the saturation of the neutrino sum rule for small four-momentum transfer q^2, Frederick Gilman and I pointed out that saturation of the neutrino sum rule for large q^2 would require a new component in the deep inelastic cross section, one that did not fall off with form-factor squared behavior. Bjorken became interested in saturation of the sum rule, and he formulated several preliminary models that had hints of the dominance of a regime in which the energy transfer grows proportionately to q^2. At the 1967 Solvay Conference, in response to questions about saturation of the neutrino sum rule, I summarized Bjorken's pre-scaling proposals. The precise saturation mechanism was clarified some months later with Bjorken's proposal[4] of scaling, and soon afterward with the SLAC experimental work on deep inelastic scattering.

The Bjorken scaling hypothesis, and its reinterpretation using parton-model ideas inspired by Richard Feynman, led to powerful theoretical tools for analyzing deep inelastic scattering. For instance, Curtis Callan and Gross used scaling to derive a proportionality relation between two of the deep inelastic structure functions, under the assumption of dominance by spin-½ constituents (partons).

Wu-Ki Tung and I, and independently Roman Jackiw and Giuliano Preparata, soon showed that in perturbative quantum field theory there would be logarithmic deviations from the Callan–Gross relation. In other words, only free field theory would give exact scaling; in Gell-Mann's memorable phrase, "Nature reads the books of free field theory." That recognition, together with the proposal by William Bardeen, Harald Fritzsch, and Gell-Mann of a tripling of fractionally charged quarks,[5] and new developments in the renormalization group, set the stage for a search for field theories that would have almost free behavior; the resulting discovery of asymptotic freedom in Yang–Mills theories gave the only case that worked.

References

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2. S. L. Adler, *Phys. Rev.* **143**, 1144 (1966).
3. G. F. Chew, *Phys. Rev. Lett.* **19**, 1492 (1967).
4. J. D. Bjorken, *Phys. Rev.* **179**, 1547 (1969).
5. W. A. Bardeen, H. Fritzsch, M. Gell-Mann, CERN preprint TH 1538, 21 July 1972; reissue available at http://www.arXiv.org/hep-ph/0211388.

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Physics or Politics?

Jim Dawson's piece on the election results (PHYSICS TODAY, January 2005, page 24), in which he suspects the winning party will seek revenge, was appalling, out of line with a professional journal. That some scientists supported John Kerry is their opinion. As John Marburger said, polarization during elections is part of our public process. Whether we backed one candidate or another should not affect our professional decisions or public sentiments. Otherwise, how can we maintain competence and credibility? As a self-employed consultant for more than 30 years, I have found credibility to be crucial to my practice.

The reason that national funding of academia is often limited is that academic research may be inefficient in the national scene. Few physicists heeded the message that OPEC sent to the world in 1974. The present Iraq war likely stems from that oversight. Where have the biomass fuel exponents in physics been for the last 30 years? Must the US again spend too late and too much to assure energy supplies now amid Homeland Security Department costs, simply because we didn't go green on energy needs 30 years ago, with academia leading the way?

I recall a physics class circa 1950, in which a PHYSICS TODAY representative announced the magazine's creation—a good idea, I thought. Has half a century reduced you to yellow journalism to obtain national funding of physics? Are you out of touch with the majority of Americans?

Stick to the technical facts. Just tell us what is going on today in physics and related fields, and leave the politics to others.

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Dawson replies: Science may be clean, cold, and objective, but it exists in a world that is anything but. When scientists form significant groups—the 48 Nobel laureates, for example—to endorse one candidate over another, PHYSICS TODAY should

cover it. When threats of revenge are implied—"pushback" was the term an administration spokesperson used—then we should cover that as well. The funding of science is, by its nature, political.

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Middle Ground in the Creationism Debate?

The two opinions in the ongoing discussion of creationism versus evolution (PHYSICS TODAY, June 2005, page 26) are not that far apart. Adherents of both believe in a common origin of modern humans. Creationists call the origin "Adam." But they obviously believe in evolution; otherwise they cannot explain the differences in Africans, Asians, Europeans, and other groups. Darwin became interested in evolution when he observed naked natives in Tierra del Fuego living in freezing temperatures. They had evolved to survive under those conditions.

The difference in beliefs is in the time period involved. A clear track goes back through Arab traditions to Abraham. Before that there are lists of names, the so-called begats in the book of Genesis. In ancient usage, the term "son of" could either mean son of an actual person or son of a tribe established by the person. Religious fundamentalists—that is, creationists—use the more restrictive meaning and come up with a time period that is too short. Use of the latter meaning results in a much longer time period that matches scientific evidence for events such as the great flood, and puts Eden at the end of the last ice age, which is where it should be if it is the origin of modern humans. The ice melted, and the population expanded into new areas, evolving to best survive the environment.

The problem is that Genesis is a very brief document that gives no history of the world outside Eden. It simply states that "sons of God married daughters of man." So Adam and Eve were exiled from Eden, and their sons married daughters of the indigenous people outside Eden, about whom Genesis gives no information. Everything is left to interpretation, scientific investigations, and opinion. The amount of material manufactured on the basis of such a brief document is truly amazing.

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Wigner Not the 'W' in WKB

David Stevenson's Reference Frame piece on tsunamis and earthquakes (PHYSICS TODAY, June 2005, page 10) is excellent. However, I offer a correction and an emendation.

Although Eugene Wigner did many things, he did not cofound the WKB approximation in 1926. Physicist Gregor Wentzel did. I got that information from the online encyclopedia Wikipedia, which despite beginning with a W was also not founded by Wigner.

And in a story devoted to the linkages between the physical and Earth sciences, it's too bad Stevenson didn't refer more accurately to the approximation as "WKBJ," and thereby give due credit to geophysicist Harold Jeffreys, whose work on the subject actually preceded that of Wentzel and coworkers by three years.

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Stevenson replies: I thank John Knox and several others for pointing out my incorrect attribution of the W in WKB. The approximation predates their quantum mechanical application and was indeed to be found in the work of Harold Jeffreys. An interesting website, http://www.du.edu/~jcalvert/phys/wkb.htm, gives more historical details. The essential features of the so-called WKB or WKBJ approximation were known even earlier[1] but Lord Rayleigh already has too many things named after him.

Reference

1. Lord Rayleigh, *Proc. R. Soc. London*, series A, **86**(586), 207 (1912), eq. 67.

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Correction

August 2005, page 16—In the second paragraph of the Albert Einstein letter to Max Born, the first parenthetical comment in the fourth line should read "such as a macroscopic parameter." ■