signal to background

Art on a big Scottish wall; National Geographic Society's emerging explorer; on the shoulders of citations; students bowling for science; a first "Nobel" introduction; where butterflies go in winter; letters.

Photos: Ken McMullen

Nuclear drive-in

Standing outside in the dark and the cold on the east coast of Scotland, 500 people let out a communal gasp as a huge screen was illuminated on the side of the Torness nuclear power station. A six-minute video loop, *Lumin de Lumine,* transmitted by some of the most powerful projectors in the world, instantly changed the north wall of the building into the largest ever public-art installation in Europe. The project is visible from the main road and rail links between Edinburgh and London, and approximately 16 million travelers will pass by the "Nuclear Drive-in" each year.

Lumin de Lumine was filmed by Ken McMullen (photo, right) in the abandoned ISR tunnel at CERN as part of the *Signatures of the Invisible* art exhibition, which consisted of artworks produced in a collaboration between CERN scientists and leading European contemporary artists. The film shows a young woman in a red dress swirling an electric light bulb around her head, thus creating a constantly changing image of intensity, darkness, and light. "The film means many things," says McMullen. "I first wanted to illustrate the uncertainty of the quantum world, where the precise position of subatomic particles could never be known. But now, I find it a telling metaphor for the dark universe. There is very little light and we are constantly surrounded by darkness, be it dark matter or dark energy."

The project, promoted by Scottish arts impresario Richard DeMarco (photo, left), will continue for a year-long run if sufficient funding can be found. **Neil Calder**

Photo: National Geographic Society

Exploring the world with the mind

Documentary producers and science writers love someone like Stephon Alexander. He's a cool physicist.

A man with tight dreadlocks, a hint of New York accent and a night gig playing tenor sax in a jazz band, 34 year-old Alexander is also a physicist who worked with the SLAC theory group for almost three years before recently relocating to Penn State.

Alexander was recently honored by the National Geographic Society as an "Emerging Explorer." The award is unusual since most recipients are mountain climbers, scuba divers or nature photographers.

Alexander said that the award only shows that physics and cosmology are becoming more mainstream and that a wider audience is starting to ask fundamental questions in science.

"[National Geographic] is broadening the scope of what people think exploration is. And that's kind of cool," Alexander says.

Susan Reeve, director of special projects at National Geographic, said there is more to exploration than forging a new route to the South Pole. "Stephon is exploring that intersection between physics and also music and trying to teach that to students… It's using new media I think."

Alexander plans to use the $10,000 prize to strengthen research collaborations in the Third World. He said it's important to strengthen ties with physicists in places like Brazil, Africa, and his homeland, Trinidad and Tobago, in the Caribbean. He also hopes to encourage others to look at science and discovery with an open mind.

"So much of exploration takes place in the mind. You don't have to take a long airplane trip or some dangerous trek through a jungle to explore," he says. "You can sit on top of a hill and the mind can take you there. That's what we learned on *Sesame Street,* right?"

Erik Vance

On the shoulders of how many giants?

Scientists since the time of Sir Isaac Newton (and before) have built their work on the work of those who preceded them. Newton famously described this by saying, "If I have been able to see farther, it was only because I stood on the shoulders of giants." (Letter to Robert Hooke, February 5, 1675. Source: wikiquote.org)

Modern-day physicists may not have Newton's turn of phrase, but they still give credit where credit is due, by referencing the works that they have used to formulate their own research.

Often we think of these citations as suggesting somehow the quality, utility, or relevance of the paper being referenced. But what about the other side of the equation: the paper making the references? How many shoulders does one stand upon; that is, how many papers does one reference when writing a new paper?

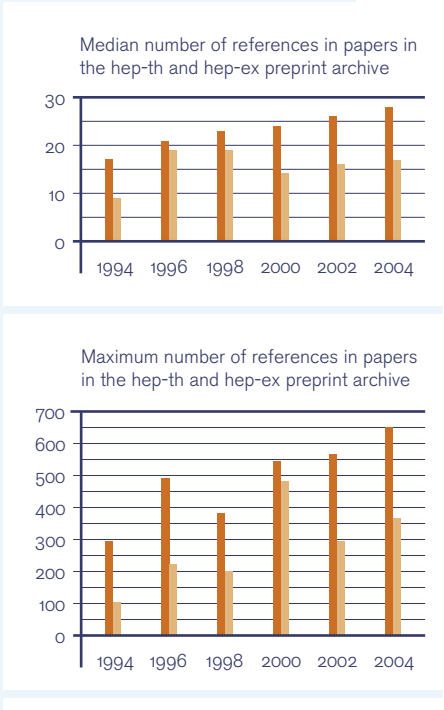
The answer depends upon the field of research. Shown in the charts are the numbers of references for two different fields: mathematical particle theory (hep-th) and particle experiment (hep-ex).

In 2004, the median numbers of references given in a paper were 29 (theory) and 17 (experiment). Such long lists of references are quite rare and are generally review papers rather than original research.

The theoretical fields list noticeably more references per paper than the experimental ones. This is not surprising given that experimentalists tend to write fewer papers (886 versus 3357 in 2004), and thus the literature is a smaller set. Perhaps more importantly, experimental papers generally describe the results and setup of an experiment built and run by the authors. While these experimental techniques rely upon other scientists, and the motivation also derives from other papers, they represent less direct connections than the theorists work with. Theoretical literature tends to carry on a conversation style of revising, extending, and sometimes subtracting from, previous work.

Curiously, the number of references per paper has increased a little over the years. This may reflect the electronic advances that have increased the ease of communication and the ease of citing. It may also be due to the increased accuracy of databases such as SPIRES.

Travis Brooks, SLAC



Source: SPIRES

Photo: Diana Rogers, SLAC

Harker bowls over Lowell in science

The competition was heated at SLAC's second annual regional tournament of the US Department of Energy Science Bowl. Alex Trebek and Regis Philbin wouldn't hold a candle to SLAC's science questioners, who probed the high school competitors about topics from quarks and DNA to volcanoes and supernovae. The turnout from the local high schools was so overwhelming that the tournament brackets had to be redrawn to accommodate the extra schools.

The initial round-robin phase saw several clear favorites emerge from the group; Los Gatos looked strong after defeating a tenacious Harker (San Jose) team in the first round. Lincoln (San Jose) put in an adroit performance, but Lowell (San Francisco) emerged as the team to beat.

As the competition moved into the elimination rounds, Harker got revenge on Los Gatos in the semifinal and moved on to face Lowell in the final match. Lowell, unbeaten at this stage, had to lose twice to cede the championship, while Harker, having lost one match already, could not afford to lose at all. Harker took the first game in decisive fashion, setting the stage for a winner-take-all final.

Both teams had played 10 matches already, but they showed no signs of injuries or fatigue, and the low-scoring match was hard-fought. The lead changed hands several times, prompting nervous looks on the faces of the team coaches. Finally, after losing points on several unfortunate interruptions, Harker (shown in photo) came through to take the lead, the match, and the competition. They will head to Nationals at the end of April in Washington, DC. The competitors' level of knowledge stunned the SLAC staff, and it was generally agreed that no team of scientists here could have done as well as these students.

Travis Brooks, SLAC

A special introduction

"It's not often you get introduced by a Nobel Prize winner," said US Energy Secretary Samuel Bodman (photo), former professor of chemical engineering at MIT and CEO of a Fortune 300 company. Speaking at the annual Council of Presidents meeting of the Universities Research Association, which manages Fermilab, Bodman was introduced by David Baltimore, President of Caltech and 1975 Nobel Prize winner for his work with enzymes related to HIV and AIDS.

The meeting took place in February, three days after Bodman had announced the much-anticipated Department of Energy budget request for the fiscal year 2007. "The President has committed to doubling funding [for the DOE Office of Science] over the next 10 years," he said. "If all goes according to what [the President] proposed, Ray will have an extra half-billion dollars to work with." Bodman was referring to Raymond Orbach, Director of the DOE Office of Science, who has been nominated for a newly-created position as the first Undersecretary of Science.

Bodman also addressed the need for US advancement in science and technology in an increasingly competitive world. "Not only will we support research that might help cure diseases, protect our country, and support productivity, but this [budget request] also supports education for those who will take part in this process in the future," he said. "As an engineer and a former university professor myself, I am very pleased to stand before you and pledge to you that this government is committed to holding up our end of the bargain, and I rest assured that you and your colleagues will do the same."

Siri Steiner

Photo: Siri Steiner, Fermilab

Photo: Tom Peterson, Fermilab

Where do they go?

High-energy physics labs worldwide are neighbors with numerous butterfly species–from the Common Blue (*Polyommatus icarus,* photo) found near CERN to the Pipevine Swallowtail (*Battus philenor*) that shares the Bay Area with SLAC. But where do butterflies go in the winter? While a few species, like Monarchs, migrate to warmer climates, the majority of species spend the winter, wherever they are, in diapause, a metabolic state similar to hibernation.

Butterflies have four stages in their life cycle–egg, larva, pupa, and imago (adult butterfly)–and while you might think they would spend winter as pupae in a cocoon or chrysalis, you'd be only partly correct. "All four stages are out there in the winter," says Fermilab's cryogenics engineer Tom Peterson, who is also the resident butterfly expert for the lab 40 miles west of Chicago. "While every species typically has one pattern and overwinters in the same stage every year, right now, in the middle of winter, there are even adult butterflies sitting in the woods, hiding in trees."

More than 50 butterfly species regularly call Fermilab home, and those that overwinter at the lab as imago include the Eastern Comma (*Polygonia comma*) and Mourning Cloak (*Nymphalis antiopa*). Both have cryptic coloring that camouflages them–the only way a butterfly in diapause can avoid predators. Butterflies overwintering as larvae (caterpillars) face dangers as well: they can be extremely sensitive to environmental changes, particularly in humidity and temperature, which makes cold, dry winters difficult for them.

Dawn Stanton

Letters

Chinese high-energy physics

In your recent editorial (Feb. 2006), you mention the upgrade of the facilities at the Institute of High Energy Physics (IHEP) in China, but do not give details of the BEPCII/BESIII construction. The BEPCII linac installation is complete, that of the storage ring started, and the installation of the muon counter and the superconducting magnet into the BESIII detector are also complete.

BEPCII is a two-ring electon-positron collider that will run in the tau-charm energy region with a luminosity improvement factor of 100 over the previous BEPC. BESIII is a new collider detector with significant improvements over the previous BES detectors. Commissioning of both the detector and accelerator are expected in summer 2007.

The next BESIII collaboration meeting is planned for June 8-10, 2006 at IHEP in Beijing. From June 11-18, there will be a workshop on Future PRC/US Cooperation in High Energy Physics, to promote and strengthen cooperation in high-energy physics between the People's Republic of China and the United States. The meetings will review the current status of the Chinese HEP program, including BESIII and the Daya Bay neutrino reactor experiment, and explore the physics potential of these experiments. Anyone interested in BESIII or the workshop should contact me for details.

Frederick A. Harris, BESIII Co-spokesman
University of Hawaii

Female-friendly physics departments

This month, thousands of college seniors will be deciding which graduate school to attend. An important issue for female students concerns the climate for women in the various departments. To help give prospective students a better idea of the climate for women at graduate institutions, the American Physical Society Committee on the Status of Women in Physics has established a database in which department chairs answer some questions ("Does your institution have family leave policies, health insurance, etc.?") and then discuss the climate in their departments. Over 110 institutions have responded. A discussion of the database can be found in the February 2006 *APS News,* and in the *CSWP Gazette.* The results are at http://cswp.catlla.com/results.php, and all are welcome to peruse this database.

Marc Sher
College of William and Mary, Virginia

Letters can be submitted via letters@symmetrymagazine.org