US, Europe Reciprocate Scientifically and Financially on LHC, Other Big Science Projects

I have read with much interest your coverage of the current discussions about American involvement in the Large Hadron Collider (LHC) that CERN is starting to build (see, for example, PHYSICS TODAY, February, page 58, and May, page 48). With the demise of the Superconducting Super Collider project, this instrument will be unique in the world.

The LHC is being constructed to respond to fundamental questions at the core of our understanding of the physical world. It is therefore natural that it should attract physicists from all over the world and in particular from the US, where there is a very strong and brilliant tradition in particle physics. At present, about 600 American physicists are already involved in the collaborations formed around the two imposing and sophisticated detectors being built to use the machine in the most efficient way. These physicists represent close to 20% of the anticipated number of LHC users on the two major detectors.

The US is very seriously considering a contribution to the project totaling $530 million ($450 million from the Department of Energy and $80 million from the National Science Foundation), with the accelerator to get $200 million (from the DOE contribution) and the detectors to get the remainder. The prospect of such a contribution has injected the question of "reciprocity" into the discussions about the LHC. Whereas the part of the proposed US contribution designated for the detectors would be fully in line with past and present practice, whereby experimentalists accept responsibility for their fair share of equipment construction costs, the special part earmarked for the accelerator may appear to be setting a precedent at odds with the philosophy of "free access." Accordingly, there are voices in America insisting that such a special contribution be linked to a European pledge of involvement in a comparable project still to come in the US.

It is clear, however, that such intercontinental collaborations on major scientific projects cannot be considered separately for each field of science, lest nothing be achieved. The time scale required for two successive major projects in the same domain is indeed likely to be at odds with any possible serious planning. In connection with that, it is worth noting that, if one brings space science into the picture and considers for instance the Hubble Space Telescope (HST), the looked-for reciprocity is already met.

The HST is a major American-led basic science project. The Europeans, through the European Space Agency (ESA), have already contributed 511 million European accounting units (about $605 million, in present-day dollars) to this project. Their involvement has been a result of a 15-page memorandum of understanding signed by NASA and ESA in 1977.

ESA's contributions to the HST have totaled $520 million for the equipment it has provided and $85 million for its participation in the science operations in Baltimore. In particle physics vernacular, ESA thus has contributed the Faint Object Camera to the detector side of the intercontinental agreement and the Solar Array and its associated hardware to the accelerator side. It is difficult to determine how the ESA hardware contribution was apportioned to the Faint Object Camera and the Solar Array, since it was handled as a single project by ESA, but an educated guess would be two-thirds and one-third, respectively. The 1977 agreement specified that the European use of the telescope should amount to at least 13–15% of available observation time, to proportionally match the scheduled relative investment; in practice, though, European usage has been at a level of 20%.

The parallel between the HST and the LHC is thus striking. If one replaces "HST" with "LHC" and "US" with "Europe," one finds that all key measures tally remarkably. This European involvement is very well known in NASA and ESA circles, but seems to be surprisingly poorly known to those who consider the matter from the standpoint of high-energy physics. At present, NASA is soliciting a longer ESA involvement in the HST, which would extend the present agreement from 2001 to 2005 with a further financial contribution from ESA. NASA is also trying to interest ESA in the Next Generation Space Telescope (NGST), which should eventually replace the HST.

There have been and are of course several other major ESA contributions to NASA-led projects, such as the Huygens Probe part of the Cassini mission to Saturn. There also have been and are some NASA contributions to ESA-led projects. In this instance, the case of the HST is particularly important when it is compared to the LHC, because of the similarity of all key measures. Of course, with the space station, one also finds very important European participation in a US-led project, with overall investments that in fact far exceed the cost of the LHC. US–European reciprocity is well at work, but one should not single out a particular field of research.

Modern science requires instruments that may now appear to be too large and too expensive to be constructed by any one of the world's major regions, and that is even more so when several of them, in different domains, happen to be in competition. That is why the Megascience Forum of the Organisation for Economic Cooperation and Development has long advocated increasing worldwide collaboration, with instruments being built under the responsibility of one region and being accessible to all regions. The LHC perfectly fits with this approach.

A free-access policy, with proposals judged on the basis of scientific excellence rather than geographical origin, and therefore not linked to the actual contribution of any particular country to a major project, has long been advocated by a variety of organizations, including the International Committee for Future Accelerators. However, the size of the LHC investment and the fact that a large fraction of the LHC users will come from countries that are not member states of CERN has

continued on page 80

led the CERN council to request contributions from nonmember states scheduled to be major users. These contributions should be not only for the detectors but also for the accelerator itself. The American contribution to the accelerator is not intended to replace some missing member state's contribution, but rather to hasten completion of the project.

The LHC could be built by the CERN member states alone, as had to be demonstrated when the project was approved in 1994. The initial stand-alone scenario assumed that a 10 TeV machine would be operating in 2004 and that it would be completed at 14 TeV by 2008 (after a one-year shutdown). However, with the extra contributions now expected from the US, Japan (which has already made two generous contributions in cash), Russia (which has pledged an important contribution in kind) and others (Canada, India and Israel, so far), the now-approved and ongoing plan is to complete the full machine at 14 TeV as early as 2005. And 2005 already looks far away to the many physicists eager to explore the new promising domains that will be opened by the LHC!

MAURICE JACOB
(maurice_jacob@cern.ch)
CERN
Geneva, Switzerland

Theory Is Tied in Nots, but Strings May Have 'Signatures'

Gordon Kane is to be complimented on his trenchant commentary about experimental tests of string theory [PHYSICS TODAY, February, page 40]. When a realistic string theory—namely, one that is mathematically complete, calculable and in agreement with existing experiments—is eventually formulated, it certainly will make testable predictions of the type Kane describes.

At present, no satisfactory realistic string theory exists. It may therefore seem surprising that some experiments potentially testing strings are actively being performed.

The point is that there may be detectable "string signatures": observable physical effects from strings that are forbidden in conventional particle physics. They could serve as signals of strings even in the absence of a specific realistic model.

Kane mentions one possibility that my colleagues and I have suggested: a mechanism in strings producing *CPT* (charge conjugation-parity-time reversal] violation that could be detectable) in the K system.[1] Current experimental sensitivity to these effects[2] is close to the Planck scale, and experiments now being designed will reach it.

The idea has been extended to the D and B systems.[3] The first experimental measurement of a *CPT*-violating parameter in the B system has been performed.[4] This result provides a bound near the Planck scale on possible *CPT*-violating effects involving the b quark. Any future B-system measurements are likely to be an order of magnitude more sensitive. Effects may also be observable in other sectors of the Standard Model.[5]

So, if anything, Kane has understated the situation. Not only will a realistic string model eventually make testable predictions, but the framework of string theory can already be experimentally investigated now.

References

1. V. A. Kostelecky, R. Potting, Nucl. Phys. B **359**, 545 (1991).
2. L. K. Gibbons *et al.*, Phys. Rev. D **55**, 6625 (1997).
3. V. A. Kostelecky, R. Potting, Phys. Rev. D **51**, 3923 (1995); D. Colladay, V. A. Kostelecky, Phys. Lett. B **344**, 259 (1995); Phys. Rev. D **52**, 6224 (1995); V. A. Kostelecky, R. Van Kooten, Phys. Rev. D **54**, 5585 (1996).
4. K. Ackerstaff *et al.* (OPAL collaboration), preprint CERN-PPE/97-036 (April 1997).
5. D. Colladay, V. A. Kostelecky, Phys. Rev. D **55**, 6760 (1997); R. Bluhm, V. A. Kostelecky, N. Russell, Phys. Rev. Lett. (in press); O. Bertolami *et al.*, Phys. Lett. B **395**, 178 (1997).

ALAN KOSTELECKY
(kostelec@indiana.edu)
Indiana University
Bloomington, Indiana

Author-to-Author Contact Simplifies AIP Figure Reprint Policy

Both David Stern ("Letters," February, page 11) and Keith Seitter ("Letters," May, page 94) complain about the time and trouble involved in authors obtaining permission to reprint figures in, say, review articles. They each offer what they hope will be a solution to the problem.

The American Institute of Physics policy regarding copying of figures, tables etc. is printed in the front matter of all its journals: "Permission is granted to quote from the journal with the customary acknowledgment of the source. To reprint a figure, table, or other excerpt requires the consent of one of the authors and notification to AIP."

Here at AIP (where I am journal publisher), we believe that the requirement to get the original author's permission, besides being a common courtesy, is good policy because an author might well wish to supersede the original figure with new data, or simply to disown the figure even if nothing better is forthcoming. I remember that the physicists on the advisory committee that helped us establish the wording of our "permissions" statement insisted on the inclusion of this particular statement about obtaining the author's permission.

Notice that we do not require the copying author to get our permission, but only to notify us and provide "customary acknowledgement of the source." However, for the editors and production staff at most publishing houses, it is much easier to insist that their authors get permission for everything, from everybody, than to try to keep track of the various permissions policies in place elsewhere. Despite our policy, we still receive many letters "requesting permission," rather than providing notification (we are happy to reply with our approval), and I suspect that Seitter at the American Meteorological Society still gets them too.

JOHN T. SCOTT
American Institute of Physics
Woodbury, New York

New Elements Could Be Better Identified: Namely by Number

I read with dismay your May story (page 52) on the naming of elements 104 through 109. While creating new elements through anthropogenic means can contribute to an understanding of our physical universe, I believe it is extremely pretentious to name these elements, since, for all intents and purposes, they are not found in nature. Worse yet, for learned men and women to engage in pointless wrangling over such names demeans the noble goals of physics, and it makes even me, a devoted student of science, question how society's money is being spent at publicly funded institutions.

I am not indicting the fine work done by the people involved in creating the new elements. Rather, I am encouraging them to put aside self-congratulation and recognize that these created elements mainly serve academic purposes and should not be held in the same esteem as the discov-