

magnetic fields, neither cancer nor capital punishment is an acceptable subject for attempts at humor.

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LHC May Be on Collision Course with Higgs Boson

The letter from Jay Orear (August 1995, page 15) casts doubt on the possibility that CERN's Large Hadron Collider could do Higgs particle physics, on the grounds that electroweak precision data would indicate a very high Higgs mass (on the order of 1 TeV). In a following letter, John Huth disputes this point of view, concluding that "the existing data on the top quark do not support the conclusion that the Higgs boson is very heavy and hence, at present, do not serve as a guide to the discovery potential of future accelerators."

Having been involved in precision tests of the electroweak theory for some time, we can provide a few pieces of information relevant to this issue. In particular, we argue that existing data disfavor, with increasing confidence, a Higgs mass of 1 TeV or more, and actually prefer a light Higgs, well within the LHC's reach.

Much of the information on the top quark and the Higgs boson masses comes from their virtual effects in electroweak processes as positron-electron annihilation (Large Electron-Positron and Stanford Linear Accelerator Center experiments) and neutrino scattering on electrons or nucleons. This information by itself constrains the masses of both the top quark and Higgs boson, although with a correlated uncertainty: As Orear says, the heavier the top, the heavier the Higgs, and vice versa. These indirect data favor a relatively light Higgs boson. The direct observations of the top quark in experiments at Fermilab by the Collider Detector Facility and the D0 group help to fix the top's mass with a relative error of less than 10 percent, thus reducing the above uncertainty substantially while maintaining a central value of the Higgs boson mass that is not very high.

In reference 1, we have combined the direct and indirect data together in a global analysis of all the available precision measurements known to date. We have done so within the framework of the minimal Standard Model of the electroweak interaction, but have made no other (restrictive) assumption.

In particular, our theoretical calculations of the electroweak radiative corrections include all first-order contributions, as well as the numerically relevant higher-order terms. For the Higgs boson mass, we have obtained a preferred value of about 80 GeV, with upper bounds of 220, 450 and 700 GeV at statistical significance levels of 68, 90 and 95 percent, respectively. We have concluded that the probability that the Higgs boson is heavier than 1 TeV is less than 2 percent. (Comparable results have been obtained by others independently.)

We believe that the results of our analysis are very promising for Higgs searches at the LHC. The precision of this type of estimate is likely to be strengthened as the top quark mass is measured with increasing precision at Fermilab, and as the W boson mass is measured better both there and at LEP 2. For the moment, all the indications are that the Higgs boson is well within the reach of the LHC.

Reference

1. J. Ellis, G. L. Fogli, E. Lisi, to appear in *Zeit. Phys. C* **69**, 627 (1996).

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Courage Bred at Oak Ridge Sets Example

In the "Letters" section of the October 1995 issue of *PHYSICS TODAY*, several writers discussed the topic of plutonium being bred in the biosphere that had been raised in the May 1995 issue by Alex Gabbard of Oak Ridge National Laboratory. They offered useful information and calculations, but the most important information presented was Gabbard's retraction of his original letter.

That was an act of courage that should be emulated by more scientists, particularly those in the federal agencies that are the most prolific in terms of pages published and for which there is no general forum for external peer commentary.

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Quantum Mechanics Books Include Software

I'd like to correct an impression I made in the review of the second edition of Brandt and Dahmen's vol-

ume *The Picture Book of Quantum Mechanics* (Springer-Verlag, 1995) that appeared in the January 1996 issue of *PHYSICS TODAY* (page 65). The reviewer aptly suggests that students would find it exciting to generate their own computer images of fundamental quantum processes (similar to the nearly 500 in this book), and he recommends that the next edition of the book be equipped with an interactive version of the software to facilitate this. The authors and publisher agree. They have been making the *INTERQUANTA* software and detailed instructions for its use available in *Quantum Mechanics on the PC* since 1989 and in *Quantum Mechanics on the Macintosh* since 1991. For an informative review of the Macintosh version, see the April 1992 issue of *PHYSICS TODAY* (page 87).

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Atoms on the Move—Up, Down and Acrostatic

I thought that Noel and Stroud's experiment, as summarized in your "Physics Update" section under the heading "Interferometry within an Atom" (September 1995, page 9), would make an excellent journal club topic. I was so inspired that I was moved to compose this "Ode to a Rydberg Atom":

I never truly understood
How atoms oscillate,
Always turning back again
To their original state.
Eventually decaying,
Just as I felt they ought,
Only to coagulate
Until a packet's wrought.
Rydberg would be pleased to know,
'Neath his lonely grave,
Atoms of his namesake give
Life to Kepler waves.
Could I, too, a wavelet be,
Lasting momentarily,
Until I find myself once more
Beyond time's endless sea?

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Correction

February 1996, page 29—The frontispieces in figure 1 were reprinted with kind permission of Elsevier Science—NL, Sara Burgerhartstraat 25, 1055 KV Amsterdam, The Netherlands. ■