**An American's five-country research tour**

Tess Jaffe

*For one astrophysicist, an impromptu transfer to a position in Switzerland turned into a 17-year stint on the European continent.*

**Tess Jaffe** is an astrophysicist at the Goddard Space Flight Center in Greenbelt, Maryland, where she is also the chief archive scientist at NASA's High Energy Astrophysics Science Archive Research Center.

A year ago, former PHYSICS TODAY editor-in-chief Charles Day asked me to write a narrative of what we termed my "rather bizarre career path." That's a reasonable summation. My first research experience in astronomy was a summer internship I did after my freshman year of college. Having no astronomy background, I applied on a whim, and happened to be accepted as their wildcard for the year. While modeling stellar atmospheres, I fell in love with the subject. It was a fantastic experience that made me decide to pursue a physics major. But when I returned for my sophomore year, motivated and with a plan, I effectively flunked out of the physics program. That roller-coaster experience turned out to be a microcosm of my career.

**Early days in the US, 1997–99**

After dropping out of college for a bit, I had much more success during my second go-around at University of California, Riverside, where the physics department was a much better fit. I was working on my master's thesis (also at Riverside) when I noticed that an author of a paper I was reading worked at a company called Hughes STX. I still liked astrophysics but felt

finished with academia at the time, so I looked into the company and discovered that they provided scientific software developers to NASA's Goddard Space Flight Center (GSFC).

Somehow I got an interview for a position at Hughes STX working at GSFC for an x-ray astrophysics mission. The GSFC contractors I interviewed with happened to all be women, which was refreshing but gave me an extremely skewed view of the world I was headed into. But fortune favors the foolish, and I got the job. I packed my life into my little Japanese pickup truck, and drove across the country to Greenbelt, Maryland.

As a 23-year-old who barely knew how to program, working at NASA was amazing. I found my people and my first real mentor, and quickly found that I was pretty good at the job, too—which was to help scientists analyze the data from the Rossi X-ray Timing Explorer. The mission tracked the time variations of astronomical x-ray sources and returned a variety of data types. Scientists needed to reduce the data differently depending on the nature of the source, which meant that the analysis was more complex than is typical for such missions. My group was a mix of scientists and developers who maintained the software and documentation and provided hands-on help to researchers. In return, some of the scientists taught me a bit of astrophysics. In turn, I helped create educational materials and answer public questions about astrophysics.

The astrophysics division at GSFC had a large variety of seminars and colloquia, and it paid better than grad school, so in some ways, it was a good interim substitute for a PhD program. The division has several hundred staff and is far larger than probably any university department. But the group I worked in was small, sociable, casual, and collegial. Some of us were contractors for companies like Hughes STX, and some were scientists employed through cooperative agreements with non-NASA institutions like local universities.

It didn't seem to matter at the time what institutional name was on your paycheck. (The important distinctions were things like Linux or Mac and Star Wars or Star Trek.) In fact, for non–civil servants like myself, our employer's name might change occasionally as the contractor for our positions changed. (Over the course of my seven years at GSFC, I worked for Hughes STX, Raytheon, and SP Systems.) I worked and socialized with scientists and developers, system administrators and hardware builders, and Americans and foreigners. Because our positions were all funded by "soft money"—in other words, dependent on continued funding—they were not permanent. But they could effectively be so if you were useful enough to hop from mission to mission or if you found a long-term project. GSFC was someplace I would have willingly spent my whole career.

GSFC's proximity to several university astronomy departments was something that some of us made use of and some didn't. I took one graduate class in astrophysics while working there but taking even a single course on top of a full-time job was too much for me to contemplate long term. And as a singleton on an entry-level salary—when I was offered the job, I took the first number Hughes STX offered because I didn't know to negotiate—I'd have been uncomfortable trying to complete a PhD on a part-time salary. The life of a grad student is hard to go back to after adulting for a while.

As much as I liked GSFC, after a few years, I wanted to see what else was out there. At the time, the science support group I was part of at GSFC also sent people overseas as part of the US contribution to international scientific projects. One of those individuals was working in Geneva, Switzerland, and wanted to come home. I nearly broke my shoulder waving my arm so hard asking them to pick me to replace him. And they did.

**Switzerland, 2000–03**

I was hired to take over integrating and testing the data analysis pipelines for a gamma-ray astrophysics mission called INTEGRAL (still flying!), whose scientific data center was and is run out of a tiny, dedicated institute in Ecogia, a historic hamlet outside Geneva.[1] The data center is technically part of the Geneva Observatory and the University of Geneva, but it is largely independent of both institutions. (On the rare occasions I set foot on the university's campus, it was by accident.)

Leaving GSFC was wrenching, and the prospect of moving to Europe—which I had only visited once (for the job interview), where I didn't speak much of the language, and where I hardly knew another soul—was terrifying at the age of 25. Apparently it was also a bit alarming to the folks in Geneva, who wondered what NASA was thinking sending them a child in exchange for an experienced developer.

The staff was very international: Like me, most of them had been sent by various countries in the collaboration. Although there were only a few grad students on staff and the atmosphere was a bit more formal than GSFC, my colleagues at the data center were extremely friendly and welcoming. The staff was used to providing a lot of help to foreigners trying to find apartments and deal with Swiss administrative mysteries without sufficient French. (*Merci, Martine!*) On a side note, despite knowing that having a fling with a colleague is a risky idea in any country, I did it anyway. (I was 25!) I'm now happily married to him, so it worked out well in the end.

I missed my GSFC friends, but I liked the work and was good at it—and I got to travel in Europe in my spare time, which was the best part. When the satellite (seen in figure 1) was launched and the data analysis pipelines were running smoothly, I wasn't ready to go back to the

US. With much trepidation, I decided to quit my job (I now had savings) and go back to grad school somewhere in Europe.

That was nontrivial. Since by now my French was functional, I looked into some of the high-quality research institutions in France. But at the time, they had limits against funding grad students who began their programs over the age of 25. In Italy, I could have snuck under the age limit of 30 by a few months, and my age didn't matter in Germany. Despite my background in high energy, I decided to head down the electromagnetic spectrum because the newly measured cosmic microwave background (CMB) angular power spectrum was the coolest thing I'd ever seen.[2] (Pun intended.) I was ultimately accepted into a program in Munich to pursue a PhD in the exciting field of CMB anisotropies.

**Germany, 2004–2006**

I did my PhD work at the Max Planck Institute for Astrophysics (MPA), one of over 80 research institutes operated by the nongovernmental Max Planck Society for the Advancement of Science. Max Planck Institutes are well funded and independently run, and their directors have a large amount of discretion over the distribution of each institute's funding.

In physics, that means that grad students (and postdocs) generally do not need to spend much time applying for grants. Instead, they are hired onto a project that typically funds them for a fixed term with its own money or with external funding from a fellowship such as a Marie Skłodowska-Curie Action.[3] The MPA also had a lot of experience helping foreigners who don't speak enough German. After a few months, my partner managed to get a software-support job at the institute next door and was thus able to follow me from Geneva, which gave us a temporary solution to the two-body problem.

Luckily I had done a master's degree in the US, because European PhD programs don't generally accept applicants who only have a US undergraduate-equivalent degree. Doctoral programs in Europe focus exclusively on full-time research and students are generally limited to three years of funding. There are advantages and disadvantages to the European system, but it was important for me to know that I was only setting aside three years and not embarking on an indeterminate project.

Although it had plenty of international personnel, the MPA's permanent staff was German-dominated. But the institute's graduate program—which is part of one of the International Max Planck Research Schools—was and is set up to recruit international talent, so we were all in the same boat linguistically speaking. The MPA is located amidst a large campus of research institutes in Garching, a suburb of Munich, and the graduate students at those institutes are enrolled at different local universities. I was officially affiliated with the Ludwig-Maximilians-University of Munich, but I rarely went to the university's campus in the center of the city. Unlike in the US, I wasn't able to work with undergraduates, but the point of the three-year limit on European PhD programs is that there's nothing to distract you from your research project (see figure 2).

The fact that there was a majority language group meant that non-German speakers tended to self-segregate a bit by language. There were smaller enclaves of Russians, Italians, and Brits. At the time, I was one of two Americans. By chance, my supervisor happened to be English, and our seminars were entirely in English. (My partner was the only non-German in his group, and struggled through their exclusively German-language group meetings.) So I'm embarrassed to say that after three years there, my German was never very good, and most of it left my brain when I left the country.

I was very lucky in that my supervisor was supportive and generous, but some other students faced bullying before it became remotely possible to address such issues in research, not to mention some casual sexism from senior staff (*aber natürlich*). Overall, however, I was happy. I loved Munich, and I couldn't have asked for a better PhD project.

After two years, our unstable solution to the two-body problem threw my husband out of his job. He took a job in the UK while I stayed in Germany for the last year of my PhD. When I was finished, I began to hunt for jobs in the UK. I was again at a fork in the road, and I didn't know if I wanted to continue in research or get a "real" job. After applying to both types of positions, I was offered a postdoc at the Jodrell Bank Observatory (part of the University of Manchester), and a scientific software developer position at the Rutherford Appleton Laboratory, the UK national lab in Oxfordshire where my husband was working.

I had gone to grad school not because I had ambitions of an academic career but simply because I wanted to spend three years studying the CMB. I never intended to do any postdocs, but when I got to that point, I decided I might as well do more research since I had the chance. So I took the postdoc at Jodrell Bank. Although the postdoc paid less than the software-development position, I enjoyed the science—and with two incomes, the salary difference wasn't much of an issue.

**UK, 2007–09**

For the first year of my postdoc, we worked out in the beautiful Cheshire countryside, where I had a fabulously distracting view of the Lovell Telescope (see figure 3). My husband was granted a transfer to a closer laboratory so we could live together. But I had a harder time feeling comfortable in my department. My position was funded by a large "rolling grant," which meant that I didn't have to apply for any further funding. In the British system, there aren't many

funding options aside from large grants for tenure-track researchers to start a whole group.https://commons.wikimedia.org/wiki/File:Lovell_Telescope_17.jpg

After a year, we academics moved into a new building in central Manchester, where I shared an office with other postdocs I could talk to, so I felt more integrated into the department. But my project didn't go well. Aside from parenthood, which I was gobsmacked to discover I liked, I didn't have a good time. To make matters worse, after three years, my husband's department was decimated by a budget crisis in the Science and Technology Facilities Council, the UK agency that funded his laboratory.[4] Although he still had a job, he no longer had a group.

So when my former PhD supervisor from Germany moved to a permanent position at a French institute, won a large grant, and offered me a postdoc in sunny Toulouse, I took it. Again, I wasn't intending to search for a permanent academic job. But having felt I'd failed at my first postdoc, I needed to try again to prove that I could do it.

**France, 2009–16**

So my husband quit his job again, and we moved to Toulouse, where I started working at the Institute for Research in Astrophysics and Planetology (IRAP). One of the independent institutes that arises from a partnership between the French National Centre for Scientific Research (*Centre national de la recherche scientifique*; CNRS) and the Paul Sabatier University, IRAP is located on a large campus south of the city where the university adjoins several research labs, an engineering school, and part of the French space agency.

My contract was administered by the university, but as in Switzerland and Germany, I barely visited the rest of the campus. IRAP had a healthy population of masters and PhD students, and a relatively small number of international postdocs and research staff. But at the time, it was not well set up to support incoming foreigners. Had I not already spoken French, it

would have been even more difficult. (Seminars were often in French, and they regularly started with the host asking if anybody in the audience didn't speak French and wanted the speaker to do it in English. That would often be asked…*en français*. I've been told things are changing.)

I loved living in Toulouse (see figure 4 for one reason why), and my work went well. My supervisor had guaranteed me the same salary I'd had in the UK, which I believe made me the highest paid postdoc at the time and higher paid than some tenured researchers. After a few months, my partner got a job in Toulouse's large aerospace industry.

We had another kid, and I highly recommend Europe for the early years of parenthood. The NHS in England was great for maternity and childcare, and the French system is good too, although it is of course far more bureaucratic (*mon dieu*). In Manchester, daycare for one child cost nearly half my salary after taxes, but in France it was subsidized to be a reasonable fraction of your income. Having French amounts of vacation was also fantastic, although if I'd taken all of it my research productivity would have been impacted.

As I neared the end of my three-year postdoc contract, we were settled in Toulouse and did not want to leave. Unlike everywhere else I had been, at IRAP it was impossible to find long-term employment by working on a longer project or hopping from project to project: In France it is illegal to employ people long term without making their positions permanent. So I started applying for permanent positions.

Another unusual aspect of the French system is that most permanent positions in research fields are decided by national competitions judged by a set of panels drawn from one's broader field—in my case, astronomy—much like grant review in the US. Instead of an hour-long job talk, you have less than 15 minutes to present to the panel your entire career and your research plans. The system is meant to be more egalitarian and reduce the effect of the old boys' club.

I applied to two types of positions, which were funded by different agencies that do not have American equivalents. There are pure research positions funded by the CNRS, and positions that are part research, part teaching, and part science support, which are managed by the National Council of Astronomers and Physicists (*Conceil national des astronomes et physiciens*; CNAP).

Most people apply repeatedly before landing a job, and I ranked highly enough the first time around to think it would be worth trying again. I scrounged some funding so I could apply two more times. In doing so, I ended up being a postdoc at IRAP for nearly seven years (including an extension for maternity leave), under three different funding sources. That must be a record at IRAP.

But I was ultimately unsuccessful. I suspect my publication rate was not high enough for the CNRS positions. (That was in part because I had worked on a large collaboration with a controlled publication policy, which is unusual in astronomy.) For the CNAP positions, it was too late for me to get hired permanently onto the project I proposed working on, and national priorities had shifted to projects I had no "in" with. (Networking remains important in the CNAP application because the positions are project based.)

My research specialty at that point didn't help either. The study of galactic magnetic fields intersects many different subfields of astrophysics[5] without fitting comfortably into any of them. (The story of my life.) I will also note that during the years that I applied (2013–15), the CNRS competition recruited seven men and zero women at my level in astronomy.[6] *Va savoir*.

I was out of research opportunities in France, and I wanted to be closer to my family. So even though I loved living in Toulouse, we decided to move to the US. I hoped to get hired at an institute like GSFC into the kind of long term but not officially permanent position that is not

legal in France. So my husband and I applied to various positions in the US at institutions like JPL and NASA's Ames Research Center.

I got lucky: Somebody at GSFC who knew and valued me happened to have an opening for a staff scientist, and the old boys' club ended up working in my favor for once. I tried working my connections for my husband and passed his resume to everybody I knew, but he ended up landing a job in a GSFC division I knew nothing about—as a contractor for a company I'd never heard of—solely on his own merits.

**US, 2016–present**

Coming back to the US after 17 years in Europe was extremely difficult. The American lifestyle was not one I wanted to live. I'd driven only a handful of times in the previous decade and didn't miss it. The only American things I missed were proper deodorant and jeans. (Yes, I'm a cliché.) But I was willing to try out what seemed to me to be a strange and not-quite-civilized country to come back to NASA and be closer to family. After all, it was my fifth move to a foreign place, so how bad could it be?

After moving back to the US, things initially got worse and worse for me for reasons entirely unrelated to the job or the location. It turns out that getting mental health treatment can be remarkably effective and is a good idea to do sooner rather than later. Who knew? I'm far from the only one in astrophysics who's dealt with mental health issues,[7] but I'm one of the few who is willing to talk about it. Note that I could only afford treatment in the US because we had two solid salaries. In the UK or France, it would have been free.

Coming back to GSFC after 17 years was not difficult at all. Now that I'm a scientist and not a developer, I've picked up on a few things I hadn't noticed when I was young and naïve—and the government bureaucracy is annoying even to someone who survived seven years in

France. But it's the right place for me. My initial position was a long-term contract position funded by the University of Maryland. I'm now the chief archive scientist at NASA's High Energy Astrophysics Science Archive Research Center, a repository for mission data, which means that I need to stay current on the research community's needs and the technical tools needed to meet them.

I work with a team of excellent system administrators, developers, and scientists (see figure 5). My favorite part is that we get to learn new technologies on a regular basis so that we can keep up with a changing world. We're currently trying to figure out how to connect a 30-year-old archive to a modern cloud computing environment without causing too much trauma to our change-averse user community or our funding managers at NASA headquarters.

Some of my previous astronomy collaborations have continued, although I can now only devote a fraction of my time to them. When I was employed by Maryland, I was a bit more involved with the astronomy department. I would go over to campus for occasional seminars, applied for funding using my university affiliation, and looked for students there. It's a nice department, but the academic promotion process is ill-suited for NASA support scientists.

To be fair, I'm biased: The dean refused to promote me from assistant to associate level despite 13 years of post-PhD experience, a recommendation from the promotion committee, and strong support from NASA folks who understood what I did. Unfortunately NASA's opinions hold no weight with the university when it comes to promotions, which makes sense for the department's academic independence but doesn't work out well for staff in those positions. (I hear that, too, is improving as Maryland better defines promotion criteria for non-tenure-track staff.)

Despite that, I was willing to stay in that position. I was used to being undervalued and underpaid (see figure 6 for my salary history), and the people I worked with knew my worth. Ironically, one year later, I landed a top-rung NASA position. (I can never seem to do things in the usual order.) A NASA civil-servant colleague I was working with retired, and their position opened. I won the competition—and I can now say that I have my dream job, one which matches my whole skill set. I lead a team that provides data access through web tools and programmatic interfaces; ensures our mission data are findable, accessible, interoperable, and reusable; and explores how cloud-computing resources can benefit our community. I also have some time for my own research.

In the end, I got used to driving again—although I mostly biked to work pre-pandemic. My kids are in a French immersion public school that happens to be down the street, and my Belgian husband is pleasantly surprised by the local craft-beer scene. I'm looking forward to a much less adventurous life in the future, or one that's limited to the adventure inherent to living with teenagers, navigating shifting NASA priorities,[8] and working with fast-evolving technologies. Given my winding career path and the luck I've had, I can't distill my experience into any advice. Nevertheless, I hope it's been useful to see the gory details of a successful yet nontraditional career path.

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**Figure captions**

**Figure 1.** My favorite picture from my time in Switzerland: Part of the INTEGRAL software team visiting the hardware before launch. My behind is third from the right. (Courtesy of Peter Kretschmar.)

**Figure 2.** According to my partner, I spent most of my time during my PhD contemplating the universe on a beach ball.

**Figure 3.** The famous Lovell Telescope at Jodrell Bank Observatory in the UK. During the space race, the telescope tracked US and Soviet spacecraft. Pictured is the view from my office: Every time the telescope moved, I gawked like a tourist. (Courtesy of Mike Peel, Jodrell Bank Centre for Astrophysics, University of Manchester, CC BY-SA 4.0.)

**Figure 4.** My bike commute to work in Toulouse along the historic Canal du Midi.

**Figure 5.** My GSFC colleagues and I reflected in the mirror of the *James Webb Space Telescope*. After the telescope was assembled in GSFC's large clean room, the mirror was deliberately positioned to face the observation hall for several weeks so that we could have the amazing view pictured here.

**Figure 6.** My salary history. Noteworthy elements include the steady salary growth in my first real job (1997–2003) at STX; the huge drop when I went back to graduate school in fall 2003; the drops when my funding agency at IRAP changed (2013 and 2014); the flat salary of a university scientist who only gets a raise when given one by the state legislature (2017–19); and the dizzying rise to stability on the federal pay scale in 2020. The star in 2007 is the salary I turned down at the Rutherford Appleton Laboratory, and the star with the error bar in 2015 is the tenured salary range I would have had if I had received one of the CNRS-funded positions at IRAP.