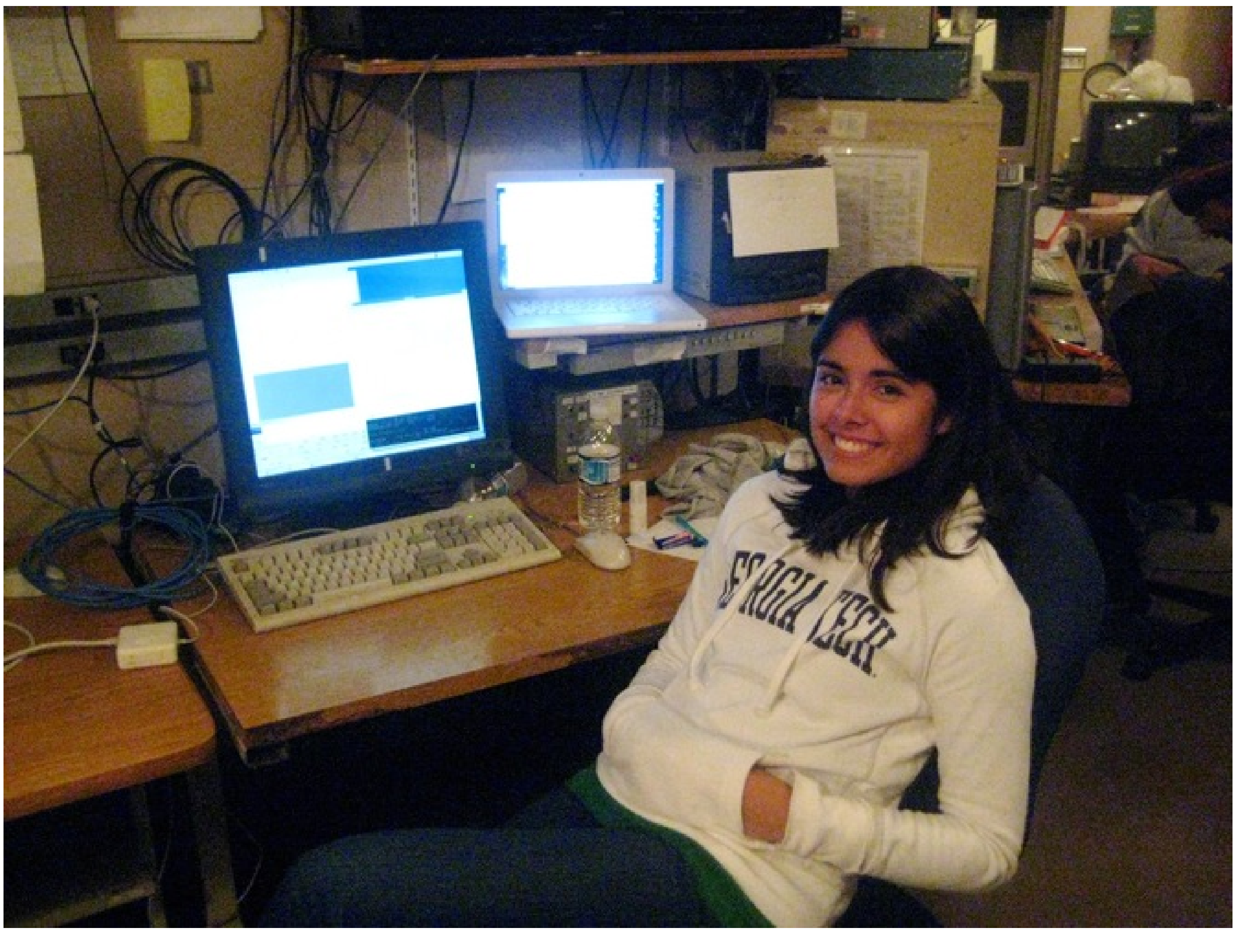
Most days in the life of an astronomer aren't spent at telescopes

May 6 2015, by Nicole Cabrera



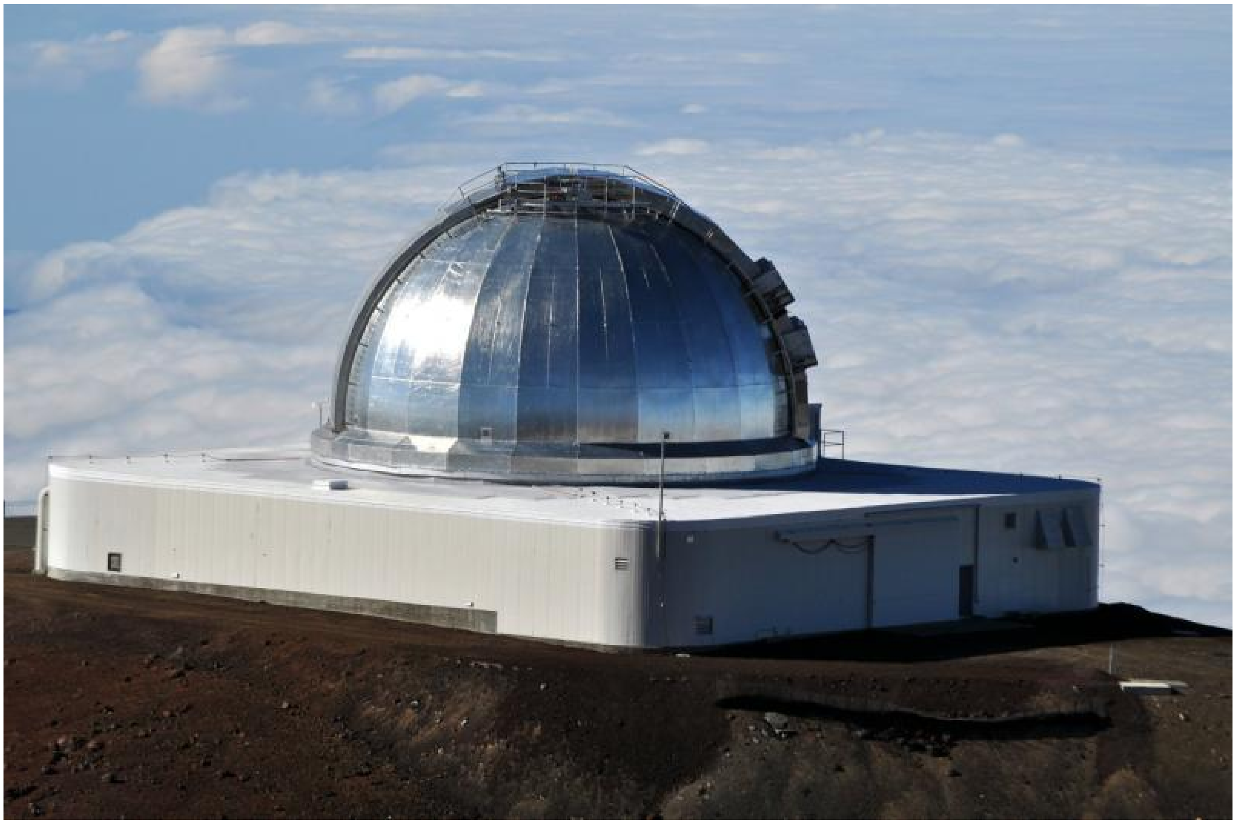
Observing on-site at the University of Hawaii 2.2-meter telescope on Mauna Kea, Hawaii in 2008. Credit: Nicole Cabrera, CC BY-NC-ND

On a telescope at the summit of Mauna Kea in Hawaii, it's not easy to put in a full night of work. At 14,000 feet, you're operating at only 60% of the oxygen available at sea level, which makes concentrating difficult. Top that off with a shift that begins at 6:30 pm and ends at 6:30 am, and it becomes hard to imagine astronomers working like that year-round. Luckily, most of us don't have to.

Misrepresentation of astronomers in movies and TV may lead some people to believe that we live at our telescopes, observing the stars and taking data every single night. Actually, most astronomers don't spend a lot of time at the observatory. In my case, I spent an average of five weeks per year for two years observing the stars I studied for my PhD. If you're wondering why so little time is dedicated to observations, the answer lies in one word: resources.

It costs millions of dollars to build even a moderate two-meter ground-based telescope, including the telescope itself, the building that houses it, the instruments attached to it, and the salaries of the people operating and maintaining it. There are many more astronomers in the world than there are telescopes, so everyone has to apply for time at the observatory that best suits the data they need.

A Time Allocation Committee at each observatory reviews the applications every season and chooses the best projects to which to award observing time, making the process very competitive. As an astronomer, my job is to convince the Time Allocation Committee that my project is important enough to the scientific community to merit time on their telescope. Since the observing time has to be divided fairly among the dozens of astronomers with winning proposals, each astronomer's time is quite limited.



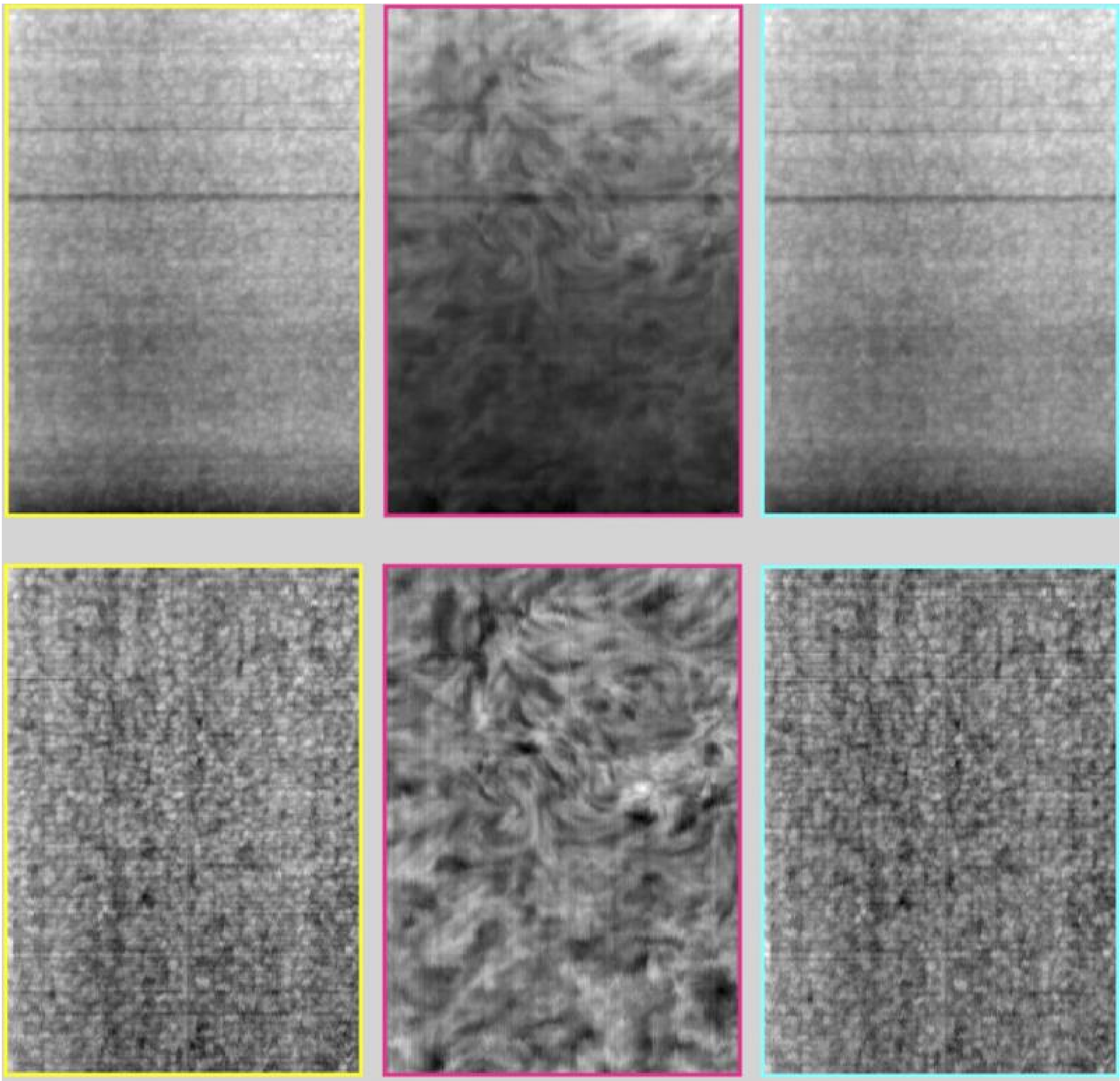
NASA Infrared Telescope Facility above the clouds on Mauna Kea in Hawaii. Credit: Afshin Darian, CC BY

Still, there's so much more to being an astronomer that additional observations wouldn't necessarily be better! The rest of the year, back home in our research institutions, we need time to transform our "raw" data into something we can use. Think of a photographer in her studio. There's a reason wedding pictures take so long to get back; the photographer has to edit the pictures to remove noise, adjust the lighting, and generally perfect the photos.

Astronomers have a similar task, removing effects from the atmosphere, the telescope, and the instrument they used to make sure everything is cleaned up and ready for analysis. Depending on the type of data, this calibration process can take days to weeks. For example, the raw images above have artifacts and "blurriness" that would affect the analysis. Although these images may look only marginally different to the untrained eye, 13 separate calibrations had to be performed (in the form of clever calculations carried out by a computer program I coded as an undergrad).

Of course, once the data are calibrated, it's not over. For example, I now study nearby stars that are like the Sun in size and temperature, only much younger (millions of years old instead of billions – I know, our sense of things like "young" and "old" and "near" and "far" is a little skewed). I'm trying to measure the "wobble" these stars experience if they have a Jupiter-sized planet around them. The problem is that I'm not sure if these stars do have planets, so I have to do all sorts of calculations to see if what I observe actually matches my predictions. I run computer programs to handle the calculations, either ones I've written myself or that other astronomers have put together. Astronomers are actually quite like computer programmers, except usually with a much more specific goal in mind.

Let's say I do find something around my "young" Sun-like star, except it's not quite what I expected. Perhaps the signal of the planet I've discovered is a bit weird, and I need to figure out why that is. This is the part called "data interpretation," where I take all my knowledge of astronomy and physics and use it to explain my data. I don't do this alone, of course. I collaborate with a team of astronomers, and discussing my results with them helps to generate ideas about what my data are telling us. Collaborators can be colleagues that I see everyday, but many times they are people in other parts of the world, some that I've never even met in person.



Images of the Sun through an H-alpha filter, taken with the Dunn Solar Telescope at the National Solar Observatory. Several types of calibration processes were performed to turn the raw images (top) into their respective calibrated images (bottom). Credit: Nicole Cabrera, CC BY-NC-ND

Once you're sure that your discovery is robust, it's time to let the world know by writing a scientific publication about your results. This can take weeks of writing and revision between collaborators, and it can then take months for a peer-reviewed journal to revise, accept and publish the paper. It's also important to attend conferences and present the results of your paper to other astronomers so that they can ask questions and give you feedback based on their own expertise. Conferences are great places for discussions, especially with researchers who are otherwise scattered across the planet.

Did I mention that astronomers have lives outside of work? I myself am an avid dancer (of swing, salsa and now tango), sing in a college choir, and once played a real sport called underwater hockey. I've known other astronomers who are also artists, activists, serious cooks and bakers, martial artists and writers. Sure, we study the stars, but we can also be very down to Earth.

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The author hard at work at Georgia State University in Atlanta, Georgia – thousands of miles from the telescope. Credit: Nicole Cabrera, CC BY-NC-ND

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