fast in conveyances that are not completely closed conductors—for example, riding on motorcycles, in open convertibles or soft-top cars, in airplanes with fiberglass bodies and in metal-covered jet planes with appreciable window area (as in the cockpit of a jet fighter plane). Similarly, astronauts go on space walks outside their spaceships, and so on. The point was (and it was a minor one) that there are plenty of common activities in which one is exposed to electric fields of this type that are much larger than those coupled into the body at ground level below typical power lines.

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Retooling the Tevatron for Top Performance

I am puzzled why the 1994 subpanel of DOE's High Energy Physics Advisory Panel led by Sidney Drell has proposed a US contribution to the CERN Large Hadron Collider (see PHYSICS TODAY, July 1994, page 51), whereas a similar Drell subpanel in 1990 pointed out that the LHC energy is about a factor of 3 too low "to elucidate [with confidence] the nature of electroweak symmetry breaking."[1] The new Drell subpanel not only endorses the LHC but recommends a US contribution to it of $400 million over eight years!

If $320 million of that $400 million were given to Fermilab instead, the Tevatron energy could be doubled and its luminosity increased to 10^{33} cm^{-2} sec^{-1} or more.[2] With such an upgraded Tevatron at 4 TeV in the center of mass, over 2000 top-quark events could be produced per day. We would have a T-factory, equivalent to the present Cornell B-factory, which would open up a new field of physics. Also, there would be a chance of finding clues to electroweak symmetry breaking: Heavy Higgs particles of mass up to approximately 300 GeV decaying into two vector bosons could be seen. The D0 detector, which now has a hole through it for the main ring, could be made state of the art, and a third detector could be designed for C0. In addition, fixed-target experiments could be done with a primary beam of twice the present energy. Ever higher-energy upgrades are under consideration.[3] All this would be more exciting and more cost effective than trying to fit in with the 1500 European physicists already planning to use the LHC. It could be completed five years before the LHC, at one-tenth the cost, and it would reverse the present decline of American high-energy physics.

A very important fringe benefit of such a Tevatron upgrade is that it would be an ideal injector for a future 20-TeV ring that could do the physics that the Superconducting Super Collider was to do, but at a fraction of the SSC's cost. Fermilab would then have antiproton beams almost as intense as proton beams, and there would be no need for two rings of magnets, as was necessary for the SSC. The number of magnets would be one-third that of the SSC. I have seen estimates of around $1 billion for the magnets and $200 million for the tunnel. Besides, in the Illinois site proposal for the SSC, the State of Illinois pledged to cover tunnel costs. There would be no need to go through the additional costs and new layers of management connected with creating a new, large laboratory from scratch.

Perhaps the Drell subpanel operated under the rigid assumption that the next accelerator above the LHC energy *must* be an international enterprise. From a world point of view it would be wasteful of resources and money to build a new high-energy physics laboratory from scratch at some unknown location. (We should have learned this lesson from the SSC.) The Tevatron is an existing national accelerator and laboratory. As is the usual practice, other countries would contribute to the new, large detectors and the experimental program in proportion to their participation.

Not only is the Drell report being misused to promote the LHC over the physics that we Americans would normally be doing at that time, but it is being used to promote linear colliders over hadron colliders. For example, *Science*, in a report on the Drell subpanel's recommendations,[4] said that "nearly all physicists agree that the next step after the LHC should be a long, straight linear collider, a larger version of the one now operating at SLAC." One can guess whom the *Science* reporter talked to. I bet the reporter was not told that a proton collider uses known technology at known cost, whereas no one knows how to build an electron–positron collider of reasonable cost and of high enough energy to produce the Higgs particles that could be produced by the SSC or its equivalent.

Almost all the American physicists I know would prefer the first of the following two choices:

▷ the Fermilab program I have just described

▷ giving the equivalent funds to the LHC, followed by an international linear collider project of too low an energy, as described in the box on page 1397 of the *Science* report.

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Seeking ν Oscillations with Old Reactors

Bertram Schwarzschild's news story on anomalous cosmic-ray data and neutrino oscillations (October, page 22) nicely reviews the status of the atmospheric neutrino puzzle and mentions several high-energy experiments that have been proposed to shed light on neutrino oscillations in the critical parameter range