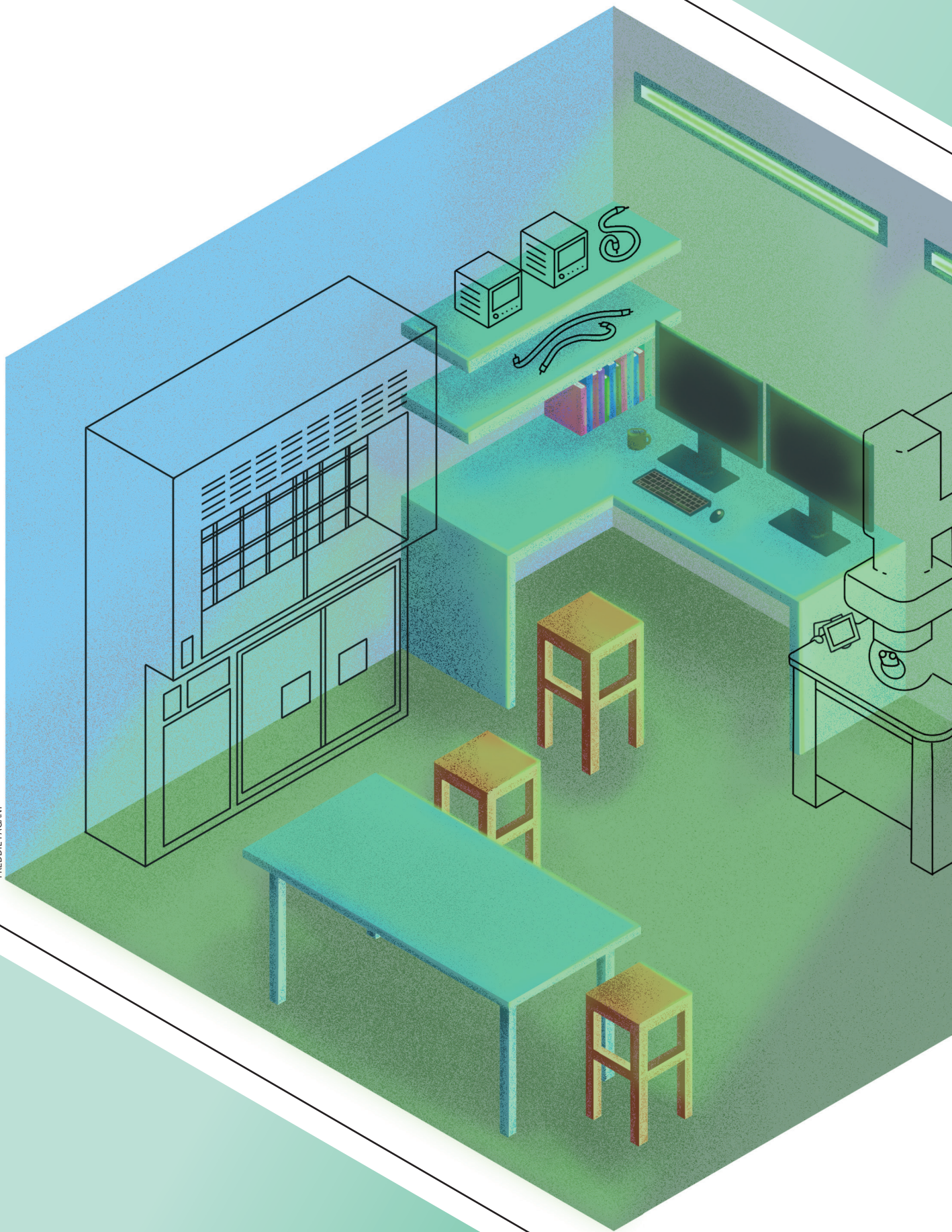
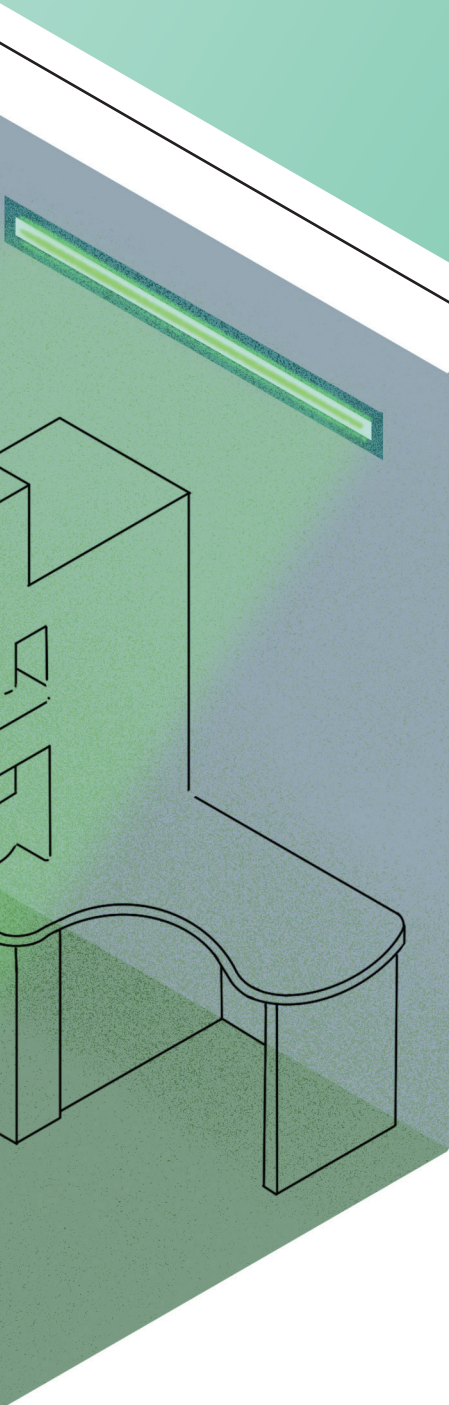




Alex Lopatka is an editor at PHYSICS TODAY.

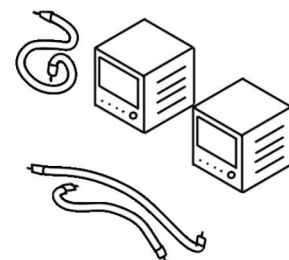
An abstract geometric illustration on the left side of the page. It features a green rectangular block with a white outline, a white curved line, and a white rectangular block. A green rectangular block is also visible in the background. The illustration is set against a white background with a green border.

Early-career faculty face many challenges

Alex Lopatka

Navigating a host of clear—and sometimes
not-so-clear—responsibilities is critical to
succeeding in academia.

Lamie Tayar describes her assistant professorship in the University of Florida's department of astronomy as akin to running a small business. "You have to bid on contracts or grants, hire and manage personnel or students, deal with the finances, and communicate results to stakeholders in the form of grant reports, papers, and colloquia," she says. "Then on the side, you have a gig teaching classes and doing committee work."



Even getting a faculty position in the first place is competitive.¹ (For more on academia as a career path, see "Stepping off the tenure track," by Lisa Balbes, *PHYSICS TODAY* online, 10 August 2022; for advice on applying for faculty positions, see the article by Omar Magaña-Loaiza, *PHYSICS TODAY*, October 2020, page 30.) And once employed, an academic faces a ballooning number of duties. At a large research university, faculty are expected to secure grant funding, build a research group, and teach courses. At a small liberal arts school, the pressures of research may be less, but the teaching load is likely larger. Regardless of the type of institution, new faculty face other responsibilities, too, including serving on department or university committees and counseling students on personal matters.

To learn more about the experiences of early-career physicists and physical scientists in the US, *PHYSICS TODAY* emailed a short list of questions, listed in the box on page 46, to physics department chairs at colleges and universities and to other select individuals. Nine faculty members who obtained their PhDs within the past decade responded to the questionnaire, along with a postdoc who will soon be applying for a faculty position. In their responses and in follow-up conversations, they discussed the time-consuming challenges of securing funding, building laboratories, teaching classes, and finding students to join their groups. Many of those duties are often learned on the job, sometimes without much formal training.

By no means is the questionnaire meant to be an exhaustive survey. For a more quantitative snapshot of the state of the physical sciences, see the article on page 30. And to read about how some faculty have made mid-career changes in their research focus, see page 50.

Competing for cash

Throughout their careers, faculty members must win grants to support their work. Without the money and prestige of prior grants, it can be especially difficult for early-career professors to hire their first graduate students and postdocs, pay for lab instrumentation, and secure subsequent grants. Over

the past decade, less than 30% of proposals submitted each year to NSF have been funded.²

Wonhee Ko, an assistant professor of condensed-matter physics at the University of Tennessee, Knoxville, has applied for 10 research grants since he started there in August 2022—so far without success. He did negotiate more than \$1 million in startup funding from the school, and since then, he has received internal university support. Ko says that those grants have each provided \$50 000–\$100 000 for a year or two of work. Additional funding comes in part from grants awarded to his research collaborators. "Everything matters for new professors," he says.

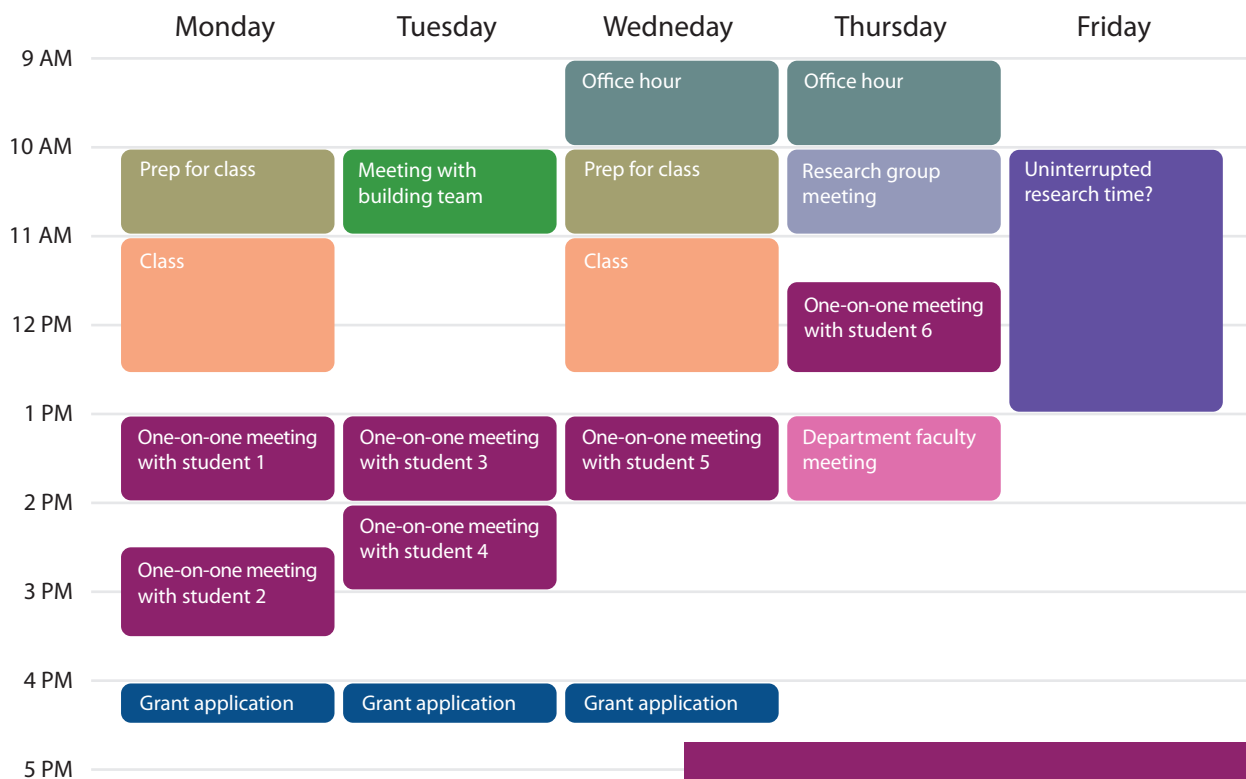
Rogério Jorge, a theoretical plasma physicist who has been at the University of Wisconsin–Madison since January 2024, was awarded his first multiyear research grant of \$500 000 from NSF in the spring. "Each grant proposal requires me to think about which tasks are needed to accomplish a research goal, how long each task will take, which one must come first, and how many people are needed," he says. "Project management skills are a key part of many research breakthroughs."

To help write research proposals, Tiffany Lewis turned to her experience volunteering as a grant reviewer. "Something that comes up a lot in review panels is risk. Is it likely that the project will succeed?" says the assistant professor of theoretical astrophysics at Michigan Tech. "That can be addressed directly in the text of the proposal." In recent proposals, Lewis has included what she anticipates learning both if the project succeeds and if it doesn't.

"A lot of the proposal is trying to anticipate outcomes," Lewis says. A well-planned proposal with a few possible outcomes, she says, gives reviewers confidence in an applicant's research skills and how they will use the funding. Lewis has written about half a dozen proposals, most of which were submitted in the spring and are under review. "I'm looking forward to the feedback," she says, "and to refining my projects."

Richard Anantua, an assistant professor of astrophysics at the University of Texas at San Antonio, says the proposal pro-

September 2024



BUSY SCHEDULES are a fixture for most academics. For new faculty, many of the duties—and the challenges of managing all of them—are learned on the job. (Illustration by Freddie Pagani.)

cess can be time consuming and inefficient. Some online submission portals, for example, require proposers to manually enter the names of coauthors. For some of his published papers, Anantua was part of a team that numbered in the hundreds.

The timing of grant funding has sometimes made it difficult for Anantua to pay some members of his research group. One year, he says, “I found myself having to pay a student in October by using a grant from a previous summer. For early faculty, this makes a big difference because we sometimes don’t have a stream of grants to fall back on.” The timing can require faculty to reevaluate their research budgets: In Anantua’s case, the money that was supposed to support the student ended up arriving after the work was already done.

Building laboratories

When faculty members have to prepare lab space, it can take time away from conducting research. For several months

before James W. Dottin III stepped foot on Brown University’s campus, he had weekly meetings with the building team to design every aspect of his stable-isotope lab. After setbacks and redesigns and after deciding on so many particulars—for example, how many outlets were needed, power requirements, and the number and color of cabinets—Dottin had some decision fatigue. “I don’t have time to care about how many drawers and their sizes,” he says.

Dottin has been an assistant professor of geochemistry at Brown for about a year, and his lab has reached the point of what the building team calls “substantial completion.” A mass spectrometer he ordered has been delivered, but it can’t be installed until the power requirements are met, the room is checked for air leaks, and the air pressure is balanced. “I’m hoping that we’ll be able to get in there soon



to start testing sample preparatory methods,” he says. “And then by the end of fall, we’ll hopefully be making measurements.”

Ko’s experience was similar. During his job interview, he negotiated for the physical space and the money to prepare a lab for his research. Once on campus, he says, “I had to talk a lot with the building manager. I had to get the right utilities.

I had to change the position of pipes in the ceilings. That took almost a year.”

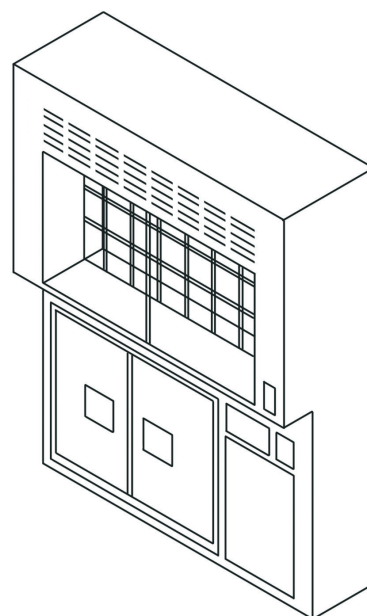
As university staff readied the lab space, Ko ordered equipment, including a \$1.2 million scanning tunneling microscope, with his startup funding. He took pictures and notes as the building manager and company technician installed the microscope. If things go wrong, he says, “students and I will need to know how to fix it.”

Finding students

Once an applicant has landed an academic job, they need to build a research group. Although most faculty routinely need to recruit students, postdocs, and visiting researchers to join their group, the value of collaborators is especially high for early-career faculty, who are expanding their research programs.



WONHEE KO helps prepare his scanning tunneling microscope. Building a research space can mean many meetings with the facility staff and understanding how everything fits into place. That work limits the available time to conduct research. (Courtesy of Wonhee Ko.)



THE LABORATORY OF JAMES W. DOTTIN III, an assistant professor at Brown University, took more than a year to build. The lab will be used for Earth and planetary sciences research. (Courtesy of James W. Dottin III.)

As a postdoc at Harvard University and during his first two years as an assistant professor, Anantua served as the Event Horizon Telescope collaboration's outreach coordinator, an opportunity that involved speaking to many students. "Several students have reached out to me over the years due to my science communication," he says. And he makes sure his website has a modern-looking design and is continuously updated because he says it attracts students to his group.

At Harvard, Anantua met a PhD student who later came to work with him at the University of Texas as a postdoc. The postdoc was already prepared to do their own research, which gave Anantua more time to write grants and work on other projects. "As a faculty member, having research-ready members in your group is invaluable," he says.

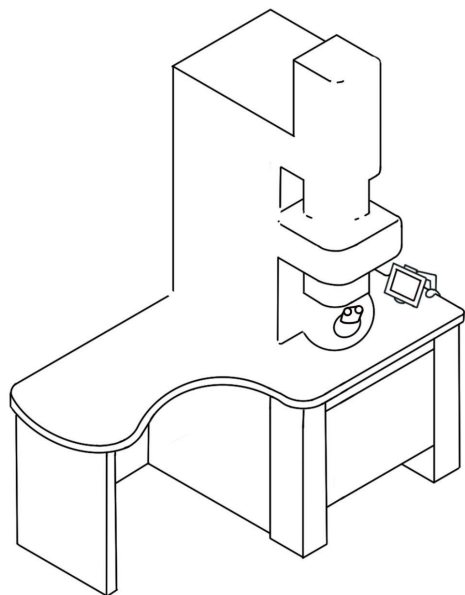
Dottin uses his own graduate school experience to help build his team. "I remember that the project is not the only reason a prospective student should consider when deciding on a grad program," he says. "I make sure to be truthful and candid, showing the students who I really am so that they can make the most informed decisions. I'm up front about my scientific knowledge gaps and strengths, my work habits, my expectations for them." (For more on student-adviser pairings, see *PHYSICS TODAY*, October 2020, page 22.) Dottin's group—consisting of him, a lab manager, and an undergraduate research intern—is expanding in the next few months with the addition of two postdocs, two graduate students, and one postbaccalaureate scholar.

A similar strategy worked for Nicholas MacDonald, who joined the University of Mississippi as an assistant professor of astrophysics last year. He was approached by several prospective graduate students and met with them one-on-one to discuss research projects, and he invited them to his group's weekly seminar series. "That gave these students a chance to read papers in my discipline and to meet international researchers in my field." MacDonald hired one of the students, who had worked for him the previous summer as a research assistant.

Managing a team

"Group building and group management were the skills I was worried about when I started my position," says Lewis of Michigan Tech. After reaching out to several academic role models for advice, she decided to structure group meetings so that students can casually present their research projects. And in the summer, Lewis started a journal club to familiarize students with the field's literature. She currently advises two graduate students, one postbaccalaureate scholar, and four undergraduates. Lewis says that she typically assigns prospective group members a small project and then assesses whether they are a good fit for her research group. "If they do reasonably well with the project and they're good at communicating when they get stuck, we continue on."

Lewis says she introduces her group members to collaborators and others in the field and provides them with



The questions that **PHYSICS TODAY** asked early-career faculty members

1. What have you done to bring graduate students to your research group?
2. What has been your experience in applying for research grants?
3. Talk us through the process, if applicable, of building a research lab. What equipment did you need, and how did you find it?
4. What skills, if any, have you had to use as a new faculty member that you didn't expect or that no one taught you?
5. Is there any advice you would give to a senior graduate student or postdoc looking for a faculty position?
6. Is there anything else you want to share about starting out as a new faculty member?

opportunities to travel to conferences and other professional events. In addition, she says, "I try to be very mindful of the things that academics often just assume. I communicate social expectations at conferences, how to appropriately introduce yourself in a professional setting. I also try to not assume that my students have money when I ask them to do things. I don't assume that they can just go and buy a new computer."

Jorge of the University of Wisconsin has focused on fostering an encouraging, collaborative environment for members of his research group. "I know it's really hard as a graduate student or undergraduate student to just say something because they're really afraid that it may be completely wrong," he says. At his weekly group meetings, Jorge reminds everyone to ask whatever questions they have, no matter how basic they may seem. "I've gone through a few groups in a few different countries," he says, "and I always liked when supervisors allowed me to voice my opinions."

Jorge's group consists of two postdocs, three graduate students, and three undergraduates. He didn't do much advertising for the positions. "One postdoc is somebody that was referred by a previous supervisor. And I ended up taking him because he had the right skills," says Jorge. All the graduate students contacted him after a welcome event hosted by

the department. "The group is the right size," he says. "I don't want to get any more people for at least a few years."

Finding support

Teaching pressures are common and add to faculty members' already busy schedules. When Ko started teaching introductory physics in 2022 at the University of Tennessee, he hadn't taught since graduate school 10 years earlier. "I forgot how difficult it was to learn physics," he says. "It was hard to know what incoming freshmen knew and what they didn't." He changed his approach and adjusted how he graded homework to become a more effective teacher.

Lewis spent more time preparing for lectures in her first semester at Michigan Tech than she anticipated. "I don't know if you remember any classes that you took about a decade ago," she says, "but for me the details are kind of fuzzy." She retaught her-

self some electricity and magnetism concepts to get through the semester.

Zachary Maas, a visiting assistant professor of astronomy at Indiana University Bloomington, teaches several introductory courses in addition to conducting research. To improve his instructional skills, he attended the Faculty Teaching Institute—a professional development workshop sponsored by the American Association of Physics Teachers, the Amer-

"Having that tight first-year faculty community has been invaluable."

—Yashashree Jadhav



NICHOLAS MACDONALD discusses research with his students. Group meetings are an important time for students to ask questions and develop as researchers. Learning to effectively manage a team is not often a skill early-career faculty already have. (Courtesy of Dan Bradley.)

ican Physical Society, and the American Astronomical Society (see the article by Stephanie Chasteen, Edward Prather, and Rachel Scherr, *PHYSICS TODAY*, April 2024, page 30). Maas says he learned many interactive teaching methods and is implementing them in the classroom, although time management is a balancing act. “I have tons and tons of checklists,” he says. “I write down my weekly goals, and I put every single thing in my calendar and make sure there are reminders set all over the place.”

Many of the faculty members who were interviewed spoke about the importance of maintaining a support network to help cope with the competing responsibilities they faced in their new jobs. “The first year as a faculty member is very overwhelming,” says Maas. “In grad school, I could focus on one thing at a time.” During his first year teaching at Bloomington, he was preparing grant proposals, lectures for teaching, assignments for students, and working on his own research. “I had to say no to new opportunities,” he says. “Being in a supportive community and reaching out to friends and mentors really got me through that first year.”

During her first faculty position, as a temporary lecturer at Elon University in North Carolina, Yashashree Jadhav says that “one of the things that helped me a lot was making friends! Having that tight first-year faculty community has

been invaluable in learning about university-wide requirements, keeping each other updated about university deadlines, faculty events, and more.” Jadhav, who also attended the Faculty Teaching Institute, now works as a permanent physics lecturer at the Stevens Institute of Technology in New Jersey.

The University of Florida’s Tayar says, “Having a supportive network has been a huge help for me, and I highly encourage that for other people.” Colleagues and other professors in Tayar’s department have shared teaching suggestions, showed her successful grant applications, and served as sounding boards for ideas and new research opportunities. “Maybe some people can do this job alone,” says Tayar, “but that certainly hasn’t been something I could or would want to do.”

REFERENCES

1. K. H. Wapman et al., *Nature* **610**, 120 (2022).
2. National Science Board, “New Report Details Recent Trends in NSF Awards,” news release, 11 July 2023. PT