Physicists, especially those employed in industry, continued to enjoy rising salaries in 2000, according to results from a recent survey conducted by the American Institute of Physics (AIP) Statistical Research Center. The median annual salary for full-time employed respondents with PhDs reached $78,000, while those with master's degrees earned a median salary of $63,000, and those with bachelor's degrees, $60,000. And AIP society members who received their PhDs within the last five years, and are not postdocs, report median salaries that are 9% higher than their colleagues with similar experience in 1998. (The AIP consists of 10 member societies, of which AIP is the largest.)

The survey included all 19,350 members in the US who received a bachelor's degree in physics between 1986 and 1999 and who reported their salaries in 2000. The median salary is the midpoint in the salary distribution, meaning that half of the respondents earned more than the median and half earned less. The median salary for respondents holding a PhD is $77,600, compared to $75,700 for non-PhD respondents.

The survey revealed that the biggest rise in median salaries has occurred in the specialty of condensed matter physics, where respondents earned a median salary of $93,000 in 2000, up from $83,000 in 1998. Other specialties showing strong increases in median salaries include nuclear and high-energy physics, particle and astrophysics, and applied physics. Respondents in nuclear physics and high-energy physics earned a median salary of $76,000 in 2000, up from $70,000 in 1998. Respondents in particle and astrophysics earned a median salary of $77,000 in 2000, up from $72,000 in 1998. Respondents in applied physics earned a median salary of $73,000 in 2000, up from $68,000 in 1998.

The median salary for respondents holding a PhD and working in academia was $73,000 in 2000, up from $70,000 in 1998. The median salary for respondents holding a PhD and working in industry was $86,000 in 2000, up from $83,000 in 1998. The median salary for respondents holding a PhD and working in government was $76,000 in 2000, up from $73,000 in 1998.

The survey also revealed that the number of people receiving physics bachelor's degrees continued to drop in 1999, reaching a 40-year low, and the number of people receiving physics PhD degrees did in 1999, marking the fifth consecutive decline, according to a just-released report from the American Institute of Physics. But the report notes that the number of undergraduate students in their junior year who were enrolled in physics programs in 1999-2000 rose four percent over the previous year.

In the near future, I expect an increase in the number of physics bachelor's degrees,” said Patrick Mulvey, a technical research associate with the American Institute of Physics and lead author of the report. “I look to see if that number is rising or falling. I use that as a method to anticipate whether the number of degrees are going to be doing in a year or two.”

Mulvey also said that an upturn in such undergraduate physics program enrollment will likely eventually translate into an increase in the number of physics PhD degrees.

The majority of people who go on to get a PhD in physics have a bachelor's of science in physics. Almost half of all people with bachelor's degrees continue with graduate school. This is not true of other fields.”

Other significant findings in the report include the growing representation of women receiving physics bachelor's degrees, and the continued significant under-representation of Hispanics and African Americans among physics degree recipients at both the undergraduate and graduate levels. In a fall 1999 survey of 762 degree-granting physics departments across the United States, Mulvey and co-author Starr Nicholson found that 3,646 physics bachelor's of science degrees were conferred in the class of 1999. This represents a decline of 175 degrees or about five percent over the class of 1998 and a drop of 1,304 degrees or 26 percent over the class of 1991.

The vast majority of these degrees or about 95 percent of the total— were awarded to US citizens, since foreign students are a rule generally do not study physics at the undergraduate level in the United States. Women earned 21 percent of the physics bachelor's degrees conferred in 1999, a new high and up 3 percent over the 1998 number. Back in 1978, women accounted for just 9 percent of the total receiving bachelor degrees in physics.
calls for understanding the history, content, shape and ultimate fate of the universe.” — Charles Bennett, NASA

“Most important thing MAP will do is to put us on the right track on our theories about the early universe.” — David Williams, Princeton University

“Once we acknowledge the possibility that empty space can have energy, our ability to unambiguously predict the future of the universe is out the window.” — Lawrence Krauss, Case Western Reserve University, Dallas Morning News, July 13, 2001

“Generally speaking, these things just don’t happen.” — John M. Burgar, Director of Brookhaven National Laboratory and President of the American Physical Society, on deciding whether to have an astrophysical "ならびに" observatory off the coast of New York City.

— Robert M. Grint, SUNY Stony Brook, on Marburger’s nomination for science adviser and his performance at Brookhaven, New York Times, July 3, 2001

“I’'m here to please us who can pursue...are powerful machines that could transform our science.” — Michael Witherell, Director of the Los Alamos National Laboratory, in the Washington Post, July 2, 2001.

On the launch of the MAP satellite to measure microwave background, CNN Headline News, June 30, 2001:

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Russia Lifts Restrictions but Persecutions Continue
By Richard M. Todaro

Recent critical media attention and the election from scientific orga-
nizations abroad have prompted the Russian Academy of Sciences to back off a controversial direc-
tive issued in May requiring all researchers to report all contacts with foreign scientists.
The academy's governing pre-
sidium announced on June 19 th to rescind the order and replace it with a less sweeping one deal-
ing only with "secret" programs.

By Michael S. Lubell, APS Director of Public Affairs

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Houston, Texas
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research laboratory was transferred to Long Range Planning and reported
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Ernst Bucher
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b) US universities
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Hagar Physicists Develop ‘Quantum Slacks’

Preliminary tests conducted last month at the Hagar Pants Propulsion Laboratory in Dallas indicate that the quantum slacks, generated by smashing together two large sizes of slacks at near-light speeds, defy scientific explanation. Said Chang: “We asked the pants a casual lawn-party setting and discovered them to be functional and comfortable. Subsequent experiments yielded analogous results.”

“Additional study and data-gathering is proceeding at a slow pace, as the pants have a strange tendency to vanish and reappear elsewhere,” said Kohl. “Understanding and harnessing this trait is essential before we can find a way to distribute the slacks to stores.”

More exciting, Kohl said, is the potential for gaining insight into the very nature of this breakthrough. “We are on the verge of understanding the secrets of creation and peering into the pants of God Himself. We are about to discover the very fabric of the universe, and it appears to be a smart cotton-twill weave.”

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Kohls, Albert English

Letters, from page 4

Olympiad Missed Some Years

Robert R. McDow, a Ph.D. candidate in mathematical physics at the Eindhoven University of Technology, was the first to catch that I had put the parentheses in the wrong order. We conjured up the name Megafuga to fix that. Feynman’s Hair Raiser Function described by Lorin Vant Hull and Michael Egan (http://prola.aps.org/) is the Megafuga function, i.e., the Megafuga function is the integral of the Megafuga function at having reinvented something Feynman invented 50 years ago — quite the opposite, I’m delighted. Sunir Shah wrote that not only was Megafuga already known as “tetration”, but there is a standard way of writing it as repeat exponential, putting the superscript to the left of the number it raises. Megafuga(4) is (4 tetrating 4), which is 3,437,745,714... , truly a big number.

We played with these things for a while, becoming old 8-year-olds again, until Stephan Houben suggested we stop using kid-styled repetition: “It’s more interesting if you can do it without referring to another function.” We did our best, and created something new, and at about the same time previously defined the Megafuga function. He offered the Ackerman function, which creates new, bigger functions as it goes. Megafuga / tetration (n) is only Ackerman[n](4).

Then someone wrote in with Graham’s number and someone else with a reference to Conway’s “Book of Numbers” with some other very large numbers and functions in it.

Interestingly, none of the readers in the previous six months noticed what Virginia Trimble did, the goof of having 10^5 be ten thousand (blush). Spell checkers don’t catch that, and evidently, neither do more than one in 10^3 web readers. I guess that’s what peer review is about.

The publication gave aside, I’d like to thank APS News for thinking the article interesting enough to include among the other articles appearing in the October edition. Most interesting is the fact that even in this discussion of functions, I think that Kieran’s “gargoogolplex” will remain a handy number to stick into any function (just think of gargoogolexiation of gargoogolplex).

Alistair Cockburn
Salt Lake City, Utah

The Editors reply: it certainly is the policy of APS News to seek authors’ permission before reprinting original material, whether in the “Zero Gravity” column or elsewhere. Unfortunately, Dr. Cockburn’s article — first sent via a private mailing list — appears to have slipped through the cracks somehow. We humbly apologize for the mix-up.

PROLA isn’t free

Wonderful, PROLA is complete. And so, I goin, find a ancient (short) paper and discover that being a long-time APS member is insufficient to let me see the paper. Back to the dusty visible library volumes.

Albent English
Delray Beach, Fl.

Thomas McIlrath, APS Treasurer/Publisher, replies: PROLA (http://prola.aps.org) has proven to be an outstanding success, containing all of Physical Review, Physical Review Letters and Reviews of Modern Physics from three years ago back to 1893 (the past three years are accessed for free). To offset the cost of creating PROLA the APS is charging $2,000,000 more than the creation of PROLA cost more than $2,000,000 plus intense dedication by a few truly outstanding individuals. This initial cost has been absorbed in the general budget and reserves. However, there is an ongoing cost of updating (linking) the texts, and maintaining the operation of the site, maintaining support servers, etc. This cost is covered by subscription fees, mainly from libraries. Library subscriptions allow unlimited access to their faculty and staff. (Librarians often ask us to remind members that their campus access is not free, but is paid for by the library.). Individuals may subscribe for $100 per year or they can buy articles on a pay-per-view basis. The Society is not-for-profit and continues to price its journals at cost and attempts to spread its charges evenly through the community, but someone has to pay the bills.

Beltway, from page 3

there neither nor certainly in the House. The President can call on Congress to pass a bill, but spending bill to him before any other, as he already has, but Senate Democrats, who control the se- quence of appropriations bills, can refuse to comply, as they already have sworn they would not.

The outcome could be a stalemate with a year-long continuing resolution for many programs, which would keep spending at or below current-year levels. The party could also duke it out in the media for much of the coming year, hoping to get an early boost for the 2002 congressional election. in the process. There’s at least 30% possibility. Congress could strike a deal to increase de- spending significantly — but not by the full $35 billion — and add serious money to education and social programs — but not as much as the Democrats want, squeezing everything else in sight. None of those scenarios bodes particularly well for science. It is doubtful that the numbers will rise much above the average of the House and Senate appropriations bills. There a good chance they won’t make it at all.

And with a Chairman of the Board using his MBA training to or- chestrate future White House budget policy, science may have to learn to live with a quarterly earn- ings mentality or suffer meager offerings for the next few years if it ever.

"And we who do and make things have learned, to our dis- may, that if we measure what we lose sight of width and vice versa. These tricks defy all traditional means of measurement," added Kohl. Added Kohl, "Additional study and data-gathering is proceeding at a slow pace, as the pants have a strange tendency to vanish and reappear elsewhere. Understanding and harnessing this trait is essential before we can find a way to distribute the slacks to stores.

More exciting, Kohl said, is the potential for gaining insight into the very nature of this breakthrough. “We are on the verge of understanding the secrets of creation and peering into the pants of God Himself. We are about to discover the very fabric of the universe, and it appears to be a smart cotton-twill weave.”

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Hagar physicist Dr. Mathias Kohl said, “But we’ve learned, to our dis- may, that if we measure what we lose sight of width and vice versa. These tricks defy all traditional means of measurement." Added Kohl, "Additional study and data-gathering is proceeding at a slow pace, as the pants have a strange tendency to vanish and reappear elsewhere. Understanding and harnessing this trait is essential before we can find a way to distribute the slacks to stores.”

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Mass Media Fellow Relishes Drama of Science Policy

OPA Intern Gets Crash Course in Science Policy

Persecutions, from page 3

Young admits, but adds that program participants are carefully screened. "They're not going to put you in a classroom with Charles Manson," Despite the strain on her already hectic schedule, the fellow finds the experience rewarding, even though the mathematics involved is very basic addition and subtraction. "It's very satisfying to know they'll come to one of these events and do math problems," she says. "It makes me feel like I'm doing something worthwhile to help the community in some way."

Young admits, but adds that program participants are carefully screened. "They're not going to put you in a classroom with Charles Manson," Despite the strain on her already hectic schedule, the fellow finds the experience rewarding, even though the mathematics involved is very basic addition and subtraction. "It's very satisfying to know they'll come to one of these events and do math problems," she says. "It makes me feel like I'm doing something worthwhile to help the community in some way."

It feels very personally because, I've spent well over $100 million in supporting Russian science, and I would certainly not have been either willing or able to do it if such an order had been in existence," Soros said at a news conference in Moscow in June, as reported by the Associated Press. The new directive, as reported in the August 10, 2001 Science, requires all faculty and their supervisors in writing about any foreign activities.

Washington internships have been the subject of much negative media attention in recent years, but Young isn't likely to be basically cowed or dissuaded from her goals by any real or imagined risks. She spent the last year volunteering as a math tutor to prison inmates in San Quentin in her spare time. San Quentin is one of only a handful of prisons nationwide that offers education programs for inmates. In fact, inmates can earn the equivalent of an AA degree at the prison.

Young admits, but adds that program participants are carefully screened. "They're not going to put you in a classroom with Charles Manson," Despite the strain on her already hectic schedule, the fellow finds the experience rewarding, even though the mathematics involved is very basic addition and subtraction. "It's very satisfying to know they'll come to one of these events and do math problems," she says. "It makes me feel like I'm doing something worthwhile to help the community in some way."

As Mattis outlined in a letter to the Albuquerque Tribune and a former intern at the University of California, Berkeley, who spent this past summer at Case Western Reserve University, who was arrested and jailed in June.

Persecutions, from page 3

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As Mattis outlined in a letter to the Albuquerque Tribune and a former intern at the University of California, Berkeley, who spent this past summer at Case Western Reserve University, who was arrested and jailed in June.
Bachelors, from page 1

By contrast, women earned 13 percent of the physics PhD degrees conferred in 1999, a number that represents just under five percent of the total number of US citizens that received such degrees. The 3,646 physics bachelors of science degrees conferred in 1999 was almost 40 percent below the peak number of 6,095 in 1969 when a combination of Cold War military-industrial complex needs, the Vietnam War, and the Apollo space program helped turn out about 6,000 physics bachelor's degrees, and it is the lowest number since the mid-1950s. After dropping in the 1970s, physics bachelor’s degree production was relatively flat in the 1980s before beginning its decade-long slide in the 1990s. At the graduate level, the report found the number of PhDs conferred to the class of 1999 was 1,262, a drop of about five percent over the previous year. This number is off about 15 percent from the class of 1994. The number of physics Masters degrees conferred has fallen even more dramatically during the same period. In 1999, there were 671 physics Masters degrees conferred, down 14 percent from 1998 and off 37 percent from the class of 1994. As with bachelor’s degrees, the number of PhDs conferred in the past half century has reflected social trends and the two numbers have mostly moved in tandem. PhD degree production soared in the 1950s and 1960s before falling in the 1970s and stabilizing in the 1980s. A notable exception occurred between 1991 and 1994, when PhD degree production spiked 34 percent even as bachelor’s degree production began its decade-long decline. The spike is attributable to a temporary change in US immigration policy toward Chinese students studying in the US in the wake of the Chinese government crackdown on the pro-democracy movement.

The report indicates why changes in the number of foreign students should affect the physics graduate degree numbers so much. Whereas US students accounted for 93 percent of the bachelor’s degrees recipients in the class of 1999, they accounted for just 58 percent of the physics Masters degree recipients and 53 percent of the physics PhD degree recipients among the class of 1999.

The proportion of US citizens receiving physics graduate degrees is likely to fall even more with foreign students now comprise 49 percent of the physics graduate school population in the United States and they accounted for 53 percent of the first year graduate students.

By contrast, the number of African Americans and Hispanics receiving graduate degrees in physics remains very low. Only 24 African Americans received Masters degrees and only 10 received PhD degrees in physics in 1999. Among Hispanics, the numbers were 9 and 10, respectively.

Mulvey said that growth in the number of foreign students is likely to propel an overall increase in PhD production in coming years. His report found that for the first time since 1992, the number of first-year graduate student enrollments had a positive increase over the previous year by 0.5 percent over the previous year to 2,510 students, and that most of this increase came from a jump in foreign students.

“THERE was a six percent jump in foreign students compared to a one percent increase in US students, which equated to a four percent increase overall,” Mulvey said in a November 2000 report. Mulvey found that 95 percent of first-year foreign students had received the equivalent of a bachelor’s degree in physics. He also estimated that over half of foreign students enrolling in graduate physics programs in the United States in 1997-1998 had more than the equivalent of a bachelor’s degree, with many having the equivalent of a Master’s degree. "Much of this discrepancy in educational background is attributable to the differences between undergraduate programs in the US and undergraduate-equiva- lent foreign programs abroad, which may cover the physics curriculum in greater depth and require more years to complete," Mulvey wrote in that report.
It Takes a Real Community to Keep Physics Healthy

By Jim Tsang and Craig Davis

There are many positives for the US physics community. Intellectually, US physics is one of the world’s most productive and innovative centers. The US physics community continues to make contributions to fundamental science at the forefront of innovation, invention and insight. In addition, the US physics community is a destination of choice for many of our colleagues as a place to work, meet and publish. Outstanding students from across the globe who earn their PhDs at our universities. Many of our graduates obtain outstanding positions in industry, employment and government. Our universities are the primary source of research, and when detailed statistics are available, was only 0.7%, half of that for all science and engineering graduates. In that year, 2000, and on the other hand, the physics community was funded only 0.9% of the research and development (R&D) is carried out at universities.

At the same time, many of our colleagues believe this is a bad time for US physics. Two powerful trends have increased its funding for research in recent years. We need to consider increased the number of native-born graduate students. A prominent national leader ranked his undergraduate physics courses around the world’s top in the 21st century. We feel we have an unnatural difficult time obtaining a proper hearing for the importance of physics research to the nation. Ten percent of our recent graduates in 1997 said they could not find full-time employment that was “closely related” or “some what related” to their degrees. This was the highest number for any science or engineering discipline.

Over the next 5 years, a series of articles will appear in APS News considering several aspects of the current situation of the US physics community. They are not a reflection of the intellectual health of our profession, which is in excellent condition. They will consider our institutions and workplaces, the opportunities provided for new graduates, the frustrations that plague the careers of our colleagues, and the students we attract; the education we provide, how our fellow citizens view us, and our relationship to our sister disciplines.

These articles have been created because too few APS members are trying to understand how our community fares in the give and take of US society. Our love for physics causes many of us to think that only a small percentage of physics is of use to us and that we will not generally support physics research. The record in fact shows that the physics community has problems with arguments about how the physics community is funded, what to do. These arguments have little resemblance to physics, and a great deal of resemblance to history or the social sciences, where differences in personal background, experience, and circumstances can produce a decisive reordering of priorities and values.

These arguments must be made on paper, and in person-to-person encounters, through give-and-take and dialogue. The health of the physics profession today requires the active involvement of physicists, who understand what physics is, with their representatives, bosses, and other non-scientist fellows. The argument can only be made when the values of the other party are recognized and understood. Each side must be willing to be effectively by a fraction of a percent of the 40,000-person APS membership. It will require the involvement of many members, the more the better.

For this reason, these essays will not attempt to make explicit argumentation. Members with PhDs, with a background information on several critical topics related to the physics community and its relation to the larger US community. This will allow readers to make their own arguments, and craft cases that are relevant to their experiences. These essays will guide to a website where they will be posted of data, links to more data, and interpretative materials from which the readers can construct their own physics model and form their own judgments.

For the first time in a period of about 20 years, there has been a period of tremendous growth for American physics. Our boom was fueled by several different factors: the relative contribution of institutional public and support for physics research. Our community has many friends. In spite of what different forces. These included the reordering of priorities and values. This cannot be done effectively, and we will still be working in the private sector. In many cases, their work has a strong physics character; in some cases, it is very remote from what they learned in graduate school. There are many differences between academia and industry. Understanding these differences in the present economic context will help us take advantage of them. The substantial majority of our graduate students will never be academics, and many of them will have careers in industry. Industry is an excellent home for certain types of problems and a poor home for other types. What can be made of what comes from industry, or what is of interest or interested in citizens? How can we better train our students for future industrial careers?

When most physicists think of the funding for physics research, they think of the US government. If we think of the present as hard times, well, the current funding for scientific research is in a very, very good state. The APS has a broad range of activities in education. The programs are vast and must have a clear need for the future, when much more will need to be done.

Craig Davis

As rivals, Neil Gershik and Bill Clinton disagreed on most issues. Interestingly they did agree on the need for the US physics community to effectively help Americans understand what it is about, what it is doing, and how it will change the future. At Caltech, in January 2000, Clinton said, “We have not done a good enough job in helping all Americans to understand why we need very large investments in science and technology.” A few months earlier, Gershik wrote in an op-ed piece that was reprinted in APS News, “...most scientists by definition would rather be in their laboratories studying, at conferences learning, or in a classroom teaching than appear in public settings and appealing for public support. Unfortunately, part of their mind seems to be a determinism that their work is so obviously important that they should not have to explain it...” While Bill and Neat are history now, their message is still current. In the next few months, through the APS News and the APS website, we hope to make clear to all members of the APS the benefits, both to the physics community and the nation, that come from an APS membership that is informed about the major issues which affect the health of the physics community in the US, and is willing to work on those issues.

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ASPS News welcomes and encourages letters and submissions from its members responding to these and other issues. Responses may be sent to: letters@aps.org.

Salaries, from page 1

salaries for society members with PhDs vary with geographical location and are influenced most strongly by type of employer, with industry paying the highest salaries. With 11-12 month contracts.

The median salary for PhDs in industry was $80,000 in 1996-2000. The highest median salary for PhDs in industry was in the Pacific states ($80,000), while the lowest median salary was in the East South Central and West North Central states. Industry respondents with PhDs are more likely to accept that there is a minimum level of support for physics research required for the well-being of the nation. On the other hand, they do ask that a good case be made for the next dollar that goes to physics rather than tax cuts, research in health care, aid to education, etc. The physics community has problems with arguments about how the physics community is funded, what to do. These arguments have little resemblance to physics, and a great deal of resemblance to history or the social sciences, where differences in personal background, experience, and circumstances can produce a decisive reordering of priorities and values.

In the last salary survey, $90,200 was reported as the median industry salary of $90,000. This is 7% higher than the median salary at FFRDCs, where men in their early career reported substantially higher salaries than women in the same category. However, among late-career physicists working in universities, women reported salaries substantially higher than those reported by men. Females with PhDs are also more likely to work part-time than men with PhDs, but the overall part-time employment rate has dropped. The unemployment rate for women remains under 2%, and for men it is less than 1%, according to Chu.

In Washington, DC, an area af-...