SO YOU WANT TO START A TEEN ASTRONOMY CAFÉ?

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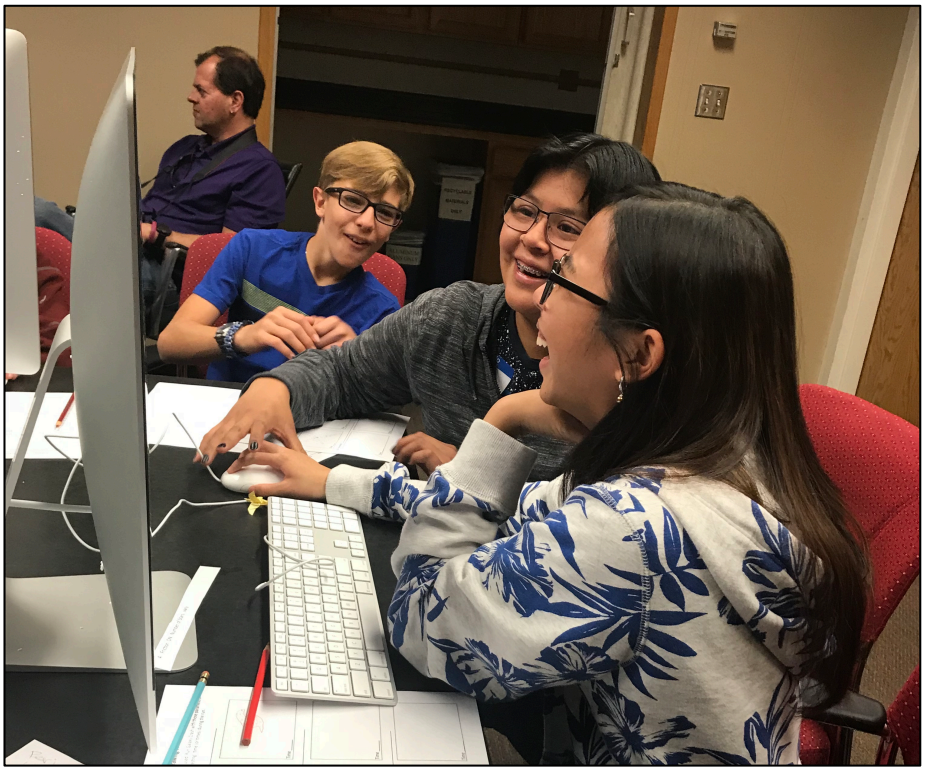

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Contents

Preface

Welcome to the wonderful world of teen astronomy cafés! We are truly grateful for your willingness to inspire teens by hosting Teen Astronomy Cafés about stories of new science and technology discoveries. Sharing such discoveries and new ideas with a teen audience is a unique experience and merits a different approach than the typical technical presentation. For example, the presenter may choose to include questioning techniques and occasionally some elements of storytelling to better communicate science to teens. To prepare you for the teen café experience, we describe below the elements that contribute to the essence of a teen science café and the critical role you can play in changing the lives of teens. Acknowledgement and appreciation goes out to the Teen Science Café Network (https://teensciencecafe.org/) from which was drawn some of the informational materials embedded herein.

1. Introduction

1.1 What is a Teen Science Café?

Science Café programs are a means to engage people of all ages and walks of life in discussions of current and relevant science and technology discoveries. Though the details of Science Café programs may differ somewhat, all combine two essential ingredients. First, they take place in an informal social setting where participants can interact easily with each other. Second, they satisfy participants' curiosity about a science topic through lively interaction with a scientist.

A Science Café is not a lecture. A typical program (for adults) begins with a short presentation (~20 minutes) on an intriguing topic, providing just enough background to encourage questions and ideas from the audience without answering everything. The café ends with a question, which (after a short food and beverage break) the audience can discuss.

Teen Science Cafés are built around a hands-on activity. Teens enjoy the opportunity for hands-on exploration, especially after a week in school. The exploration can take many forms, depending on the venue, size of the crowd, and topic. The primary form NOAO has chosen has been computer activities on astronomy topics. In the evaluations after each café, teens have said the best part of the program has been learning from a scientist about his or her work and having an interactive learning experience (the computer activities) beyond the presentation and discussion.

1.2 Why Teen Astronomy Cafés?

Teens are the future science workforce and the voting citizens of tomorrow. Having awareness and knowledge of how science, technology, and engineering are changing our world is critical for teens to contribute to society and can enrich their lives. We were motivated to foster lifelong learning behaviors that increased the teens' appreciation and understanding of science and stimulated interest in science and engineering careers. Through our program, we show that a Teen Astronomy Café can instill attitudes and behaviors that provide a level of confidence and skill for engaging in scientific discourse, thought, and exploration of new and varied topics. Teens can get a deeper appreciation of the importance of science to their daily lives and a desire to stay informed. Cafés can open teens to careers in science, technology, and engineering by giving them insight into the nature of science and the work of scientists.

By providing a teen-centric environment and program, teens can more easily take ownership of their learning. A teen-only Café ensures that an adult audience will not overshadow the teens or make them uncomfortable in asking questions, offering opinions, or taking on leadership roles. It also allows the presenter to focus on the needs and interests of this unique audience.

1.3 Goals of Teen Astronomy Cafés

The goals of Teen Astronomy Cafés are:

- To be a free out-of-school program that offers high school students opportunities to interact with scientists who work (with big data) at the forefront of astronomy.
- To excite students about the process of science and the role of large datasets in astronomy investigations
- To elevate student achievement and desire to go to college and, perhaps, inspire some students to pursue a career in science, technology, engineering, or mathematics.
- To mentor high school youth leaders and offer them training in planning, leadership, and communication skills and encourages their personal interests in STEM research.
- To strive for gender equity and serve at least one third of the schools with average and below average grades.
- To demonstrate that scientists play a key role in increasing student interest and curiosity about their research and in helping students get a sense of scientists as people.
- To demonstrate that scientists help students see how research connects with issues important to society, and with students' daily lives.

- To bring the activities into classrooms for other students to experience and be inspired about STEM.
- To increase the success of the program through having a team of people that will help promote and facilitate the student experience at the café and in the classroom

1.4 Overview of the Tucson Teen Astronomy Café Program

Funded for the first 12 months by the LSST Corporation during the 2016-2017 academic year, NOAO started the Teen Astronomy Cafés program to excite the interest of talented youth in STEM. One Saturday a month during the academic year, high school students interact with expert astronomers who work with big data. Students learn about killer asteroids, exo-planets, lives and deaths of stars, variable stars, black holes, the structure of the universe, gravitational lensing, dark matter, colliding galaxies, and more. The team includes 7 local high school students, an undergraduate coordinator, 2 grad students, the astronomer and program director. The format for the cafés is a short presentation by an astronomer, a computer-based lab activity and a discussion during lunch. In a room with 15 iMacs, students explore the astronomer's research, usually using Python coding. Many students are exposed to programming for the first time. Evaluations show positive feedback on their experiences and impressions of STEM[1]. Our science cafés demonstrate that scientists play a key role in increasing student interest and curiosity about science research and in helping students get a sense of scientists as people. The cafés also demonstrate that scientists can help students see how research connects with issues important to society and with students' daily lives.

2. General Planning to Start the Year

2.1 Connect with the Schools to Recruit Youth Leaders.

Make appointments with the science teachers, science chairs, and/or principals at high schools and with local homeschooling networks from which you want to draw youth leaders. Ask them to help you organize a meeting with students that might be interested in helping to lead the program. Have them either send out an email (written by you) to students or you can visit classrooms to tell the students about the Teen Astronomy Café program. Pitch the program to the teens and the importance of their leadership to make it teen centered. You will usually find the teens to be quite interested in your story, if they feel they can have genuine input into the program development. Collect names, email addresses, and phone numbers of interested youth so you can invite them to an organizational meeting. For our youth leaders in the Tucson Teen Astronomy Café program, text messaging is the most effective means of communicating; emailing is almost as effective, but in a secondary sense and phoning, only when necessary.

[1] NOAO Prototype LSST Big Data Academy Summative Evaluation Report, June 22, 2017,

The Teen Astronomy Café program in Tucson started with inviting a focus group of teenagers (identified by teachers) to our institution (the National Optical Astronomy Observatory). At the beginning, the program was called the Big Data Academy. Through our SurveyMonkey application for a focus group of youth leaders, high school teachers asked interested students 16 years or older to apply. The application and follow-up letter to the parents are in Appendix A. We invited them to the first get-together and discussed what they would like to see in a Teen Café. By the end of the event, we asked if they would be interested in being our youth leaders for the program for an academic year and they enthusiastically said yes! The "Fab 5" youth leaders were born; most have stayed in the program until they graduated from high school and occasionally attend to help as undergrads at the nearby university. The initial focus group was a way of getting to know each other and making sure we were a good fit for each other and the program. (We also supply them with a $300 stipend at the end of the year.) Since then we have had so much interest from those attending the program, that we now have an overabundance of potential youth leaders.

2.2 Identify a Venue.

You will want space for teens to hear the presentations, mingle (and eat) and engage in hands-on activities and/or computer activities. If your own institution does not have such a venue, look for a central location that is large enough to comfortably hold the audience (but not too big); has flexible space and furniture; is provided at minimal or no cost; promotes interaction; has good audio-visual capability; and allows food to be served. Many kinds of informal social venues can be suitable, but avoid holding Cafés in K-12 schools, as it is of great importance to the teens that their Café not feel like school. The locations could be at small and large museums, local colleges and universities, a large conference room in a research park, a performance amphitheater, a computer classroom, a teen center, and the meeting space of an organization that promotes science, technology, and arts innovations. You may also consider conducting the cafés at multiple sites. By partnering with multiple sites, the effort of the café staff and the presenters in preparing presentations and computer activities can be less onerous.

2.3 Schedule Cafés to Avoid Conflicts.

Scheduling around work, church, family, sports, club, school events, and community calendar schedules is challenging. Some cafés have had good attendance taking place for an hour and a half in the evenings during the school week. Cafés can start in September and end at the beginning of April. The April end date is due to College Board tests, Advanced Placement tests, and State performance tests. Some programs do not have a café in December due to holidays. Also by mid-May, students may be too focused on end-of-school-year activities.

The cafés that take place at the National Optical Astronomy Observatory (NOAO) are done over 2.5 hours on the first Saturday morning each month, October through May excluding January.

For our café audiences at NOAO, school nights for only an hour and a half are not preferable. However we note that anything over 2.5 hours is too long.

Our location is close to a parking lot where parents can easily drop off their teenagers and pick them up or park. There is also room for signage so people can find the location: two big signs for the outside walls, a sandwich sign for the corner of the street and a large 6 foot sign for the parking lot gate. Besides signage, it is important to coordinate with security as to when the parking lot gate and doors to the building should be opened and closed and with Buildings and Grounds as to when the air conditioning should be turned on and off.

We have a separate room at NOAO for the 15 iMac computers. We found that the students wanted to play with them during the presentation, when the computers were in the same room. Plus many students had a hard time seeing above the large iMac monitors. So it was decided to use a second room when doing the computer activity.

2.4 Determine Minimum Requirements for Computers.

The Tucson Teen Astronomy Cafés use 15 iMac computers with their computer activities. At the start of the café program, six of them were available from another program and we got the remainder as refurbished iMacs. As the program has evolved, we noted that a small and less expensive computer might be a better choice in the future. The number is a concern, especially when at minimum 15 computers are needed. The size is a concern, if the computers must be moved up the stairs every month to a "computer" room or to another site completely. The Tucson program initially felt the larger monitors would have the advantage over the smaller monitors, but teens have young eyes.

One consideration has been the Google Chromebook, which runs a Linux-based operating system (https://en.wikipedia.org/wiki/Chromebook). The device is primarily used to perform a variety of tasks using the Google Chrome browser, with most applications and data residing in the cloud rather than on the machine itself. That may be applicable to running python-coded Jupyter notebooks, but will not be optimal in running other image and analysis software programs like TOPCAT, Aladin or code that requires a java applet. There is also the possibility of turning older Mac computers into a new Chromebook (https://blog.macsales.com/35484-tech-tip-turn-an-old-mac-into-a-chromebook). The Tucson program is taking all this under consideration. In summary, it depends what software programs you choose the teens to experience, the number of computers you will need, your budget and whether or not the computers need to be mobile as to the minimum computer requirements that need to be satisfied.

2.5 Choose Topics.

If at all possible, begin the process of identifying potential topics and computer activities with the youth leaders. Also attending teens are asked in the evaluations at the end of every café to provide topics for future cafés. They will be eager to tell you what topics they think would be interesting. Making an effort to find presenters for those topics resulting from teen recommendations helps to build the teens' sense of ownership. On the other hand, teens are not super familiar with cutting-edge astronomy that would make an interesting café. Or you may not be able to find a scientist who is available to present on a particular topic. A great presenter can make an obscure topic come alive, while a poor presenter can make the most interesting topic seem boring. So, we also develop lists of potential topics based on knowledge of high quality presenters and ask the teens, and especially the youth leaders, for feedback and rankings of those topic ideas. This dual approach increases the pool of potential topics and presenters, allowing the adult leaders more flexibility in scheduling and recruiting.

2.6 Advertise Broadly within the Community to Recruit Teen Participants.

Identify community leaders who have the attention of teens, parents, teachers, librarians, and other leaders. Connect with businesses, universities, and organizations that have a focus on science, technology, engineering, and mathematics (STEM) to encourage their experts to participate. Community leaders such as the Rotary Clubs have connections to spread the word about your program. Make appointments with the science teachers, science department chairs and principals at high schools from which you want to invite teens.

Meeting with school principals and STEM teachers can be crucial in gaining their support in advertising. When visiting classrooms, pass out flyers to students, requesting they register online for the cafés, if they were interested, and thereby capturing their contact information. Through emails provide information and a link to the website and the online registration. Rarely email an attached file to schools or students as many school districts see that as spam and the emails never reach their intended destinations.

Some other approaches that work at schools include messages on school bulletin boards or marquee signs, meeting information in daily announcements, and emails to teachers, teen participants, and the Parent Teacher organization. Gathering the contact information of parents can occur upon registration of the teen (since they are minors). This information makes it possible to send them program announcements, especially as reminders for their teens.

A teen Café program needs a website and/or Facebook page that contains all the information about the past and upcoming programs. (See teenastronomycafe.org for an example.) Free advertising on public and community radio stations, libraries, the community calendar of the local newspapers, and even the community websites of the local television stations is often

available. For the Tucson Teen Astronomy Café program at NOAO in Tucson, we often provide 19 packets of flyers to the main library, which distributes them to 19 libraries around town. And in towns with community newspapers, it is even possible to submit short stories about the program for publication.

Sometimes employers of the presenters will highlight the event on their website. An employer may publish an announcement about the program in the weekly or quarterly news that is distributed to all employees when an employee is presenting. These articles can raise the profile of the program and presenters, making it easier to recruit future presenters.

2.7 Identify Potential Presenters.

Presenters could come from a wide variety of organizations: colleges, tech companies, government agencies, local science and engineering organizations, etc. Approach contacts at these places and ask for recommendations on colleagues who are doing some particularly interesting research and have given good talks to public audiences on the subject. The public relations office can often recommend scientists who have been effective in public interviews or outreach to public audiences. If you feel it is needed, follow up with further inquiries about the presenters that have been recommended to you until multiple trusted sources confirm their abilities.

A scientist who knows how to tell a science story in plain language and who understands the importance of the research to society can make any topic interesting, especially to teens. In finding out whether a potential presenter is a good science communicator, ask the contacts if they have a good science story to tell. Do they have an engaging personality? Can they promote lively conversation and interact comfortably (with teens)? Are they likely to respond to your guidance? Book your presenters months ahead. Their schedules fill up quickly and you will want them to have sufficient time to prepare for this unique experience.

Once you have identified potential presenters, contact them to explore their interest in participating; you will likely find that most scientists are eager to participate. You can contact them by sending out an email to schedule a call or a short meeting with them to talk about what the teen café is and how their participation as a presenter could be inspiring to students. Discuss up front your expectations and provide written guidelines for how to prepare for a Café. (See Appendix B for an example of the presenter's guide from the Tucson Teen Astronomy Café.) The meeting will help you confirm whether the potential presenter would be good at communicating science with the students. At the meeting, discuss their ideas for the Café and provide feedback before confirming their participation. This allows you to get them thinking about the interests of the teen audience early and to plan for ways to integrate relevant hands-on activities, discussion questions, and such to ensure a highly interactive program. In the Tucson Teen Astronomy Café program, the scientists are asked to provide a research activity for the hands-on activity. Most of the times presenters also prefer to do demonstrations (e.g., the use of a large gravity well for the topic on black holes). The preferred

type of research activity is a python-coded activity run by Jupyter notebooks (or in general a computer-based research activity using big data).

2.8 Prepare Presenters.

Once scientists are invited and accept, they may want or need some guidance in preparing their presentations with teens in mind. Encourage presenters to focus their presentation at most on a couple of big ideas (take-away concepts that the teens can form a mental image around and discuss), why it matters, and how it will change our world. Encourage story telling. Advise that graphics in Powerpoints are large, clean, and simple to interpret and that the slides are few, jargon-free, and contain a minimal number of words. This reduces the presenter's likelihood of reading the slides to the audience. (A very good 2-page reference for creating interactive presentations for teens can be found at https://teensciencecafe.org/wp-content/uploads/Creating-Interactive-Presentations.pdf. Another 1-page reference that applies well to speaking to teens is https://teensciencecafe.org/featured/10-common-rookie-presentation-mistakes/.) If the program director feels it necessary, he/she can review the presentation in advance of the practice session. (See the section below on the Practice Session.) For the Tucson Teen Astronomy Cafés, Powerpoints are used and the Program Director and the undergraduate lead are happy to review it as well as the computer activity to make sure they are understandable to teens, that concepts and terms are clearly defined and inserted if missing, and that they are enjoyable. The Director then meets with the presenter to go over comments.

2.9 Undertake a Practice Session.

It is strongly recommended for the presenter to do a dry run (a practice session) of the presentation and the hands-on or computer activity a few days before their scheduled Café. Everyone who is "on staff" and will be in attendance during the café should do their best to be at the practice session: the youth leaders, the graduate students, the undergraduate lead and the program director. Their primary function at the practice session is to provide constructive comments on both the presentation and the activity. Typically for the café program in Tucson, the comments received are insightful and the days between the practice session and café are enough to modify the materials to include the suggestions. Comments include (but are not limited to) if key vocabulary is not well defined, if concepts are not clear, if concepts are not explained, if the wording needs improvement or is not age appropriate. The improvements help to ensure the success of the event.

2.10 Request Bio Sketches for the Website.

Ask the presenters to write two paragraphs: one a summary of the science topic they will present and the other a very personalized biographic sketch (where did they come from, how did they get to where they are, what grabbed their interest along the way, what their lives are like in their present research position, etc). Let the presenters know that the program

director would be willing to review the paragraphs, provide constructive feedback and get their approvals on the edits before uploading them to the Teen Astronomy Café website or use them in the email advertisements or flyers.

3. Team Members and Their Roles

3.1 Program Director

To be successful, these types of programs must be lead by a mature individual who believes in the value of the program and is committed to the positive development of teens. The effort is significant, but the rewards are high. This is a program management function, which for a Teen Astronomy Cafe program includes oversight of presenter recruitment and training, engagement of teens, communication with teachers, parents, and others who will encourage teen participation, liaison with local partners and providers of program venues, publicity, and the myriad details of running an ambitious program.

3.2 Undergraduate Lead

The undergraduate lead has been an astronomy, physics, engineering and/or educational major at the nearby university who shows skill in leadership and communication as well as organization, creativity, self-motivation and dependability. The student works 10 hours per week on average. He or she is responsible for advertising the Cafés, helping to organize them, helping to organize and execute the practice sessions, setting up for the practice sessions and the Cafés each month, acting as the liaison with the high school youth leaders, providing tasks to the youth leaders before, during and after the cafés, helping to run and take down the Cafés, and contributing to the debriefing of the Cafés with suggestions of improvements.

For details in all of these areas, the How-to-Guide for the Undergrad Lead particular to the Tucson Teen Astronomy Café site is included as Appendix C.

3.3 Youth Leaders

Each year, roughly 25% of a teen program's audience will graduate and move on, so ensuring a steady influx of new teens to the program is critical. Each school year requires renewed efforts to engage freshmen and retain older teens as their interests change and school demands increase. Retention is achieved through regular and frequent communications with the teens, especially the youth leaders. Youth leadership retention is generally high due to the sense of community they develop. The youth leaders themselves extend a sense of community to their friends and peers, making the Café a welcoming place for all.

One cannot expect youth leaders and general participants to attend every Café. Some will be athletes and cannot attend during the season of their sport. Others may have concerts, plays,

debates, and other special activities that may conflict on occasion. But even with schedule conflicts, youth leaders sometimes stay involved in the planning meetings throughout the year, even if they cannot attend the regular Café meetings. Long-term commitments of youth leaders, even if sporadic, increase overall retention and strengthen the program, as we have found in Tucson with the Teen Astronomy Cafés.

In the Tucson Teen Astronomy Café program, the youth leaders help with setting up, running and taking down the Café. Most importantly they facilitate the computer activities with attending students. Plus their feedback (and the rest of the team's) shapes and improves the program. The experience offers them training in planning, leadership, and communication skills and encourages their personal interests in STEM. In the 2.5 years of the Tucson Teen Astronomy Café program, all seven youth leaders graduating high school have gone into STEM disciplines in college.

3.4 Graduate Students

At every Teen Astronomy Café in Tucson, two to three astronomy-related graduate students sign up to help with two aspects of the café. They help facilitate the computer activity, but even more importantly, they sit at different tables at lunch and facilitate a discussion on careers, the path they have taken or answer any questions related to astronomy, space science, physics or optics. The opportunity not only increases the exposure of teens to the STEM workforce pipeline, but helps the grad students become even better science communicators and enhances their resumés. One graduate student has presented at two cafés on our local group of big and small galaxies. Two more graduate students who have been involved in helping with the cafés are now presenting this coming year on planetary dynamics.

3.5 Reaching Underserved Audiences

Understanding and appreciating the cultural and logistical differences is important for connecting with the teens and ensuring they stay with the program. For instance, in smaller communities it is easier to spread word of the Café among teens, teachers, and parents, and getting to the program is easier. While a large city has a bigger pool from which to draw attendees, the challenges of transportation and competition for teen's time also increases.

Youth are often dependent upon others for transportation or may have restrictions on their driving. Thus, the location chosen for the meetings is a factor in who is able to attend and who isn't. Consider, if possible, providing carpooling incentives to youth drivers to offset the cost of gas when they bring one or more of their friends or siblings. Or when hosting a Café in a larger city, you will generally only attract teens that have transportation and live near the venues. To be most effective in reaching the underserved in a large city, the program needs to be held near those populations. Sometimes providing the same café topic in multiple locations is beneficial to those without transportation and provides more opportunities for the presenter to share his/her enthusiasm for the profession.

For the Tucson Teen Astronomy Café, we were able to increase the number of attendees from schools with failing grades, the number of girls and the cultural diversity by targeting schools and advertising in person. We contacted principals, science coordinators and teachers in selected school districts to be permitted to conduct 5-minute visits to classrooms at the beginning of the semester. As a result, 45% of the attending students are from schools with grades of C and D as determined at the Arizona Department of Education. The schools of the attending students are located in districts with mostly a Hispanic population. Over 50% of the attendees are girls. A third of the students are 14 and 15 years of age. A third are 16 years of age and a third are 17 and 18 years of age. In addition, the presenters have their origins from different countries and represent a variety of ethnic backgrounds and genders. Their backgrounds and appearances can be such that students relate to them more easily and identify them as role models.

4. Forms for Students

Your institution may require you to get the consent from parents on forms like 1) parental permissions for student participation, 2) photo and video releases, 3) release and hold harmless forms; 4) conduct code forms and 5) medical emergency forms. Examples of some of the forms are in Appendix D.

4.1 Parental Permission Form

Parental Permission Form grants permission for their teen to participate in all Teen Astronomy Café activities.

4.2 Photo and Video Permission Slip

While teens may think it's cool to have their picture taken, you can't use the fact that a child gave you permission to photograph him or her as consent to publish the images. You'll need to get written consent from a parent or guardian of any child you photograph whose picture you want to publish.

A photo/video release form is a written agreement between you, the person you are photographing, the parent or guardian of the child (or children) you are photographing, or the owner of any property you are photographing. The main reason to obtain a release form from potential photo and video subjects is to protect yourself from future legal action arising from your publication of the images. A photo/video subject could verbally agree to have his or her picture taken, but change his or her mind later. By getting a written agreement, you avoid getting involved in messy legal procedures. Laws in all 50 states in the USA recognize that individuals have the right to privacy. Violation of this right is met with harsh punishment.

4.3 Release and Hold Harmless Agreement

You may decide that a Release and Hold Harmless Agreement is a necessary form for the youth leaders to fill out. By signing the form, the parents agree to release, hold harmless, and forever discharge institution that hosts the Teen Astronomy Cafés, its employees and agents from any and all liability, claims, demands, actions, and causes of action whatsoever arising out of or related to any loss, property damage, or personal injury, including death, that may be sustained by the parents or their child or to any property belonging to the parents or their child while their child is participating in the program, except for damages caused by the negligence of the institution, its agents and employees. The parent(s) state they are fully aware of the risks and hazards associated with the program and acknowledge that their child's participation in this activity is elected by the parent(s) and not required. The parent(s) voluntarily assume full responsibility for any risk of loss, damage, or personal injury, including death, and for any property damage that may be sustained by the parent(s) or their child as a result of their child's participation as a youth leader.

4.4 Conduct Code Form

To affirm its commitment to ensure an environment of highest professional and ethical standards of conduct, the hosting institution can require a conduct code form where all employees, visitors, and participants in the institution's programs and activities are expected to comply with its Standards of Workplace Conduct. The conduct code form will also require employees, visitors and participants to take appropriate measures to ensure that their conduct reflects values of civility, respect and inclusiveness and that prohibited conduct does not occur.

4.5 Medical Emergency Form

The parent's signature on a Medical Emergency Form can authorize Teen Astronomy Café staff with current Red Cross first aid certification to administer first aid to their child, and authorize the staff to obtain emergency medical treatment for their child at hospitals as deemed necessary, including administration of an anesthetic or other medication and surgery. The parent would also agree to assume the cost of the treatment. By signing, the parent understands that the authorization is given in advance of any specific diagnosis, treatment, or hospital care being required but is given to provide authority and power on the part of the host institution to give specific consent to the diagnosis, treatment, or hospital care which in the best judgment of a licensed physician is deemed advisable. The parent understands that the staff and host institution will make best efforts to notify the parents immediately should emergency treatment for their child become necessary. The parent also grants permission for emergency CPR to be administered to their child by a certified person should it become necessary.

5. Preparing for the Next Teen Astronomy Café

5.1 Four Weeks Before

The Program Director:

- Thanks the people who helped with the previous café.
- Asks the graphics designer to modify the title, date and presenter information on the flyer and print.
- Asks the webmaster to add the flyer to the website and update the speaker, title and date of next café.
- Evaluates the questionnaires, discusses recommendations with others and makes improvements.
- Contacts the next speaker to assist him/her in preparing for the next café.

The Undergraduate Lead:

- Partitions the flyers and delivers them to places like the Main Library for dispersing to other libraries.
- Contacts the two or three graduate students as well as the teen youth leaders who have signed up for the next Café to remind them of the Café date and confirm their attendance.
- Gets permission from school districts to post next month's Café flyer with their approval statements on them, allowing them to be posted at their schools.
- Requests the department coordinator to purchase needed supplies like nametags or mounting tape (made by Scotch; at ACE Hardware). (The tape allows the large posters to stick without harm to the building to direct attending students toward the café entrance.)

5.2 Three Weeks Before

The Program Director:

- Advertises to schools and informal education organizations (like Girl Scouts).
    - Arranges and visits school classrooms plus sends out emails

The Undergraduate Lead:

- Uses emails to advertise to schools and informal education organizations (like Girl Scouts).
- Readies any demos that are needed like making props with the 3D printer.
- Readies any raffle items that can be prepared in-house like printing posters.

5.3 Two Weeks Before

The Program Director:

- Checks in with presenter to offer assistance in reviewing the presentation and activity.

The Undergraduate Lead:

- Sends out reminders (> 10-days in advance) to the students who have signed up for the café.
- Sends out confirmation requests to the youth leaders and the graduate students who have signed up for the café and the practice session.

5.4 The Week Before

The Program Director and Undergraduate Lead:

- Conduct the practice session, going over constructive comments made by youth leaders, graduate students, undergraduate lead, etc. and coming up with modifications that presenter (and possibly undergraduate lead and program director) will make in the next few days to the powerpoint and (computer) activity.

The Program Director:

- Edits the agenda changing presenter's name, presentation title and date, and then prints out enough documents to be hung around both the presentation room and (computer) activity room.
- Edits the evaluation, changing presenter's name, presentation title, date, and a couple of questions and then prints enough for each participant.
- Orders and pays for the pizza a couple of days ahead of the café (and requests an educational discount).

The Undergraduate Lead:

- While at the practice session, asks the youth leaders to volunteer to introduce the speaker and write the introduction, pointing them to the speaker information on the program website.
- While at the practice session, asks the youth leaders to sign up for tasks the day of the Café.
- Creates and prints out the final sign-in sheet according to the latest registration.
- Prints out the medical, photo release, permission, code of conduct forms.
- Prints out any handouts from the presenter.
- Sends out reminders ≤ 3-days in advance) to the students who have signed up for the Café.

5.5 The Day Before

The Program Director and Undergraduate Lead:

- Set up the computers (if applicable) in the "computer" room.
- Set up the tables, etc. in the "presenter" room.
- Put white "black out" material on windows that need it.

The Program Director:

- Gets the groceries (breakfast items) the night before the café and any paper goods needed.

The Undergraduate Lead:

- Gathers general supplies.
- Makes sure that all of the python-code Jupyter notebooks work correctly.
- Makes sure that all of the batteries on the wireless mice and keyboards are charged.

6. The Day of the Café

Help with the "before", "during" and "after" tasks the day of the café are requested of the teen youth leaders, the undergraduate lead, and the program director. Youth leaders are asked to choose the tasks by signing a task list while at the practice session. Each different café location may have a different list of tasks. Depending on how much was set up the day before, the youth leaders, undergrad lead and director get to the site between 1 and 2 hours before the café starts. A minimum of 3 youth leaders, the undergraduate lead and the program director are typically needed (besides the presenter and 2 graduate students) to run a café.

6.1 Providing Refreshments

The importance of food should not be underestimated as a draw for teenagers to socialize and engage. If the program is in the evening, many teens come straight from sports practice, club meetings, or work and have not had dinner. If it is on Saturdays like the Tucson Teen Astronomy Café, we supply breakfast materials and a pizza lunch. Pizza or sub sandwiches are cheap and easy to come by and are gratefully consumed by the teens. Add some fresh fruit and vegetables as sides and you have a meal. It can be kept simple and low cost by buying in bulk and choosing food that is easy to clean up.

6.2 Setting up on the Day of the Café

At minimum, the list of tasks setting up on the day of the café for the program could look like the following (with one person per task unless otherwise noted):

- Put up posters and banner. (2 people)
- Set up the registration area.
- Rearrange tables. (2 people)
- Set up the food area. (include making coffee @ 9am)
- Set up for the icebreaker activity.
- Put out post-it notes and pencils.
- Set up patio for pizza lunch. (Bring desert items, beverages and paper goods) (2 people)

6.3 Helping During the Café

At minimum, the list of tasks during the cafe for the program could look like the following (with one person per task unless otherwise noted):

- Explain and encourage attending students to try the icebreaker to get comfortable with asking questions and to introduce the topic of the café.

- Introduce the speaker.
- Stay near speaker to help with whatever is needed (except when facilitating the activity).
- Take photographs.
- Take people to the bathroom.
- Escort people to and from the computer activity room.
- Bring ice chest of bottled waters to computer room then patio. (2 people)
- Get the prepaid pizzas when they arrive and bring them to the patio.
- Facilitate the computer activities among the attending students. (Everyone)
- After computer activity, one person stays behind to help the undergrad lead put computers away. (Be sure to save some pizza for the undergrad lead and whoever stays behind.)
- Sit at separate lunch tables to facilitate discussion at pizza time. (Everyone)
- Help with the raffle (and giving out the raffle prizes).
- Hand out the questionnaires at the end as well other handouts. (2 people)

6.4 Format of a Teen Astronomy Café

There are four elements of a teen astronomy café.

- If the café begins with food and an icebreaker activity, the atmosphere lends itself to being comfortable and welcoming. People easily socialize around the food table: the attending students, the high school youth leaders, the undergraduate lead, the graduate students, visiting teachers, the presenter, and the program director. The icebreaker activity provides a fun start to the topic at hand and its inquisitive nature encourages questions from students in a very non-confrontational manner. This can help set the tone for students' willingness later to ask questions during the presentation. We have also found the attending students insist on their morning coffee. (15 minutes)
- Through his/her presentation, the speaker encourages lively conversation with the teens about the topic of the program and shares personal stories about experiences in doing the science or engineering that has shaped his or her career. Post-its and pencils allow for anonymous questions that can be collected and given to the speaker at the start of the discussion session, in case there are a few shy students. (30 minutes + 10 for questions)
- As a follow-up, students are given an active learning experience aligned with the topic. For the Tucson Teen Astronomy Café, most of the experiences have been using computer activities. Many have been python-coded Jupyter notebooks. These activities help the teens digest the new ideas and formulate better questions for the presenter. (30 minutes + 15 for questions)
- A pizza lunch is enjoyed by all. The speaker and graduate students each sit at a different table to talk to a smaller group of students about careers and any other astronomy or physics related questions. (30 minutes)

A typical agenda for the Tucson Teen Astronomy Café is in Appendix E.

6.5 Evaluating at the End of Each Café

The questionnaires are evaluations that should be given at the end of every café. They not only can ask for what worked, what did not and what can be improved but also include a set of questions to determine learning outcomes and behavioral changes. For that purpose a Likert test is used as part of the evaluations for the Tucson cafés. And with only two questions in each set of evaluations changing due to changes in café topic, the questions are similar each café for comparative assessments later. An example of the questionnaires from the Tucson Teen Astronomy Café program is in Appendix F.

6.6 Participating in the Debrief on the Day of the Café

The teen youth leaders, the undergraduate lead, the graduate students, the presenter, the program director and any visiting teachers are asked to stay for the 20-minute at most debriefing after the café has ended. The director goes around the room, asking for what worked, what did not and what could be improved, taking notes. The feedback serves to improve the program by the next café.

6.7 Taking Down on the Day of the Café

At minimum, the list of tasks for taking down after the café has ended for the program could look like the following (with one person per task unless otherwise noted):

- Whoever put up the signs and banners takes them down and removes sticky tape (2 people)
- Whoever set up the registration area takes that down and cleans up.
- Whoever set up the food table cleans that up and puts it back to how it was before. (Registration desk goes where snack table is.)
- Whoever set up the patio, please clean that up and put it back to the way it was. (2 people)
- All help rearrange tables and chairs back to proper configuration. (2+ people)
- All take things back down to the storeroom (e.g., as many as people possible).

7. Presenters and their Topics at the Tucson Cafés

7.1 Past Presenters and their Topics

Since January 2017 we have run 19 Teen Astronomy Cafés, initially under the name of Big Data Academies. The same presentation can be offered the following year but not more than twice. There have been 12 different topics, 7 of which (boldfaced in the list below) are provided as python-coded Jupyter notebooks, which we are gravitating toward.

Dr. Adam Bolton, *Looking through Gravitational Lenses*, October 7, 2017 and November 3, 2018

Dr. Gautham Narayan, *Life and Death of Stars*, January 21, 2017 and November 4, 2017

Dr. Stephanie Juneau, *Our Vast Universe*, February 18, 2017 and Dec. 2, 2017

Drs. Lori Allen & Frank Valdes, *Killer Asteroids*, May 13, 2017 and February 3, 2018

Dr. Dara Norman, *Island Universes*, March 4, 2017 and March 3, 2018

Ekta Patel, *Galactic Archaeology: from Little to Big*, April 7, 2018 and March 9, 2019

Dr. Knut Olsen, *Our Galactic Neighborhood,* April 1, 2017 and May 5, 2018

Dr. Chien-Hsiu Lee, *Twinkle, Twinkle Little Star*, October 6, 2018

Dr. Travis Rector, *Coloring the Universe: How Astronomy Images are Made*, December 1, 2018

Dr. Daniel Apai, *Project EDEN: The Search for Habitable Planets in the Solar Neighborhood*, February 2, 2019

Dr. Stephanie Juneau, *Black Holes and the Fate of Galaxies*, April 6, 2019

Dr. Dante Lauretta and Carina Bennett, *OSIRIS-REx: Exploration of Asteroid Bennu*, May 4, 2019

Starting in Fall 2019, the seven boldfaced titles above will be downloadable online from one of the National Optical Astronomy Observatory's Data Lab servers in hopes they will foster interest in other institutions hosting Teen Astronomy Cafés as well as high school teachers using the python-coded Jupyter notebooks in classrooms. For more details as to where to find the notebooks online, contact Connie Walker at cwalker@noao.edu after Oct. 1, 2019.

7.2 Future Presenters and their Topics

At the time of this writing, the café presenters and topics for the 2019/2020 Tucson Teen Astronomy Cafés (Saturday mornings 9:30am until noon) will be:

DATE:	**Presenter/Topic:**
October 5, 2019	Pierre Christian (Black Holes and Einstein's Gravity)
November 2, 2019	OPEN
December 7, 2019	Daniel Apai (EDEN and Exoplanets)
February 1, 2020	Everett Schlawin (Exoplanets and Spectroscopy)
March 7, 2020	Chien-Hsiu Lee (Variable Stars)
April 4, 2020	Rachel Smullen and Christine O'Donnell (Planetary Dynamics)
May 2, 2020	Tod Lauer (Interstellar Navigation)

8. Sustaining Funding for Teen Astronomy Cafés

The Teen Science Café model is designed to be flexible and low cost. In the case of NOAO there was an initial capital investment for computers, but, beyond that, the program is largely self-sufficient. Venues and food can be found for free and by utilizing teen leaders the need for staff hours can be minimized. Adult leaders could even be volunteers. Marketing and activity

materials can be paid through small local sponsorships. However, it does take some time to set this all in place. Some institutions have a development office that can help funds for these activities, but others rely on the program director to find those funds. Here is a link to a presentation with helpful fund raising hints: https://teensciencecafe.org/resources/finding-sponsors-or-funders-for-your-cafe/. This resource is adapted from a Teen Science Café Network webinar series presented by Carol Conine of Conine and Associates and Howard Rutherford, at the University of South Florida College of Marine Sciences.

Part 1. How to Identify and Research Funding Prospects

First, determine the funding sources that are a good match to your program. The best prospects for Teen Astronomy Cafés are private funding sources, which include:

1.Foundations

2.Corporations and Businesses

3.Local Private Sector Organizations

4.Individual Donors

The website https://teensciencecafe.org/resources/finding-sponsors-or-funders-for-your-cafe/ goes into more detail under each private funding source including examples and how to research the funding sources.

Part 2. Developing a Case Statement and Building Connections to Prospective Funders

A case statement is a document that explains to your potential donors what you need the money for and what the benefits will be if the donor gives to your cause. It should clearly state your organization's vision and mission, why funding is needed, the outcomes of investing that money, and why a gift from the organization is a good idea. The above website tells what the case statement should include, tips for writing it and resources available. It talks about identifying who you can ask, building relationships, making the ask and continuing to engage donors.

Part 3. Elements of a Strong Proposal: Tips and Tricks of the Trade are addressed in a very helpful way.

Part 4. Audio webinar recording: Panel of Funders' Share Their Perspectives.

This webinar recording (https://teensciencecafe.org/wp-content/uploads/Sustainability-Webinar-Series-5-5-27-14.mov) is unique and valuable resource to anyone thinking of working with these foundations now or in the future. The Teen Science Café Network hosted the stellar line-up of panelists. (Note that there is a bit of an echo in the first few minutes, but the sound quality improves.) Read also the sustainability panel bios at https://teensciencecafe.org/wp-content/uploads/Sustainability_Panel_Bios.docx.

9. Take-aways and Lessons Learned

The Tucson Teen Astronomy Café program recognizes key points that are worth emphasizing for anyone who is considering hosting a Teen Astronomy Café. First, the program is worth doing on many levels. The mentoring of the youth leaders and the encouragement of the attending students to explore the field of astronomy and possibly consider a STEM field as a career, the passion of the presenters and willingness of them and the graduate students to share their enthusiasm – these are all positive elements that benefit not only the students, but everyone who is involved. The café provides a safe, comfortable atmosphere for inquiry, exploration and discovery.

Here are a few items we have found to be key to a successful Teen Café:

- The organizers recognize that we must allow flexibility with what presenters can and cannot do, since they are volunteering their time in an otherwise busy schedule.

- To recruit more students, at the beginning of every semester, we make arrangements with the schools and teachers to visit their classrooms at the start or end of class to provide a 5-minute spiel about the Teen Astronomy Cafés (with flyers).

- We wrestled with what to do to help students be less shy about asking questions. We came up with and successfully implemented these ideas:
  - Icebreaker activities that tied in with the topic of the café
  - Post it notes students could write questions on and we would collect them and give them to the presenter.
  - Think-pair-share: asking the students to think to themselves about an answer, then turn to their neighbor to discuss and then share with the whole group.
  - Be sure when asking questions straight out to ask the group and not the individual.

- Presenters were asked to shorten the presentation to between 20 to 30 minutes at most. This was a better time span for the students. (Since cafés are informal and not classrooms, presenters are encouraged not to be too detailed.)

- Presenters were asked to concentrate on the Big Idea (breakthrough science) of the café. Instead of having lots and lots of concepts to include in the presentation, have only a couple at most that are summarized in a slide toward the beginning of the presentation. This enables to students to know the purpose of the presentation and on what to focus.

- Students got more curious, involved and eager to ask questions once they participated in hands-on activities; like drawing the 2D image of a back-lit, sheet-covered 3’ x 3’ cube of filaments and voids to understand large scale structure OR experimenting with marbles in a giant gravity well.

- Another useful strategy was to clearly and explicitly link the ideas in the presentation to the data analysis activities students conduct in the second half of a session by introducing the purpose of the computer activity at the end of the presentation and again after the break, but before students began working on the computers.

- We designed the computer activities so students could understand the reasons for analyzing data, the types of data represented by the computer programs, and are correctly reading and interpreting data.

- Student experiences were definitely enhanced by including graduate students in addition to the presenter to discuss career paths and additional astronomy-related questions at the pizza lunch.

- Feedback is infinitely important, especially if the organizers are able to use it to make improvements to the program. Feedback is obtained after every café from the student evaluation forms and staff debriefings.

- Build a community for the youth leaders by involving them in extra-curricular events like trips to the observatory, lunar eclipses, star parties or fun, local family-oriented events. This will serve to enhance and enrich relationships between everyone.

10. Future Plans of the Tucson Teen Astronomy Café Program

Our future plans include reconfiguring the python-coded Jupyter notebooks for use in high school classrooms as well as at other café sites. These plans have begun as of the summer 2019. We have had the pleasure to work with an intern from the University of Arizona TIMESTEP program (https://lavinia.as.arizona.edu/~timestep/). Andy has transformed all of the notebooks to Python 3; he has provided a similar format to all of them; he has streamlined the apps and made them uniform in all 7 notebooks; he has installed a few different types of widgets within each of the notebooks making the activities more fun, etc. In short, he has done a lot to improve the notebooks and has set the standard for future notebooks.

This year we are planning to invite those from other institutions interested in starting a café program to a workshop at the National Optical Astronomy Observatory on the café program and its activities. As a precursor to this effort, we are offering a workshop on this topic on August 13 for interested people who are attending the LSST Project and Community Workshop. In the future we would also like to train high school teachers on how to use the 7 notebooks in the classroom.

In addition to this guide, we are aiming to write a paper on the topic In the coming year.

Appendix A

Big Data Academy SurveyMonkey Application

Big Data Academy Focus Group Applicaiton

* 1. First Name

* 2. Last Name

* 3. Home Address

* 4. City

* 5. State

* 6. Zip Code

* 7. Parent or Guardian First Name

* 8. Parent or Guardian Last Name

* 9. Parent or Gaurdian Phone Number

* 10. Parent or Guardian Email Address

* 11. Home Phone

* 11. Home Phone

* 12. School

* 13. Current Grade

- ◯ 9
- ◯ 10
- ◯ 11
- ◯ 12

* 14. Email Address

* 15. What science and math classes have you taken in high school?

* 16. Why are you interested in joining this focus group on big data in astronomy?

* 17. Describe and experience you have had working with data and what you learned from it.

* 18. Please provide the name of a teacher who can be a reference for you.

* 19. Reference Teacher's Email Address

Letter to the parents of the high school student focus group applicants

Hello,

This is Connie Walker, the co-director of the Big Data Academy program to which _____ applied to be part of the focus group.

We would like to invite you and _____ to attend the first focus group get-together on Nov. 12 at 9:30am (til no later than noon) in room 402 in Harvill Hall at the University of Arizona. We are writing to ask whether _____ be able to attend and also if you would like to attend as well.

We would like to meet for a number of reasons. We would like the potential student team members of the focus group to meet each other and see how they could work together to help plan the science cafés that will take place once a month on Saturday mornings at Harvill Hall. We want to talk about how the students can be a part of the planning and how they will be ambassadors to encouraging other high school students at their schools to register to come to the science cafés. We will talk about the astronomical topics that could be selected for the 5 science cafés and the speakers and activities that could be done for those science cafés and to get their input on what they would prefer.

We will spend half of the time in the "Innovation Lab" (room 401) in which, by January, there will be a maker space with a 3-D printer and laser cutting machine as well as the computers that are there now. We will also explore the World Wide Telescope software and get to play with an ocular rift (3-D visualizer), tools that could also be used during the 5 science cafés.

We look forward to hearing from you soon and hopefully hearing that you and _____ will be able to join us on November 12.

Many thanks to _____ for applying to join our team,
Connie Walker, co-director
Blake Smith, lead coordinator

~~*~*~*~*~*~*~*~*~*~*~*~*~*
Constance E. Walker, Ph.D.
National Optical Astronomy Observatory
950 N. Cherry Avenue
Tucson, AZ 85719 USA
520-318-8535
cwalker@noao.edu
~~*~*~*~*~*~*~*~*~*~*~*~*~*

Appendix B

Presenter Guidelines

Teen Astronomy Café Presenter Guidelines

Introduction

The point of this document is to address the specified guidelines for the Teen Astronomy Café presentation, activity and discussion. By agreeing to present at a café, the guidelines discussed here should be followed to the best of the ability of the presenter. Each Teen Astronomy Café will be held on the first Saturday of the month ranging from September to May, excluding January. Your target audience are teenagers who are in high school, with some younger students intermingled. Your primary goal is to present a topic that will encourage the students to learn more about astronomy and hopefully pursue a degree in a STEM field such as astronomy.

Presentation

The presentation portion of the Café will be a 20 - 30-minute talk on one specific topic. The presentation must be made in PowerPoint and should be no more than 20 slides. The first one or two slides should introduce yourself and explain how you became interested in astronomy and what your field of research is. If your activity requires a demonstration, discuss the design and requirements of the demonstration with us and we will work together to build the demonstration. The topic covered can be anything involving the prescribed topic; however, the topic should be focus and detailed instead of a broader scope. For example, if you were to have the topic of Mars, you could present the search for water on Mars and the discoveries; the possibility of terraforming Mars or the history of Mars. While each would be a good topic to present upon, it is best to choose one and focus on that one topic. The final slide or two of your presentation should also bring the topic back around and should present an argument as to why this is important to you and other people.

Activity

For a typical café, you will have the opportunity to develop an interactive computer activity using the Juypter Notebook. It is strongly suggested to have your activity on this platform. When it comes to the actual design and construction of the activity, we are available to help test the activity. There are no limitations on what your activity can be, but it must be relevant to your presentation topic and must be interactive (i.e. playing with parameters, tweaking constants etc.).

Discussion

Each café will finish with a discussion over pizza. In this discussion there can be talks about career choices, a Q&A session, a more in-depth conversation on the topic, etc. We can work with you to build up a good discussion topic and/or talk. While this is the last and least demanding part, it is a good idea to come into it with some idea of what you want to talk about with the students. A couple of graduate students from Steward will be around to help at this time.

Practice Sessions and Timelines

There will be one practice session usually the Monday (sometimes Tuesday) (at 4pm til 6pm) during the week leading up to the café. It is at this time that you will be able to practice presenting in front of several high school students, grad students and EPO staff who will be able to give feedback. In addition to presenting, your activity will also be tested by students so that they may help at the café. Prior to this, the presentation should be emailed to both the undergrad lead and Connie Walker one week before the practice session (Friday at the very latest) so that we can look through and ensure that the guidelines are followed. Furthermore, the activity should be sent the week before the practice session so that we may look for bugs and fix any before the practice session and also so that we can load the program onto the computers to be used.

Volunteers

The high school students (called the “Fab 5”) and grad students who may be at the practice session are the same students who will be available to help all during the café and especially during the activity.

Café Agenda

An agenda for the café will always be available before the café and will resemble the following:

9:30-9:35am	Introduction and refreshments
9:35-10:05am	Presenter talks about why she/he became interested in astronomy, what her/his research is about, what problem it is solving and why it is important to solve.
10:05-10:15am	Question and answer period; refreshments
10:15-10:25am	Bio-break; students move to the Main Conference Room (MCR) to do the computer activity.
10:25-10:55am	Presenter introduces the tools of research to the students and leads them through the computer activity in the MCR.
10:55-11:10am	Wrap up presentation and discussion of activity
11:00-11:20am	Bio-break; students go to the patio.
11:20-11:50am	Everyone enjoys pizza on the patio. At the round tables outside the interaction and the tables under the eaves, grad students and the presenter leads one of two or three groups of students in a discussion of astronomy questions, career and/or the key concepts.
11:50-12:05pm	Everyone returns to room 27 and the students complete a Questionnaire (evaluation).

Debrief after the Café

Immediately after students leave, the team, including the presenter, will sit in room 27 for a 20 minute debrief. This is an opportunity to voice what went well, what may not have, and if so, how to improve on things. The intention is to be done by 12:30pm.

Café Location and Dates

The Teen Astronomy Cafés are held at the National Optical Astronomy Observatory in room 27, located at the east end of the adjacent parking lot on the south side of the building to start. We move to the Main Conference Room during the middle part of the café (see agenda) and end back in room 27. The Teen Astronomy Café program runs for 2½ hours (9:30am till noon) on the first Saturday morning each month, October through May (except January).

The dates are:

October 5, 2019

November 2, 2019

December 7, 2019

February 1, 2020

March 7, 2020

April 4, 2020

May 2, 2020

For more information

For more information on the program, please visit our webpage, teenastronomycafe.org plus you are welcome to talk to any of the previous presenters, Knut Olsen, Dara Norman, Stephanie Juneau, Lori Allen, Frank Valdes, Adam Bolton, Ekta Patel, Gautham Narayan, Chien-Hsiu Lee, Daniel Apai, Carina Bennett and Dante Lauretta.

Appendix C

Guide for the Undergrad Lead

TEEN ASTRONOMY CAFÉ GUIDE FOR THE UNDERGRAD LEAD

Contents

Preparations for the Café

Practice Session

The practice session is crucial for those attending the café so that the presenter has a chance to test out both the presentation and activity on people who were not involved in the development process. There are two main components to setting up room B43 for the practice session: the iMacs and the room.

For setting up the iMacs, there are two tables and a desk in B43. Three computers can be placed on the tables and one on the desk. It is advised to have the at least one of each type (i.e. linux, EPO) to ensure that the activity works on all of them. For example, we have found one time the widgets on the "linux" labelled computers didn't work properly. This was fixed by changing some settings and downloading an additional package for Jupyter notebooks. It is advised to try out the activity a couple days in advance to make sure problems like these are avoided during the practice session and the time for the practice session can be used to make the activity more user friendly. One of the most useful ways to fix bugs in the system is to type the problem into google and find a *Stack Overflow* page that is similar to the problem you are facing. Later in this document there will be descriptions of short scripts and programs that will make the overall process of setting up computers and matters.

To set up the room, there is a projector in room 3 next to Jessica's office. Set up the projector so that it hits the white board, some adjustments may be required. The second part to setting up is to arrange the chairs on the east side of the room, 3 per row, with clipboards and paper for people to take notes. After the practice session is over, ask the students to help put back the chairs and remember to take the projector back up to room 3 before leaving. It is advised to leave all 4 iMacs out since changes will be made to the activity and this will make for easier set-up on the Friday before the café.

It is also important to note here that after the practice session or even before to ensure that the AC is turned on for the Saturday of the Café and that the gates and doors will open at the proper times. This is done via an email to the facilities management people.

Friday Before the Café

This is by far the most labor-intensive part of the job. There are two rooms to set up: the main conference room (MCR) and room 27. The MCR is located in the northeast corner of NOAO –on the floor above the room B43. Room 27 is located just to the east of the visitors parking lot. Typically the set-up time will be about 4 hours starting around 1pm or 2pm depending on scheduling, though it can take as little as 2 hours or as much as 6 hours depending on the extent of the activities and demonstrations. It is advised to block off the time on Friday from 1-7 just to make sure there are no over lapping conflicts.

Room 27

Setting up room 27 can be done with one person, though there is a part that does require two people but can be pushed off until the morning of the café. There are two boxes that are required for this set up and are located on the Teen Astronomy Café/Big Data Academy shelves in the storeroom. One is a smaller box and the other is a larger box. The contents of the box are listed in the appendix. In addition to these boxes, there is a sandwich sign, two larger posters and a banner all with Teen Astronomy Café on them.

The set up in the room can vary from speaker to speaker depending on their need and preferences. The two most typical set ups are the U-setup and the classroom setup. The U-setup has the speaker at the front with a single table for their computer and the demonstration. The other tables are arranged in a U-shape with 3 tables on east and west sides of the room and two tables connecting these two on the north side of the room. In this arrangement there can fit 2 chairs per table with the green chairs and the blue fold up chairs go along the west wall. This arrangement allows for 18 people to sit at the tables. The advantage of this setup is that it gives the speaker space to work with if say they have an interactive activity or a larger demonstration at the cost of less space for the students. In the classroom setup, there are four rows with two tables on either side of a center aisle. Each table can allow for a third person to sit on the outside of each of the eight tables. This allows for 24 students at the desks and takes up all of the green chairs. Alternatively, there can be 3 rows of 3 tables with no spaces between all the tables arranged in somewhat of a U shape. This allows for 3 attendees to sit on the outside tables on both sides of the room. In these two classroom arrangements, the room can sit 24 students at the desks at the cost of space for the presenter.

In all of these setups there are things that do remain constant. For example, there will always be blue chairs along the western wall. Other things include the snack table and the speakers table. The snack table

consists of two of the grey tables put together just south of the sink. There is usually a small brown table which the coffee machine sits on in this location. Move the coffee machine onto the sink counter and move the table out of the room and under the stair well. This table is to become the registration desk. Both the registration table and the snack table will have a black space tablecloth put on them which can be found in the large box. Also in the large box will be all the essentials for the snack table such as utensils, cups, coffee, etc. In addition to these, there is also a single table in with four of the blue armchairs which will go against the railing of the ramp to provide additional seating. The boxes can go under the snack table and the part that can be done by a single person is done. If a second person is present during this setup then there should be two sheets of white blackout material in the smaller box. These are put on the middle and southern most windows on the western wall. To do this, simply have one person hold the blackout material into the top of the curtains and have the other person pull the chain to keep the blackout material in place.

There are a few small things that need to be done to finish off the room. At every table there should be 3 pencils and a small stack of sticky notes which the students can use for notes or questions. At the registration table there should be two clipboards and stacks of name tags. Markers and pens should be provided and there should also be a stack of Globe at Night postcards along with any other promotional materials. All of these materials should be found in the small box. Finally, tape about 6 schedules on the wall around the room (especially one near the door and another near the speaker) and ensure that the proper dongles are on the front table for the speaker.

The MCR

There are two main things that change in the MCR: the presence of the computers and rearranging the chairs. There is a very simple method to rearranging the room quickly and effectively and can be done with one or two people. To start off bring all the computers from downstairs up to the MCR via the stairwell closest to B43. There should be 3 binders near the door to B43 which can be used to prop open both doors on the stairwell and the door to B43. Both the doors to the MCR and B43 can be opened wider by unlocking the top and bottom holds in the door that remains closed most of the time. When bringing the computers up it is advised to stack them at the eventual place they will end up on the table. It is also good practice to set the ‘EPO’ machines on the east side of the table and the ‘linux’ machines on the west side of the table. There is a single ‘EPO’ machine which will sit at the northern head of the table and one ‘EPO’ machine which will be just to the west of that one.

Once all of the boxes are in the places, open up the kitchen and move all of the black chairs on the west side of the table into it. Then unpack and setup all the boxes on the west side, placing the empty boxes on the north counter in the MCR. Once all the computers are setup on the west side, move all the red chairs into the table. Align the computers so that one computer sits in the middle of the two chairs. Then proceed to move all the black chairs on the east side of the table to where you just moved the red chairs from. Again, setup all the computers and then move all the red chairs into the table ensuring that a computer sits in the middle of two chairs. Finally start up the computers and set up the activity. This is the best time to upload the newest and most up to date activity to the computers. Again, there is a script which should be used to make the process much faster and requires very little tinkering. However, if there are files that will be

used that are larger than 2 GB, it is advised to upload all this data in the week leading up to the café and not on the Friday of the café. Once everything is uploaded and working, be sure to turn off the mice and keyboards on the EPO machines. Finally, as in room 27, place 2 pencils with a stack of sticky notes at every computer and post the schedule around the room. If there are worksheets for the students, this is also the time to pass them out and set up any demonstrations for the speaker. Finally, tape about 8 schedules on the wall around the room (especially one near the north door and another to the right of the screen on the southside) and ensure that the proper dongles are on the front table for the speaker. (On Saturday, the speaker will be transferring his/her computer from rm 27 to set up for the computer activity in the MCR.)

The Café itself

If the previous sections were followed, there will not be much left to setup the morning of the café. However, there are still several tasks which can be delegated to the Fab 5 students helping out. These can typically be determined during the practice session or can be delegated the morning of. The list of tasks includes:

- Setting up the food on the snack table.
- Starting the coffee.
- Hanging the banners and sandwich sign.
- Setting out the cones.
- Setting up the projector for the speaker.
- Setting up the patio.
- Participating in the debriefing immediately after the café

Helping to take things down and put things away after the café. These tasks are the immediate ones that need to be taken care of in the morning. Other tasks for the Fab 5 include:

- Introducing the speaker.
- Working the registration desk.
- Wandering the room getting attendees involved in the icebreaker.
- Escorting people to the restroom.
- Making sure the computers are all still working.
- Getting the pizza when delivered to the front door around 11am.
- Two people packing up computers.
- Assisting the speaker with anything.
- Escorting people from place to place.
- Handing out the evaluations and collecting them.
- Handing out the flyer on the next café and other items (Globe at Night postcards, etc).

Once more, these tasks should typically be distributed during the practice sessions but can also be delegated as appropriate. These tasks are typically meant to extend over the entire café and are not just limited to the morning.

In regard to most of the action during the café, the Fab 5 are typically the ones who will interact with the attendees so there are options. As the Undergraduate Lead, you have the option to take a more passive route and ensure that most of the behind the scenes are taken care of such as running to grab anything that is needed, fixing any problems, etc. There is also the option to be much more active and participate much more heavily in the activity with the students and get to know them. While both are options, during some cafés, you may find that you must work as both or switch into the other role. This is entirely based on the situation and what is necessary.

Fab 5 and Responsibilities

The Fab 5 are some of the most indispensable people to work with throughout the course of the café season. As such it is important to work closely with them and ensure that your expectations of them are clear. Being part of the Fab 5 implies that these students are looking to both advance their knowledge in astronomy and take on a leadership role. Due to this, it is important to ensure that they can show that they are up to the challenge of becoming leaders.

In the initial incarnation of the Café program, the Fab 5 were positioned in a more advisory position. While this model worked, it was not as beneficial to the students. In the last year they have been taking on more leadership roles. They have advised on what works, what does not and how to improve the cafés. They have helped lead parts of the cafés. One of them lead the other Fab 5 on the day of each of the Fall 2018 & Spring 2019 cafés. And they provided feedback at the practice sessions on both the computer activity and the presentation. To help prepare the students for more in-depth leadership roles and ensure they receive valuable experience to be used later in life it is important to make sure that they take a much more active role in preparing and interacting with all aspects of the café, from conception to implementation. Some responsibilities to concentrate more on include:

- Picking speakers and topics (albeit topics are chosen by participants)
- Helping lead workshops on the Cafés
- Help in development of the activity
- Organizing events to help promote
- Leading other Fab 5 on the day of the Café

This is far from an exhaustive list of the possibilities and by no means are meant to be adhered to. As time continues, more opportunities will crop up to for the Fab 5 students to show that they are up to the challenge of leading. As the Undergraduate Lead overseeing the Fab 5, it is important to notice when things like this appear and to delegate the responsibilities properly. As such, it is not beneficial to go into the specifics of the current responsibilities of the Fab 5 at the time of writing this. Instead, it is more fruitful to personally identify the aspects of the café that can be undertaken by the current members of the Fab 5. The responsibilities of the Fab 5 are highly dependent on the personalities, strengths and weaknesses, schedule and technical skills of the current members. It is vital to the prosperity of the program to understand these capabilities and adjust the responsibilities accordingly. In some years, the students may be able to take on a

vast majority of the necessary preparations of the café and very little work will be necessary other than guidance and in other cases, it may require more oversight.

Speaker Guidelines

Choosing a speaker and topic for the next Café is typically taken care of in the summer before the next café. It is important to contact as many people as possible to get as many people as interested to speak as possible. The best places to look for speakers are internally in NOAO, at Steward and Lunar and Planetary Lab in faculty, post-docs and doctoral students. Another important group of people to ask are previous speakers at previous cafés. Here it should be noted that many of these people lead very busy lives and often need reminders and multiple follow ups both before and leading up to the café. One of the key parts of the job is to stay in contact with the current speaker and help in anyways possible.

Please remember that these people you are asking to present live busy lives and any help you can provide will make it a much painless month. Some of the general guidelines for the speaker to follow include the practice session, ensuring that the activity is python based and can be implemented as a Jupyter notebook. A full guideline list and form for the speakers is attached in the appendix and should be sent to the speakers to sign indicating knowledge of the expectations of the speaker position. Finally, it may be useful to sit down with the speakers individually and go over the expectations and offer help before they are overwhelmed. (Check with the Teen Astronomy Café director, as she usually is the one who meets with the speakers.)

Working with the Speaker

You will find that through the course of the cafés that some speakers will be fully committed and excited to meet and work with you. Other speakers may be less communicative and determined to go about things their own way. It is important to be flexible in certain regards and firm on certain positions. Many of these interactions are carried out by Program Director and in some regards is better left to her. This is because she has more experience dealing with them in case of challenges. The most important thing to keep in mind through this is to be willing and able to help the speaker in whatever way possible.

Appendix D

Student Forms

STUDENT AUTHORIZATION/RELEASE

Provide the completed forms to Elliot Kisiel or Connie Walker at the first Teen Astronomy Café attended by the student

Student Name (print) _____

Parent/Guardian Name (print)_____

Parent/Guardian's Telephone Number_____

Parent/legal guardian, please initial in the spaces provided.

PARTICIPATION

_____ I hereby grant permission for my teen to participate in all NOAO/AURA Teen Astronomy Café activities, unless otherwise noted below.

PHOTOS/VIDEOS

_____ I hereby grant permission to photo/video my teen's participation in NOAO/AURA Teen Astronomy Café activities. I understand that such photos/videos may be used by NOAO/AURA for the purpose of education, promotion, fundraising, and/or public information, however nothing for profit. I understand that I will not receive any monetary compensation for the use of any photos/videos.

MEDICAL INFORMATION

_____ I understand that the NOAO/AURA Teen Astronomy Café program does not provide medical staff for students. I understand that the parents/guardians will be called if a medical situation arises.

_____ I certify that my teen is in good health and can participate in all NOAO/AURA Teen Astronomy Café activities, unless otherwise noted:_____

Parent/Guardian Signature_____

Date_____

For any questions on the Student Authorization/Release form, please feel free to ask Elliot Kisiel at 520-318-8229 and ekisiel@noao.edu or Connie Walker at 520-318-8535 and cwalker@noao.edu. Thank you.

Permission to Videotape/Photograph A Minor Child

Dear Parent/Guardian:

To promote our educational program to other teens, educators, parents and potential donors, Science Education Solutions and the Institute for Science Education New Mexico a non-profit organization requests your permission to photograph, videotape, and/or interview your child during the Science Cafés and related events. Use of the photographs or video content on social media or publications will not include identifying information about your child. We take the privacy of your child very seriously and will do everything in our control to protect their identity and present them in a positive light.

Sincerely,

RJ Montaño
Communications Specialist
rj@scieds.com

Permission Slip (Return to Café Scientifique NM)

Child's name_____

Address_____

I am the parent/legal guardian of the student named above. I have received and read your letter regarding the videotaping and/or photographing for Institute for Science Education New Mexico/ Science Education Solutions.

☐ I hereby consent to the participation in interviews, the use of quotes, and the taking of photographs, audio recordings, or video tapes of the child named above. I also grant to the right to edit, use, and reuse said products for non- profit purposes including use in print, on the internet, and all other forms of media. I also hereby release Science Education Solutions and its agents and employees from all claims, demands, and liabilities whatsoever in connection with the above.

☐ I do not give permission to video, audio record or photograph my child.

Parent or Guardian's Name _____

Signature of parent or guardian_____

Date_____

Permissions Slips will be filed at:
Science Education Solutions and the Institute for Science Education New Mexico
4200 W. Jemez Rd Suite 322
Los Alamos, NM 87544

UNC
MOREHEAD PLANETARIUM
AND SCIENCE CENTER

Release and Hold Harmless Agreement, Consent for Medical Treatment, and Photograph Consent

Morehead Planetarium and Science Center Teen Advisory Board

As part of the consideration for my child's participation in the Morehead Planetarium and Science Center (MPSC) Teen Advisory Board (TAB) program, I hereby release, hold harmless, and forever discharge The University of North Carolina at Chapel Hill, its employees and agents from any and all liability, claims, demands, actions, and causes of action whatsoever arising out of or related to any loss, property damage, or personal injury, including death, that may be sustained by me or my child or to any property belonging to me or my child while my child is participating in the program, except for damages caused by the negligence of the University, its agents and employees.

I am fully aware of the risks and hazards associated with this program. I acknowledge that my child's participation in this activity is elected by me and not required. I voluntarily assume full responsibility for any risk of loss, damage, or personal injury, including death, and for any property damage that may be sustained by me or my child as a result of my child's participation on this board.

In the event of illness or injury, I hereby authorize MPSC staff with current Red Cross first aid certification to administer first aid to my child, and I hereby authorize MPSC staff, or other employees or agents of The University of North Carolina at Chapel Hill, to obtain emergency medical treatment for my child at UNC Hospitals as deemed necessary, including administration of an anesthetic or other medication and surgery, and I hereby assume the cost of such treatment. I understand that this authorization is given in advance of any specific diagnosis, treatment, or hospital care being required but is given to provide authority and power on the part of the University and MPSC to give specific consent to the diagnosis, treatment, or hospital care which in the best judgment of a licensed physician is deemed advisable. I understand that MPSC will make best efforts to notify me immediately should emergency treatment for my child become necessary. I also grant permission for emergency CPR to be administered to my child by a certified person should it become necessary.

I acknowledge and understand that MPSC may photograph or videotape my child's participation in the program and use those photographs and images in brochures, publications, Internet websites, audiovisual presentations, promotional literature, advertising or for any other similar purpose without compensation to me or my child and may identify my child by name in information that might accompany the photograph or image. Unless I have marked through this sentence, I agree that such photographs and images, and their reproductions, remain the property of Morehead Planetarium and Science Center; I waive the right to approve the final product; and I release, and forever discharge The University of North Carolina at Chapel Hill, its agents and employees, from any and all claims and demands arising out of or in connection with the use of said photographs and images, including but not limed to, any claims for invasion of privacy, appropriation of likeness or defamation.

I have read and I understand this document, including the release and hold harmless portions of it. I understand and agree that it is binding on myself, my child, our heirs, assigns, and personal representatives. I acknowledge that I am 18 years old or more and that I am the parent or guardian of

_____.
Name of Child

_____ _____
Signature of Parent or Guardian Date

_____ _____
Signature of Witness (Any other adult) Date

AURA affirms its commitment to ensure an environment of the highest professional and ethical standards of conduct. All employees, vendors, participants in AURA programs and activities, and visitors to its centers and facilities are expected to comply with AURA's Standards of Workplace Conduct and to take appropriate measures to ensure that their conduct reflects our values of civility, respect and inclusiveness and that prohibited conduct does not occur.

AURA's Standards of Workplace Conduct Policy Covers:

Sexual Harassment
AURA will not tolerate sexual harassment perpetrated by or against any employee, vendor, participants in AURA programs and activities, or visitors to its centers and facilities.

Other Harassment & Bullying

AURA prohibits any form of illegal harassment of any individual because of race, religion, color, gender, age, national origin, disability, marital status, veteran status, sexual orientation, gender identity or expression, or any other protected class.

AURA also strictly prohibits bullying. Bullying is generally defined as unwelcome or unreasonable behavior that demeans, intimidates, humiliates, or sabotages the work of people, either as individuals or as a group. Bullying behavior is most often pervasive, persistent and part of a pattern, but it can also occur as a single egregious incident.

Any person who believes that they have been subjected to prohibited harassment, discrimination, or bullying should immediately file a complaint with Human Resources. If any individual is unable or uncomfortable filing a complaint with Human Resources, they should contact NOAO Management or file a complaint online through EthicsPoint at https://secure.ethicspoint.com. Contact information for Human Resources is Lynda Dec, HR Division Chief, (520) 318-8247, ldec@aura-astronomy.org, or D'Andrea Williams, HR Manager, (520) 318-8158, dwilliams@aura-astronomy.org. Contact information for NOAO Management is Lori Allen, Director, (520) 318-8281, lallen@noao.edu. Individuals can also file a complaint by phone through the IntegrityLine at 855-257-4106.

Individual(s) who witness or are aware of suspected incidents of prohibited harassment, discrimination, or bullying are strongly encouraged to report the incident to Human Resources or NOAO Management.

AURA expressly prohibits retaliation against any individual who has made a good-faith complaint of harassment, bullying or any other prohibited behavior, cooperated with the investigation of a complaint, or acted as a witness during the investigation of a complaint.

A full copy of the Standards of Workplace Conduct is available on AURA's website at www.aura-astronomy.org or can be requested at NOAO. Any questions regarding this policy should be directed to Lynda Dec, HR Division Chief, (520) 318-8247, ldec@aura-astronomy.org.

By signing this acknowledgement, you affirm that you have read and understand your responsibilities while conducting business with AURA and visiting its Sites/Centers.

_____	_____
Print Name of Student	Parent/Legal Guardian Signature (if participant is under 18 years of age)
_____	_____
Signature	Date

AURA HUMAN RESOURCES OFFICE
PO BOX 26732
TUCSON, ARIZONA 85726-6732
PHONE: 520-318-8000 | CONFIDENTIAL FAX: 520-318-8494

Appendix E

Agenda for a Tucson Teen Astronomy Café

Agenda for the Teen Astronomy Café: May 4, 2019

9:30-9:35am	Introduction and refreshments
9:35-10:05am	Drs. Dante Lauretta and Carina Bennett talk about why they became interested in astronomy and planetary science, what their research is about, what problem it is solving and why it is important to solve.
10:05-10:15am	Question and answer period; refreshments
10:15-10:25am	Bio-break; students move to the Main Conference Room (MCR) to do the computer activity.
10:25-10:55am	Drs. Dante Lauretta and Carina Bennett introduce the tools of research to the students and leads them through the computer activity in the MCR.
10:55-11:10am	Wrap up presentation and discussion of activity.
11:10-11:20am	Bio-break; students go to the patio.
11:20-11:50am	Everyone enjoys pizza on the patio. At the tables, two grad students and Drs. Dante Lauretta & Carina Bennett will lead groups of interested students in a discussion of astronomy questions and/or concepts.
11:50pm-12:05pm	Everyone returns to rm 27 and the students complete a Questionnaire (evaluation).

Appendix F

A Questionnaire for the Teen Astronomy Café

Questionnaire (Teen Astronomy Café, 4 May 2019)

Name (optional)_____Date _____

School (optional)_____Age _____Grade _____

Number of science classes taken in high school (including this semester) _____

Number of Teen Astronomy Cafés you have attended (including this one) _____

Are any members of your immediate family a scientist or engineer? (circle one) yes no

In a few words, please tell us why you came today:

What are two "big" ideas about astronomy you learned today?

1.

2.

What are two questions you have about "*OSIRIS-REx: Exploration of Asteroid Bennu*"?

1.

2.

What topics would you like to see offered next year for the Teen Astronomy Cafés? Check up to 7:

- ☐ Our Solar System (our planets & the Sun)
- ☐ Killer Asteroids
- ☐ Exoplanets (planets outside our Solar System)
- ☐ How stars form and die
- ☐ Other topic: _____
- ☐ Galaxies nearby
- ☐ Galaxies far away
- ☐ Colliding galaxies
- ☐ Gravitational lensing
- ☐ Dark Energy, Dark Matter
- ☐ Spacecraft to other worlds

Would you invite someone new to come to the next Teen Astronomy Café with you? Why or why not?

Turn over-->

Please rate the following statements (circle one number for each statement):

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
I have an interest in science or engineering.	1	2	3	4
The scientist raised my curiosity about their research.	1	2	3	4
I understood the science in the presentation.	1	2	3	4
I felt comfortable asking the scientist questions.	1	2	3	4
I got a sense of who the scientist is as a person.	1	2	3	4
The scientist helped me see how their research connects with issues important to society.	1	2	3	4
The scientist made connections between their research and my daily life.	1	2	3	4
I learned more about the topic by talking with my peers.	1	2	3	4
The scientist talked too long.	1	2	3	4
We had enough time to ask the scientist questions.	1	2	3	4
I learned more about science by doing the computer activity.	1	2	3	4
I have a better understanding of how science research is actually done.	1	2	3	4
Astronomy has little to do with my daily life.	1	2	3	4
I like to watch the sky and the stars at night.	1	2	3	4
I am curious about how asteroids play a role in the origins and fate of our solar system and ourselves.	1	2	3	4
I am interested in hearing more about astronomy issues that are in the news.	1	2	3	4
People should understand science because it affects their lives every day.	1	2	3	4
I am interested in talking to scientists about their work.	1	2	3	4
I am interested in a science- or engineering- related career.	1	2	3	4
I have a good understanding of astronomy issues I hear about in the news.	1	2	3	4
When talking to others about science, I use data (evidence) to support my point of view.	1	2	3	4

Thank you for your feedback!

Adapted from a form originally authored by STEM&leaf LLC
for the predecessor to the Teen Astronomy Cafê, Spring 2017