Careers

What will you do next summer?

Physics undergraduates seeking a summer job that goes beyond traditional student employment should consider a research internship, as Margaret Harris reports

Zach Bond spent his summer building an interferometer for a quantum-optics laboratory at the University of Oregon. Roko Mijic designed a heat exchanger for Oxford Instruments and wrote software that the firm "probably still uses" years after he was a trainee cryogenic engineer there during the summers of 2002–2006. And Cacey Stevens enjoyed her summer project at the University of Chicago so much that she is now doing PhD research on viscous splashing in the same group where she worked as an undergraduate.

For thousands of physics students like Bond, Mijic and Stevens, summer means more than a break from coursework. For those who seek out internships at universities or industrial labs, summer is also the perfect time to get a first taste of research and to decide whether physics will be part of their future careers. "Doing an independent project helped me to gain the confidence to continue in physics and gave me a passion for the subject," says Stevens, citing her summer in Sidney Nagel's fluid-dynamics lab at Chicago as the "most important factor" that led her into research.

Bond, a final-year student at Southeastern Louisiana University in the US, agrees. "The summer programme at Oregon gave me the opportunity to get hands-on experience of working in a lab and dealing with lab equipment," he says, adding that it also gave him a better idea of what life would be like as a PhD student. He plans to go to physics graduate school next year.

In Mijic's case, working at Oxford Instruments, which makes hi-tech equipment like cryogenic systems, helped him develop "soft skills" such as teamwork. It also led him to

This could be your office Summer internships offer a chance for students to explore a career in research – sometimes in exotic locations like Mauna Kea in Hawaii.

re-evaluate what interested him most. "I decided that I cared more about how things ultimately worked, rather than how to make money out of physics," he says. After finishing a BSc in physics at Cambridge University in 2006, Mijic earned a Masters in pure mathematics at Cambridge, then moved to the University of Edinburgh to study artificial intelligence. He now works for the Singularity Institute, a California-based charity that promotes artificial-intelligence research.

Typically, summer research programmes place aspiring scientists into an established research group for a few weeks or months. During that time, students might tackle their own small project or work closely with the group's permanent members on ongoing experimental or theoretical problems. Along the way, the interns learn what it is like to be part of a research group, pick up new technical skills and meet like-minded people.

Within that framework, opportunities fall into three categories. One option is to apply for a place in a formal programme like CERN's summer school or the US National Science Foundation's Research Experience for Undergraduates (REU) scheme. Another is to look for a vacation placement at an industrial or government research facility like Oxford Instruments or the UK's National Physical Laboratory (NPL). Finally, students may find that physicists at their own universities have funding available for student work – particularly if it comes as a pre-ambles to a final-year project.

Finding the right programme

The first thing to consider is the research itself. Project topics in most organizations will vary from year to year, depending on which

permanent staff members are available to mentor students. However, some sites incorporate a wider range of research than others. For example, this year's research topics at the Los Alamos Summer School in Physics included computational neuroscience as well as nuclear physics; similarly, CERN offers internships in areas like radiation safety and science communication in addition to particle physics. The California Institute of Technology's REU programme, in contrast, focuses solely on gravitational-wave astrophysics.

Pay and benefits for research students also vary between institutions, sometimes dramatically. For example, students doing physics research placements at the University of Glasgow in the UK earn just £170 per week, but CERN pays its "summies" more than twice that amount; REUs and industrial firms typically fall somewhere in between. In addition to pay, programmes with a medium-to-large number of students on site often provide subsidized housing. Some organize supplementary lecture courses on other fields of research. CERN, which plays host to about 150 students every summer, does both; so do many of the 80-plus US universities and institutions that host physics or astronomy REU programmes each year.

The number of people involved in a programme can make a difference to the research environment as well, notes Nagel, Stevens' PhD supervisor (and former REU mentor) at Chicago. "It is very different doing work in a big collaboration in, for example, a high-energy experiment, than it is in a small condensed-matter or biophysics group," he says. "Different people will be thrilled by different environments."

The environment outside the laboratory can also play a role in students' choices, since the chance to live somewhere different for a few weeks or months is, for many, a key part of the research experience. And there are some attractive options. Many students are drawn to Los Alamos – located 2200 metres above sea level at the foot of the Jemez Mountains – by "a combination of natural beauty and scientific history", says Sally Seidel, a University of New Mexico physicist who coordinates the Los Alamos summer programme. Similarly, the telescopes on Mauna Kea may not be the only draw for the 600 students who apply to the University of Hawaii's astronomy REU each year. "The biggest plus [of going someplace new] comes for those students who don't have research opportunities at their home institution," says Geraldine Richmond, a chemist who organizes the joint chemistry/physics REU at Oregon. Wherever they decide to go, those students will get a broader perspective on their career options and a chance to use sophisticated equipment, she adds.

How to apply

For students who want to stay at their home universities, "applying" often means simply asking tutors and lecturers about the opportunities available. Programmes like CERN's summer school and the REU scheme, in contrast, require a formal application, and November is not too early to start thinking about it. CERN asks would-be "summies" to fill out an online application well before the summer school's 27 January deadline, and most of the REU programmes also have application deadlines in early 2010.

The application process for summer placements in industrial firms is less well defined. Indeed, placements may not even be made public – for purely practical reasons. "If we advertised for students, we'd drown in applications," says Amber Lauchlan, a human resources advisor at NPL, which received 400 applications for 40 two-to-four month placements in the summer of 2009. Students who are keen to work in a particular company should send a speculative application, Lauchlan suggests, as many firms without a

formal, advertised summer programme may still be able to employ students for short periods. If applicants can demonstrate that they are truly interested in the company's work, "doors can open", she says.

Before applying, students should check whether they meet any nationality requirements. Some REU programmes are restricted to US citizens, but others offer at least a few places to overseas students, and a handful

are designed to foster links between particular countries. Only a limited number of places are available at CERN's summer school for students from non-member countries, and those from the US, Japan and Israel need to apply through programmes funded by their home countries. Finally, defence-related organizations may require summer students to obtain security clearance.

For those who clear these hurdles, however, the benefits can be considerable. "Try to enjoy the experience of research and discovery," says Nagel. "You will spend much of your time being confused and bewildered, but when the light of a fresh and original understanding comes on, it is dazzling!"

- Finding a REU scheme: www.nsf.gov/crssprgm/reu/reu_search.cfm
- CERN's summer school: <https://hr-recruit.web.cern.ch/hr-recruit/summies/default.asp>
- The UK's National Physical Laboratory: www.npl.co.uk

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Careers and people

CERN wins media award

CERN's Large Hadron Collider (LHC) may have been (temporarily) felled by a technical problem, but the publicity campaign leading up to the collider's launch in September 2008 has won the particle-physics lab a 2009 Euroscience Media Award. CERN is the first recipient of the AlphaGalileo Research Public Relations Award, or "Galileo", which honours individuals or organizations that have contributed to "securing more and better media coverage for European research" and carries a €5000 prize. Other winners are the Basque Research TV programme *Teknopolis*, which won the award for popular science on television; *Nature's* German correspondent Alison Abbot, who scooped the European Science Writer's Award; and two freelance journalists, Bettina Gartner and Angela Saini, who shared the Junior Science Writer Award.

• Check out the "Multimedia" area of physicsworld.com for a video interview with CERN's head of communications, James Gillies, on how the lab handles media interest in the LHC

Fermi prize for Los Alamos ex-director

Stanford University's Siegfried Hecker, who served as director of the Los Alamos National Laboratory between 1986 and 1997, has won the US government's Enrico Fermi Award for his contributions

to plutonium metallurgy and scientific leadership on nuclear non-proliferation. Hecker, a metallurgy expert, will share the award with John Goodenough, a physicist at the University of Texas at Austin, who was honoured for his work on developing lithium-ion batteries. The Enrico Fermi Award is given annually in recognition of "lifetime achievements" in energy research, and this year's winners will share an honorarium of \$375 000. Past recipients include the physicists Hans Bethe and Edward Teller.

Female scientists are 'pride of Africa'

Space physicist Lee-Anne McKinnell is among the first recipients of an African Union Women Scientists Regional Award. The awards are intended to highlight scientific research by women working in the five regions of Africa. McKinnell, who manages the space-physics group at the Hermanus Magnetic Observatory of South Africa, shared the award for the Southern region with University of Pretoria geneticist Brenda Diana Wingfield. Each winner receives a trophy and \$20 000.

Movers and shakers

Physicist **Berni Alder** of the Lawrence Livermore National Laboratory and astronomer **James Gunn** of Princeton University were among nine researchers to receive the 2009 National Medal of

Science, the US government's highest honour for scientists, in a White House ceremony on 7 October.

Princeton University Nobel laureate **Philip Anderson** has been named as the first recipient of the University of Maryland's Richard E Prange Prize for condensed-matter theory.

Seamus Davis and **John Tranquada** of the Brookhaven National Laboratory and **Aharon Kapitulnik** of Stanford University have won the 2009 Heike Kamerlingh Onnes Prize for their work on high-temperature superconductors.

Physicist **Patrick Gallagher** has been named as the 14th director of the US National Institute of Standards and Technology (NIST). Gallagher had previously served as deputy director and succeeds William Jeffrey as head of the measurement-standards agency.

University of Kent biophysicist **Julia Goodfellow** has been appointed chair of the British Science Association.

The 2009 Julius Springer Prize for Applied Physics has been awarded to nanophotonics pioneer **Motoichi Ohtsu** of the University of Tokyo.

Materials scientist **John F Watts** of the University of Surrey has been awarded the British Vacuum Council's Senior Prize, while physicist **Tim Veal** of Warwick University has awarded the Junior Prize. Nominations are now being sought for the 2009 prizes.