

Question 1: How did you find your mentor?

During the summer break between my 7th and 8th grade years, I happened to read Stephen Hawking's book "Black Holes and Baby Universes". This fascinating book, along with other sources of information on the universe, piqued my interest in astronomy. During my freshman year in high school I participated in the annual American Astronomical Society meeting and became deeply interested in astronomy research. During the following summer, I searched online for faculty members in nearby university campuses involved in research in astrophysics. I contacted a few of the researchers by email and phone, expressing my interest. A senior faculty member at the Center for Astrophysics and Space Sciences at UCSD invited me to visit his office for further discussion. He directed me to Dr. Richard Rothschild, a high-energy astrophysics researcher in the department, who gladly agreed to let me work on a project and promptly gave me research papers to read.

Question 2: Do you have any successful tips and strategies to offer when looking for a mentor?

Parents, teachers and friends may provide valuable advice with regards to finding a suitable mentor, but to find someone in a particular field of interest, based on my experience, the Internet is the best tool. Search for various schools in your local area (and/or industries and institutes) to find researchers who are working in your field of interest. Contact specific researchers by email and/or by phone and voice your interest for the subject matter and for joining their research group. For any email responses received, reply immediately as their time might be limited. If a researcher is interested, set up one-on-one meetings to further discuss your prospects. Most importantly, during these meetings, showing your enthusiasm for the subject is key. Dive right in and ask questions - whether about the subject in general or about the specific field of work the prospective mentor is involved in.

Question 3: What types of mentoring relationships have you experienced? i.e. via phone or email, in person, weekly, monthly, daily, etc.

With my first mentor, Dr. Rothschild, I always had a daily one-on-one discussion. When I got started with the first project, I would meet him frequently, as this was a novel experience for me and I had to learn a lot. As the work progressed however the meetings reduced in frequency, as I was able to have a handle on the work myself. At Berkeley, I was working for Professor Alexei Filippenko and Dr. Weidong Li for the supernova search team. I met with them weekly, sometimes monthly, and even discoursed via email to discuss progress and for managing the training of new team members. With my current mentor, Adam Burgasser, I keep in contact through all methods of communication (email, phone, and in-person).

Question 4: How did you prepare for a mentorship?

Once my mentor agreed to meet with me, I read up about his work, background, as well as abstracts of articles and papers he had written and get to know about him before the meeting. During the meeting itself I talked with my mentor about everything – the subject, my interests, his work and papers, and even the posters and books in the room. The intention really was to show my interest in the field. After he agreed to allow me to work with him, I asked about the work and read papers and articles about the subject matter as provided by him as well as other material pertinent to the work that I later researched and obtained.

Question 5: What characteristics would you tell others to look for in a mentor?

The most apparent characteristic one would look for in a mentor is that he or she is not only knowledgeable and well versed in the field, but also a good and patient teacher. A great mentor is one that challenges his or her student and has great expectations but also nurtures their interests, teaches them – especially at a level they can understand, helping with problems and trouble-shooting. Graduate students and postdoctoral fellows and other undergraduate trainees in the department will testify to this ability to teach, train and mentor students. The prospective mentor should also be active in the field: working on projects, writing papers and participating in conferences. Most importantly, the mentor needs to be encouraging and supportive, and not just provide a task list to complete. A good sense of humor helps too.

Question 6: Why is mentoring important?

As is the case with astronomy, the subject of interest might not be taught in school. Regardless of the study of interest, the knowledge in the subject is furthered through the mentorship program – beyond what textbooks and classes can provide. Mentorship and research provide a platform for one-on-one interaction. It also serves the purpose of providing real-life hands-on experience in the field, rather than the limited theory and problem work from a textbook. Being able to interact and grow with a mentor allows for the nurturing, development, and piquing of the students interests and passions – ideal for determining the correct major(s) of choice at the university level.

Question 7: What did you study with your mentor and what was the process?

I completed three high-energy astrophysics projects with my mentor, spanning from 10th grade to 12th grade and even partly into the freshman year summer of Berkeley. Each project involved the analysis of data collected from different high-energy sources by the Rossi X-Ray Timing Explorer satellite.

For the first project I searched for evidence for the decay of ^{44}Ti to ^{44}Ca in the supernova remnant Cassiopeia A. The project involved preliminary processing of data followed by the production of light curves and spectra in search of the specific spectral line of ^{44}Sr – a product step in the decay of ^{44}Ti . This was the first project that my mentor had tasked me to work with him on, and my first real introduction to the field. I was earnestly trying to get a grasp of the subject by reading papers and trying to understand the background science. In addition I was immediately put to work on a unix machine, with no more instructions other than to play and learn and figure it out. Not knowing anything about the operating system, I felt as if I was being thrown in the lion's den and asked to fend for myself. For the majority of the time I was sitting down with my mentor as he showed me examples of the code as well as when we obtained spectra. I asked him questions frequently as I was just getting started.

The second project I worked on was the study of the pulsar GX301-2. The project involved the same sort of data processing as the previous but with different analysis procedures. The main goal was to understand the phases of the pulsar and determine a reason for any aberrations or atypical behavior in the pulses. For this project I was more familiar with the process and with the general environment, though I was still trying to understand the new science and the wealth of new facts. I started branching out, writing my own scripts, and doing my own work with less help from my mentor, though I ended up sitting down with my mentor at the end to obtain the spectra.

The final project involved the x-ray analysis of the active galaxy Centaurus A. Once again I was given similar data processing procedures and different spectral generation procedures. The goal was to map out the entire x-ray spectrum (using the RXTE data as well as data from another satellite) for Centaurus A, and try to understand the physical parameters of the AGN. Being well versed with the technical aspects I began writing my own scripts, automating tasks, obtaining my own spectra, and even co-authored the final paper.

Question 8: Did you ever experience difficulties or issues with a mentor? If so, were the issues resolved?

There were sometimes certain intervals when my mentor was away and there was a lack of contact (even via email). While I try not to be dependent on my mentor for all of the answers, there are certain times when confirmations need to be given or doubts need to be cleared before moving to the next step. The lack of contact pressed me to find the answers to my doubts myself through research as well as allow me to experiment with other procedures and techniques. Otherwise there have been no other problems with my mentors.

Question 9: Who should manage the relationship?

Both. This isn't a one-way relationship – it's mutual. The student needs to be prepared to work hard and continue to show interest and ask questions, while the mentor should provide what the student needs to complete the tasks and be encouraging.

Question 10: How did your work with your mentor get you to where you are today?

Because of the work with my mentor I was able to enter the various projects into the greater San Diego science fair. The first project was selected for presentation at the International Science and Engineering fair. There I also entered and won a few scholarships – one which named an asteroid after me. The final project garnered a trip to New Zealand where I presented my project at their national science fair in Wellington. I received great mentorship there from the teachers and judges. The work with the mentor also allowed me to obtain scholarships and fellowships (most notably and importantly the Davidson fellowship), which allowed me to pay for all of my tuition and books for all four years at Berkeley. The work also allowed me to get involved in the field of astronomy and helped me meet new people including faculty members, researchers, and graduate students. Among these members included important administrators and department heads involved in admissions for campuses. As a result, I'm sure my work with Dr. Rothschild helped get me into Berkeley. Professor Alex Filippenko stated that he knew me through my research work and I joined his research group as a result. At present, it has helped me obtain a research position with Professor Adam Burgasser at UCSD and I'm sure it will help me with graduate school admissions.

Question 11: Anything else you would like to add?

Mentorships and research are definitely things that should not be optional, but mandatory. Working with a mentor is essential for growing in the field of your passions through extensive learning, hands-on work, and interactions with others in platforms such as conferences and meetings. It is an experience that is unparalleled in conventional learning environments and it places the footholds for greater opportunities in the future.