations by telescopes such as Fermi (at GeV energies), NuSTAR (in X-rays), VLBA (radio), and HESS and VERITAS (at TeV energies). Even so, the details surrounding the mechanism for producing the gamma rays remain elusive. Do the gamma rays originate from interactions from interstellar gas and radiation and cosmic ray electrons, or cosmic ray protons?
- ***Type IIP Supernovae and their Progenitors* by Goni Halevi** (UC Berkeley) and Dovi Poznanski: A set of approximately 15 well-studied IIP supernovae are examined in relation to the mass constraints placed on their progenitors. Light curves and spectra are obtained from a variety of sources and the shape and rate of the post-plateau light curve decline was cross-examined with the mass of the progenitor. Though the uncertainties are too large for a definitive conclusion, there appears to be some correlation between the Ni56 mass and the progenitor mass.
- ***Thermodynamic Calculation of Ferroelectric Thin Film* by Hongling Lu** (UC Berkeley) and Lane W. Martin: Ferroelectric thin films grown epitaxially with respect to a crystalline substrate layer can demonstrate properties that are not present in bulk materials. Past decades have seen rapid progress in algorithms and calculations for analyzing thin-film ferroelectrics. In this study, the use of phenomenological models based on Landau-Ginzburg-Devonshire(LGD) theory to study such systems is described and demonstrated. Because of the presence of mechanical interactions between the ferroic oxide and substrate, modifications to the regular LGD theory are required. With appropriate transformation and minimization of such a thermodynamic potential, the equilibrium state of a film can be found and phase diagrams can be plotted. We observe shifts in the transition temperatures which imply that the strain in the film may change the properties considerably. We investigate the application of such thermodynamic calculations to compositionally-graded films and the limitations of calculations using primitive thermodynamic theories.

## B. Lab Tours

### Advanced Light Source Tour – Lawrence Berkeley National Laboratory

Several SPS members attended a tour of the Advanced Light Source at Lawrence Berkeley National Laboratory on the hill above UC Berkeley on March 28<sup>th</sup>, 2016. The Advanced Light Source is a synchrotron light source that is one of the brightest sources of ultraviolet and soft x-rays ever created.

### National Ignition Facility and High Performance Computing Tour – Lawrence Livermore National Laboratory

On May 6th, 2016, our SPS chapter had the opportunity to visit the National Ignition Facility (NIF) at Lawrence Livermore National Lab (LLNL), a testing center for nuclear fusion, weapons, and astrophysics theory, as well as many other areas of physics. After arranging with the high-security government lab, we were able to see most of the facility, including the focusing chamber, laser chamber, and control room. NIF is the most energetic laser facility that has ever been built. It's used to study not only nuclear fusion but also other extreme states of matter even at temperatures more than 100 million degrees Celsius and enormous pressures. We also arranged and had the opportunity to visit the High Performance Computing center, a high-clearance area where LLNL stores their supercomputers, including Sequoia. The supercomputer tour showed us around extremely powerful computers that many UC Berkeley scientists use for their research. After touring these facilities, we had new insights into the world of physics outside of academia, and it was overall a rewarding experience.

### Imperial College London Physics Student Tour

Physics students from the Imperial College London reached out to us for a tour of the UC Berkeley campus and physics labs last summer. We happily invited and provided the tours for them. It was a great experience for the club to interact with international physics students.

## C. Publications by UCB SPS Members

Several SPS members were published in papers this year. Their names and publications are below.

1. *Observational constraints on neutron star crust–core coupling during glitches* by W. G. Newton, **S. Berger (SPS Member)**, B. Haskell. Published in the Monthly Notices of the Royal Astronomical Society on December 21, 2015.
2. *Enhancement of Ferroelectrics: Strain-engineered Ferroelectric Thin Films* by **Hongling Lu**. Published in the Berkeley Scientific Journal in Fall, 2015 issue.

## Part 4: Our chapter's interaction with the off-campus public community

### A. Outreach

Our chapter has had consistently strong showings at outreach events this year. We are indebted to Science@Cal and BASIS (Bay Area Scientists in Schools) for connecting us with parents, teachers, and event coordinators who were looking for volunteers. Below is a list of events with brief descriptions.



#### Willie Brown Middle School STEM Symposium (September 2015)

Cal SPS planned and led a workshop for middle schoolers as part of the grand opening for this math and science magnet school in San Francisco. Participants in “Project Breakfast” were tasked with building a device to safely deliver breakfast (raw eggs, of course) to hungry CIA agents. We were impressed with the wide range of ideas presented to protect the payload.

#### Bay Area Science Festival (November 2015)

The Bay Area Science Festival has become a staple event for our chapter over the past few years, and this year was no exception. In addition to our usual demos borrowed from the university department's basement stockroom (radiometer, vortex bottles, gyroscope, van de Graaff generator), we also brought signs with physics brain teasers to entertain casual passersby, such as, “Why do astronauts weigh less on the moon?” and “Why is the sky blue?”





Thousand Oaks Elementary School Science Fair  
(February 2016)

Thousand Oaks invited a few student organizations from Berkeley to lead interactive activities during their science night. We led an investigation on electrical conductors to see which types of materials could complete a simple circuit. Many children (and parents) were surprised to find they could light up an LED by dipping the ends of both wires in a cup of Gatorade!

Think College Now Elementary School Science Fair  
(May 2016)

Our chapter was honored to send four judges to the end-of-the-year science fair at Think College Now, in Oakland. Students there were excited to present their

findings on the effect of energy drinks on heart rate, reactions between baking soda and citric acid, and the preferred food of snails, among many other critical research frontiers.

## Part 5: How our chapter strives to further the SPS Purpose and Mission.

**(This category will be double weighted)**

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The following should be reported by all schools that have Sigma Pi Sigma Chapters

## Sigma Pi Sigma Chapter Sigma Pi Sigma Activity Report

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|  |     |    |
|--|-----|----|
| Did your chapter host a Sigma Pi Sigma Induction this year?  | Yes | No |
| Is the Sigma Pi Sigma Chapter active outside of the SPS Chapter activities described above? (If yes, please tell us the story below) | Yes | No |

We do not currently host a Sigma Pi Sigma chapter.