

The psychological aspects of a well-known issue

From the PhD through several post-doctoral positions, to the few permanent academic posts, the selection processes determining who will populate the upper echelons of academic astronomy might not involve just merit, hard work or dedication.

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While exact numbers differ depending on country and field, and although these numbers are constantly being debated and re-examined, it is nevertheless well known in academic circles that only a small fraction of scholars holding STEM (science, technology, engineering and mathematics) doctorate degrees will find their way to tenured positions in academia^{1–5}. The ratio of permanent to non-permanent academic positions at universities and research institutions^{6,7} has been steadily declining over the past two decades^{2,8,9}, resulting in longer non-permanent employment for most PhD-holding astronomers, who often have to search for non-academic employment after several post-doctoral appointments.

However, the selection process leading to the higher tiers of academia has not been extensively investigated. *Jobs for Astronomers*, an initiative that aims to provide information to professional astronomers about career paths outside academia, conducted two surveys for determining the reasons leading to professional astronomers leaving academia. The surveys were advertised during spring 2016 through the Facebook group ‘Jobs for Astronomers’, to a target group consisting of professional astronomers of all academic levels.

The first survey consisted of 262 astronomers (145 male and 117 female) who at the time still held positions in academia. Participants in this survey were asked about the factors contributing to the consideration of non-academic career paths. In the second poll, 204 astronomers (104 male and 100 female) who had already made the transition to industry were questioned about the reasons they left academia, as well as on information related to their current field of work. In both surveys the academic make-up of the participants was varied, with all ranks of academia being represented, from doctorate student to tenured professor. The results of both surveys were categorized and are presented by gender in order to highlight the different factors affecting men

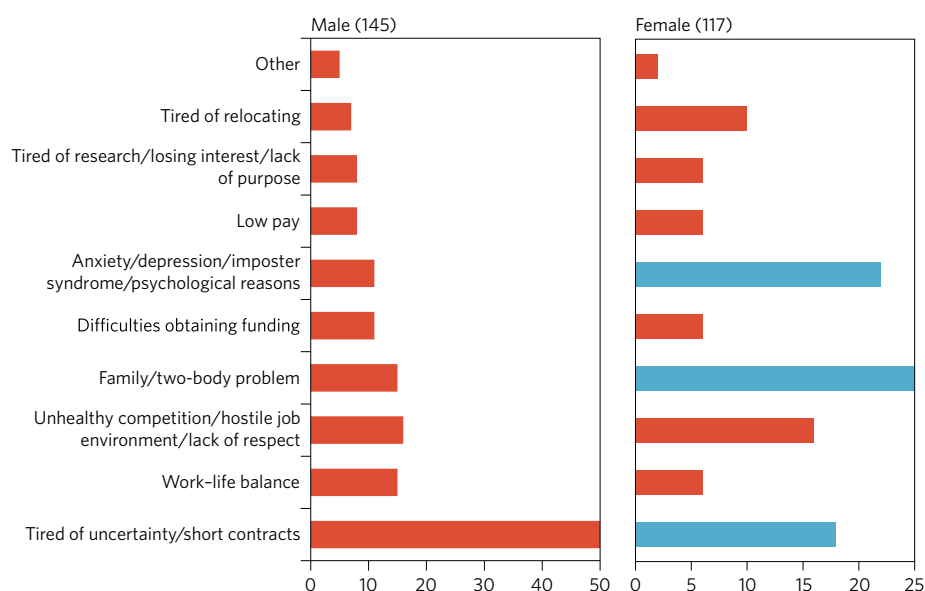


Fig. 1 | The most important reason astronomers still working in academia have considered switching to industry. For male participants uncertainty was the most important reason, whereas for female participants family and mental issues were more prevalent (the three most important reasons for women are depicted in blue).

and women in their respective professional choices. The participants were also asked to provide personal comments on their experience while working in academia, job satisfaction in their non-academic jobs compared with their experience in the academic world, and suggestions for making academic career paths more attractive for researchers.

For astronomers still in academia but considering a transition, the main factor leading to the consideration of alternative careers differed strongly between men and women participants. Men overwhelmingly cited “tired of uncertainty and short-term contracts” as the most important reason for possibly searching for another profession (33%). Women’s reasons were more varied, the most important being “family and the two-body problem” (20%), followed by “anxiety, depression, imposter syndrome and other psychological reasons” (17%) and “tired of uncertainty and short-term

contracts” (14%). When participants were asked to list multiple additional reasons for considering non-academic careers, “tired of uncertainty and short-term contracts” was by far the most prevalent answer, chosen by more than half of all participants, with “work–life balance” and “tired of relocating” following (see Fig. 1 for an analytic depiction of results, categorized by gender).

Many of the participants provided extensive comments on additional factors leading them to the consideration of alternative careers, with several recurring themes becoming apparent (Fig. 2). “The problem of having children”, as one participant posed it, was prevalent among female astronomers, who were generally concerned that having children would negatively affect their professional progress, owing not only to lack of support (childcare facilities at campuses, not enough or no maternity leave) but also to unconscious bias and the general attitude of their

employers towards maternity, which “should not be a professional issue”, as one of them pointed out.

Another recurring subject was the “non-healthy attitude” and lack of a work–life balance in academic environments, with aggressive self-promotion, the implicit demand that employees work 100-hour weeks, the constant need for relocation and the “publish or perish” paradigm being significant causes of psychological distress among academics.

Dissatisfaction with the quality of research and with what participants perceive as the wrong measures of success in academia was prevalent in participants’ comments. The obsession with metrics instead of scientific value and the focus on short-term gains — as opposed to conducting longer-term “meaningful research” and “focusing on actual science” — was often cause for discontent. Exaggeration of results, “cutting corners to get the job done [...] in the expense of good science,” the feeling of a lack of contribution to society and the disproportionately large amount of time spent writing proposals and self-promoting were also often mentioned.

“I am paid to apply for jobs, funding, and telescope time [...] It feels counterproductive and like a huge waste of my time” was the sentiment expressed by several post-doctoral researchers.

Abuse, harassment and bullying by supervisors were provided as reasons to leave academia by some doctoral candidates and young researchers. Participants claimed that little to no support is offered to victims of abuse by institutions, thus effectively putting an end to their careers should they speak out. As a result, “lowering the importance of the supervisor” was seen as key to keeping them in academia by several younger academics.

The majority (62%) of participants said they would remain in academia if the problems of constant relocation and short-term non-permanent contracts were solved. Figure 3 shows a more detailed description of what astronomers perceived as adequate incentives to stay in their academic posts.

It is crucial not to underestimate the importance of the psychological stress on astronomers’ productivity and ultimate decision to transition to non-academic employment. Although a permanent position seems to be the best incentive to keep astronomers in academia, among the 32 astronomers currently in permanent positions who participated in the first survey, 30 stated that they occasionally or often considered pursuing another career. The reasons they provided varied, with “anxiety, depression, impostor syndrome or psychological issues”

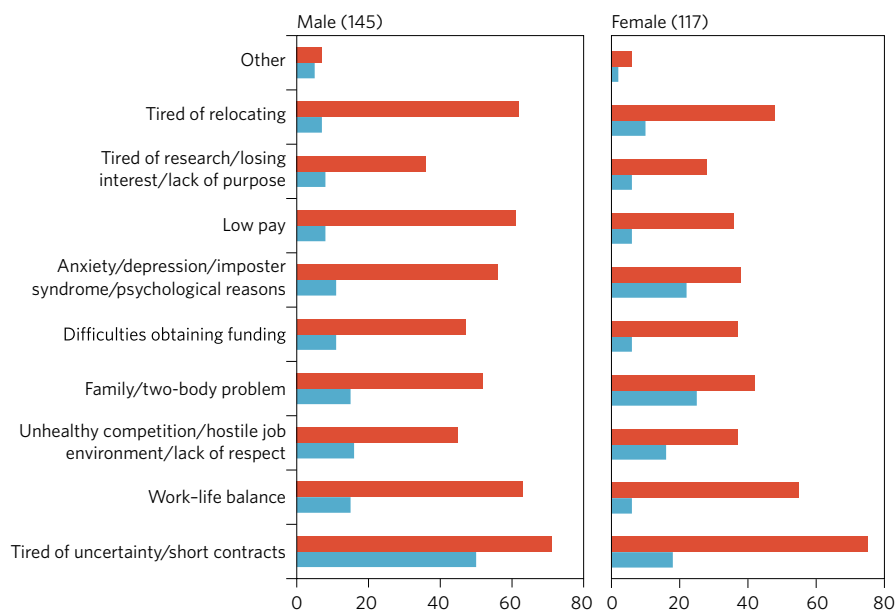


Fig. 2 | Additional reasons astronomers still working in academia have considered leaving for another field. In red is the number of participants that selected a reason as secondary. For comparison, in blue is the number of participants that selected each reason as the main reason for leaving academia (that is, same as Fig. 1).

cited six times and “unhealthy competition, hostile job environment or lack of respect” cited five times.

The second survey was aimed at astronomers who had already switched careers, focusing again on reasons for leaving academia and personal satisfaction in their new occupation. The main factor

for changing careers was, predictably, “tired of uncertainty or seeking long-term employment” followed by “two-body problem or family” for both genders (Fig. 4).

While most male astronomers transitioned into data science and programming, the most popular non-academic career for women was education,

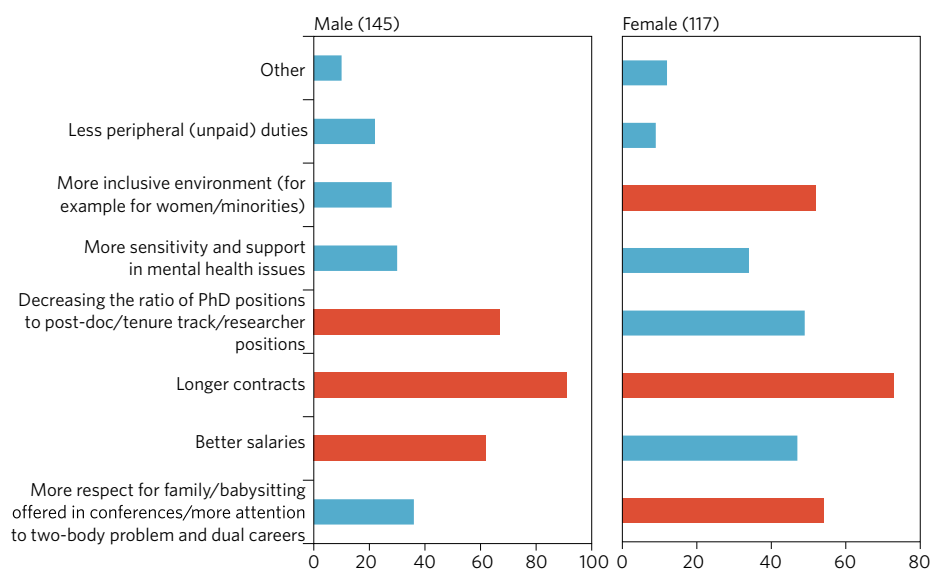


Fig. 3 | Incentives that would help astronomers to stay longer in academia. Longer-term contracts are favoured by both male and female participants. The three most important incentives for each gender are shown in red.

followed by data science. Most participants in the survey transitioned to their new career during or after their doctorate studies or the first post-doc (68% of male and 60% of female participants). 83% of female and 77% of male participants find their current position more satisfying than their last academic job. It is encouraging to note that 44% of all astronomers already had a non-academic job offer before their academic contract was finished, while only a small fraction (16%) hadn't found an industry position within the first year after leaving their academic post. The participants' job satisfaction in the new post was also high (Fig. 5).

Of the 154 participants who answered the question "would you return to astronomy if you could, and if yes, why?" 88 (57%) answered "no", 23 (15%) answered "yes" and 43 (28%) stated they would return if some condition was met. The "yes" answer was mostly supported by the participants' enjoyment of science and intellectual freedom in pursuing scientific goals. Some indicative comments include: "astronomy is my passion," "I enjoyed huge autonomy and freedom," "I felt part of something great, at the tip of human knowledge" and "I miss the intellectual stimulation."

The conditions most often cited by those who answered "maybe" were job security, permanency of residence in their desired country or area, better pay and work-life balance. Those same reasons were often cited by those who answered "no", indicating that several issues are often perceived as ingrained problems, and are therefore unlikely to be addressed soon. Some representative opinions include: "from the pace, to the goals, I believe the system is broken," "the astronomy community doesn't value broad research expertise and doesn't reward original thinking" and "it seems like a very disorganized and inefficient place." These systemic issues were thought by the participants to be closely interconnected with psychological stresses they were reluctant to take on again: "Astronomy [was an environment] in which the message was: if you want a life that's not consumed by your work, we'll find someone to hire who does," "[the] problem seems more endemic than just personal experience," "I felt overworked, anxious, isolated, uncertain about the future, and underpaid [...] tenured and adjunct faculty experience many of the same things," "my mental health is way better now," "I was sick of the emotional abuse my advisor used to motivate me [...] it seems common practice too," "my life quality has improved drastically since I left" are just a few of the most poignant statements.

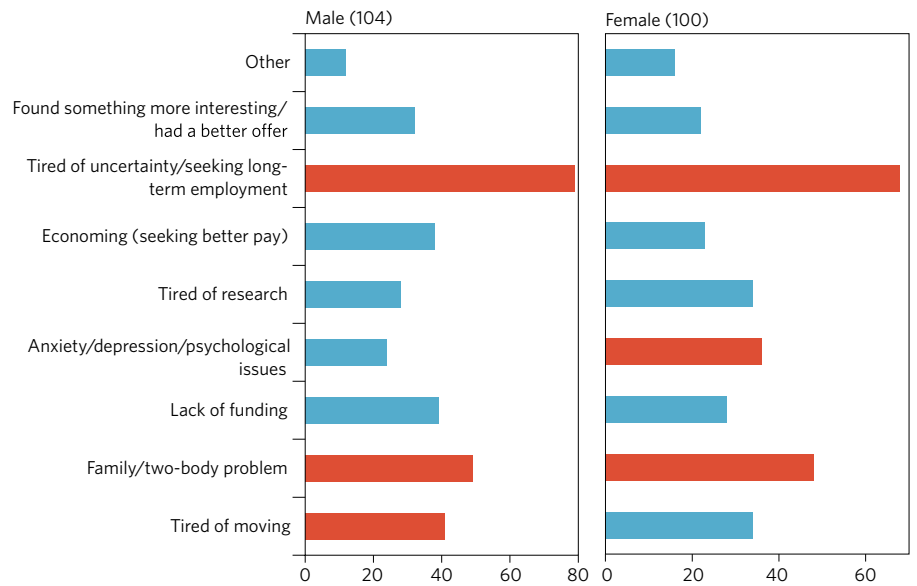


Fig. 4 | Reasons that ex-astronomers have left astronomy. Job uncertainty was by far the most prevalent factor for astronomers who transitioned to an industry job. The three most important reasons for each gender are shown in red.

Lastly, concerns about the devaluation of soft skills and technical know-how and the inadequate scientific standards compounded by the pressure to publish and bring grants were raised by several

participants. "The technical work of software development and other engineering-type skills are not respected" was the complaint of several participants currently employed in the fields of data

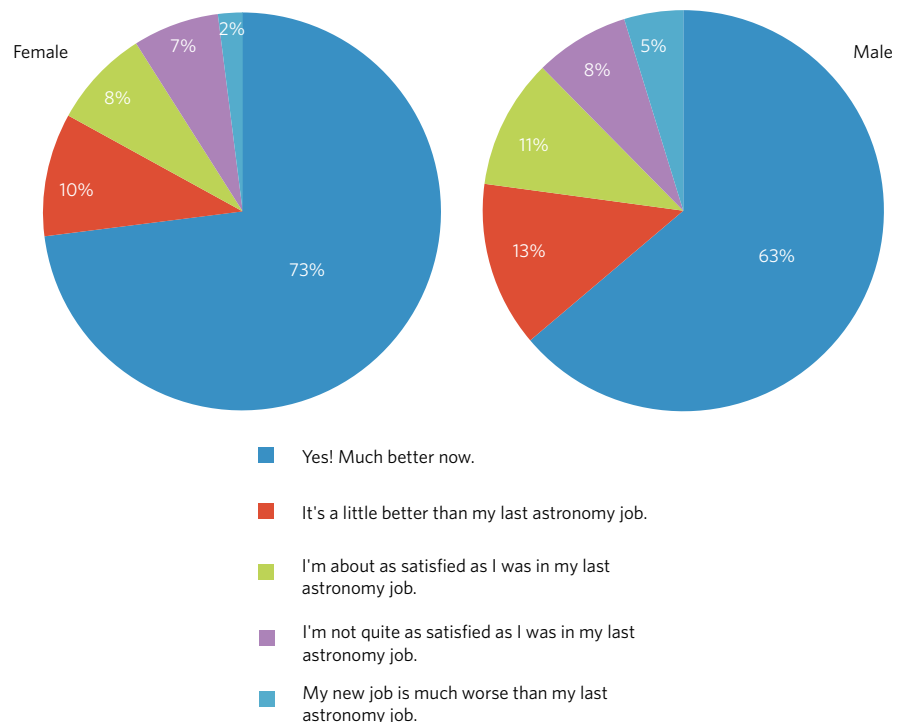


Fig. 5 | Job satisfaction of astronomers no longer working in academia, divided by gender. 83% of female ex-astronomers and 77% of male ex-astronomers found their current job more satisfying than their last academic job.

science and software development. The quality concerns as depicted by astronomers within and outside the ranks of academia are concisely summarized in one female participant's comment: "I am quite dissatisfied with the way science is running currently. I'm not sure it is wise for the future of scientific research that funds are given mostly according to the number of publications, the risks of the projects and the 'mainstream' ideas. I'd rather have few good publications that bring something new than many publications of mediocre quality."

Job uncertainty, short-term contracts and the constant need for relocation are by far the most important causes of stress and reasons for leaving academia, followed by family considerations and a general dissatisfaction with the quality of scientific research. Issues of anxiety, impostor syndrome and mental health are also prevalent, however most survey participants

believed that longer-term contracts and better job security would be enough to alleviate their anxiety and boost their productivity.

It is clear that the systemic problems plaguing the field of astronomy (and many other fields in STEM) are not straightforward to solve, however astronomers' concerns and mental health should continue to be addressed as an endemic rather than a fringe issue. A clear view of the career prospects for those holding astronomy PhDs is needed at all levels, from the small group to the institutional and national levels. A scientific career is intellectually stimulating, exciting and should be equally rewarding. We should strive for the next generations of astronomers to experience professional astronomy as a healthier place that promotes personal as well as professional growth. □

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