

Salaries for female physics faculty trail those for male colleagues

Gender pay gap is tangled with many aspects of physics culture.

Nearly 25 years ago, Nancy Hopkins, then a tenured biology professor at MIT, went to the university provost to ask for 200 square feet of lab space. To make her case, she brought floor plans that showed she had less space than junior males in her department and arguments for why she needed the space for her research. At the time, the space was unused, but a senior male professor had stuffed it full of furniture and boxes to reserve it for himself.

The provost was “mystified” by her request, says Hopkins. “He was used to people asking for whole buildings; no one came to him asking for so little.” She was asking for just one room.

Hopkins got the space. She shared her story with other tenured women science faculty at MIT and collectively they prompted the university to carry out a campus-wide comparison of conditions for men and women faculty. The university came out with a report in 1999, and then followed up with changes to make things fair. Among the measures to evaluate equity, MIT investigated lab space and other research resources, teaching assignments, administrative roles, named chairs, and time to promotion. In the years since, many universities have followed suit—Columbia University is currently working on a similar study.

Even so, things still are not equitable across academia in the US and elsewhere. In physics men earn, on average, 18% more than women, according to a survey by the Statistical Research Center (SRC) at the American Institute of Physics (which publishes this magazine). The survey looked at people who received their physics PhDs in the US in 1996, 1997, 2000, or 2001 and who were working in the country in 2011. After accounting for other factors, such as employment sector, postdoctoral experience, and age, a 5.7% disparity persists.



SHANE EPPING

WHY DOES ANGELA SPECK, a University of Missouri astrophysicist, take home 20% less pay than a male colleague of the same age, rank, and subfield?

That difference is attributable to sex, says the SRC's Susan White, who analyzed the data. “The model says that if we have two people who are identical in every way, the woman will make, on average,

6% less than the man.” It's not the oft-cited 80 cents on the dollar that women make on average across all sectors in the US. But what is driving the gender pay gap in physics?

Small differences grow big

Unpacking the pay gap is complicated. At most institutions the numbers of women in physics and related fields are small, so identifying patterns is tricky. But a host of observations and studies boil down to two contributing factors in the pay disparity. The first is that women don't negotiate as aggressively as men. The second is that men favor each other, which affects recommendations to serve as an editor or chair a committee, the amount of a raise, teaching evaluations, and the phrasing of reference letters. There is implicit bias, says a senior researcher who has served in her university's administration. “Boys in the department give money to boys in the department.”

MIT astronomer Claude Canizares cochaired a 2010 National Academy of Sciences (NAS) study, *Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty*. The ambitious study sought to evaluate many variables at hundreds of institutions in the fields of biology, chemistry, civil engineering, electrical engineering, mathematics, and physics. As a rule, he says, universities do not purposely discriminate against women and minorities. Yet, he acknowledges, inequities persist.

Several stages in an academic career can dramatically affect salary: the initial hire; promotions to tenure and to full professor; receipt of a prestigious award or an endowed chair; advancement to leadership and administrative positions; outside offers; and retention offers. Maria Klawe, president of Harvey Mudd College in California, notes that in negotiating initial salaries, men are more likely than women to ask for more. “Women say ‘Thank you very much,’ ” she says. “I've done that myself, several

times—it's embarrassing." Even a small difference can grow over time to become significant.

Studies back up Klawe's observations on negotiation habits. They also indicate that men and women are perceived differently when they do negotiate. "The threshold for men to be seen as obnoxious and women to be seen as obnoxious is different," says Patricia Rankin, a physicist at the University of Colorado Boulder and current chair of the American Physical Society (APS) Committee on the Status of Women in Physics. An assertive man is seen as showing his self-worth, whereas a woman who says the same things is seen as bossy, she adds.

Kathy Prestridge, a physicist at Los Alamos National Laboratory, coaches women in negotiating as part of an APS seminar series on professional skills development. One tactic that works well for women, she says, is to couch a request in a nonthreatening way. For example, say, "This will benefit the project," instead of "I want more money." Says Prestridge, "Women have to achieve their goals in the culture we have now. By doing so, there will be cultural changes."

Raises at tenure and at promotion to full professor are not typically negotiated, and they vary by department and institution. Nonetheless, a pay gap creeps in and widens to reward senior men more than senior women. Across the fields examined in the NAS study, male full professors earned on average 8% more than their female counterparts.

MICHAEL CARDINALI, PHOTOGRAPHER/COURTESY OF MIT MUSEUM



TAKING MEASURE. In the early 1990s Nancy Hopkins measured all the labs and office spaces in her building to prove to the MIT provost that she had less space than male faculty members. She got more space, and the university went on to correct other gender disparities on campus. The tape measure she used is in the permanent collections of the MIT Museum.

One reason is that men are more likely to serve in leadership roles such as department chair or dean, which come with additional salary.

Another contributing factor may be that men are disproportionately paid as "rock stars," says Lori Taylor, a professor of public service and administration at Texas A&M University, where since 2010 she has been coordinating a longitudinal study that tracks cross-campus salary and other gender disparities. The rock-star status mostly arises when senior scientists are recruited, and those tend to be men. High outlier salaries are "a harder nut to crack from a managerial standpoint," says Taylor. An institution

can find ways to raise salaries, but it's harder to fix if people are—comparatively—overpaid.

The retention dimension

Often the best opportunity for a faculty member to up his or her salary is to use an offer from another institution to negotiate a retention deal. A salary hike of 10–20% is typical, and it can be higher. Retention packages can also come with other perks, such as a reduced teaching load, additional lab space, renovations, or equipment. According to the NAS study, women were more likely than men to receive outside offers in electrical engineering and math, but less likely in physics and chemistry.

Multiple senior physicists told PHYSICS TODAY that women were less likely to seek a pay raise by courting outside jobs. That takes time and effort by people at both institutions. Sherry Yennello, a Texas A&M nuclear chemist who has been associate dean in the college of science, says she has seen universities make less effort to retain female faculty compared with what they do to keep male faculty members. "By the time women pursue outside offers, they are gone emotionally," she says. "They are frustrated not just because of money. They think the climate will be better elsewhere."

Moreover, although numbers are not available, several physicists observed that women are more likely to be in a relationship with another academic, which complicates a potential move (see the article by Laurie McNeil and Marc Sher,



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NEGOTIATING PAY IS AMONG THE PROFESSIONAL SKILLS discussed in seminars sponsored by the American Physical Society. One venue is the annual Conferences for Undergraduate Women in Physics; shown above is the 2016 meeting at Wesleyan University. The conferences take place simultaneously at multiple sites.

PHYSICS TODAY, July 1999, page 32). Men more often have a partner who has a mobile profession or who does not work outside the home.

Angela Speck, an astrophysics professor at the University of Missouri, compared her salary with a male colleague's and came up 20% short, which she attributes to his retention deals. (Salary information is open at public institutions.) They both started their jobs at about the same time, are in the same subfield, are about the same age, and progressed in their careers more or less in parallel; she became full professor a year before him. He has more publications than she does. But she says she has brought in more grant money, advised more students, and won more prizes. Why does he earn so much more? He got bumps by using outside offers to negotiate, says Speck. "I have been offered jobs, but I am not willing to waste my time or others' time for a job I don't want."

"It's not that men are doing something underhanded. It's not that women are not working as hard," says Speck. "It's that the way things are valued and the way we are judged are leading to these disparities."

Implicit biases

This past June, Marika Taylor, a string theorist at the University of Southampton, gave a talk on gender disparities and

academic climate at Strings 2017; it was the first time the issue was on the agenda of the annual conference. "A lot of universities are being forced to look carefully at their departments to see if people are being fairly paid, but very little [information] is in the public domain." For example, she says the average gender gap in pay for full professors in the UK is 10%. Last year the University of Essex raised the salaries of female full professors across the board to help close the gap. Another example is Canada's University of Waterloo, which in 2016 upped the salaries of all female faculty. Other universities, says Taylor, have discovered a pay gap but haven't corrected it because of the expense.

Because Taylor considers pay and other gender disparities in physics to be controversial, she ventures to discuss them publicly only now that she is head of applied mathematics in mathematical sciences at her university. Even so, she prefers not to talk about gender issues with other string theorists because she worries they won't take her research seriously.

In southern European countries, says Silvia Penati, a string theorist at the University of Milano-Bicocca, salaries are set nationally, so the problem is not in comparing salaries, but rather in comparing career progression. "For sure men have a faster career," she says. "And

most men entering the profession reach the top, they become full professor. Women more often get stuck, typically at the associate professor level." The reasons, she says, are "subtle" and many of them are rooted in deep cultural patterns. (See the article by Barbara Whitten, Suzanne Foster, and Margaret Duncombe, PHYSICS TODAY, September 2003, page 46, and see August 2005, page 29.)

Robert Birgeneau was involved in the MIT report on the status of women faculty in science and the response to it, and he later served as chancellor of the University of California, Berkeley. In an example of just how ingrained cultural biases are, not long ago he was asked for advice by a physics chair at a state university on how to deal with male physics majors insulting their female counterparts in the undergraduate physics lounge—telling them that as "girls" they weren't smart enough to do physics.

"Use senior women wisely"

One way to improve the culture of academic physics is to ensure that senior female faculty members serve on committees in proportion to their numbers in the field, says Hopkins, now an MIT professor emerita. Hiring and promotion panels, editorial boards, and powerful positions in the university administration would be a good place to start. "You need to use senior women wisely," she says. "Sometimes there are so few that you can overuse them and this becomes very time-consuming for the women." Fixing salaries and other inequities, says Rankin, requires a balance of actions by the rank and file and by people in positions of power.

Actions aimed at improving the physics climate for women would help everyone, says Canizares. He notes that university careers have become less attractive as postdoc stints and the time to tenure have become increasingly protracted. People are often over 40 before they can settle down. That lifestyle is unattractive generally, but "it's even more unattractive to women than to men," he says. "It's a profession where you live with uncertainty for a long time."

Men need to be more proactive about equity for women and underrepresented minorities, says Canizares. "It's hard to break a glass ceiling by banging your head on it from below. It's easier to break it from above with a sledge hammer."

Toni Feder