theory, the area in which John made his greatest contributions. I can still remember discussions John and I had about his vision of the use of neutrinos for astronomical purposes, in which I heatedly denied the possibility of any such thing as neutrino astronomy. Well—he was right, and I was shortsighted. (I don't recall what Konopinski's position on this was.)

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LIGO precision understated

I enjoyed Philip Bucksbaum's enthusiastic reference to the precision measurements attained by LIGO, the Laser Interferometer Gravitational-Wave Observatory (PHYSICS TODAY, June 2006, page 57). Bucksbaum and your readers may be pleased to know that these achievements were actually understated.

LIGO instruments detect changes less than a thousandth of a proton diameter over a distance of 4 km. A proposed LIGO upgrade is expected to improve displacement sensitivity by a further order of magnitude.

The Laser Interferometer Space Antenna, a planned space-based detector, will not have such fine displacement resolution, but it will span 5 million km, so its strain sensitivity will be comparable to LIGO's. LISA's greater length means space and terrestrial experiments will sample complementary, nonoverlapping frequency ranges, and thus target different realms of astrophysics.

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Superparticles on the energy horizon

In his article "Is String Theory Phenomenologically Viable?" (PHYSICS TODAY, June 2006, page 54), Jim Gates extrapolates from past discoveries to estimate the time of discovery of new massive elementary particles such as those predicted by supersymmetry. He uses the discovery dates and measured masses of the neutron and the W boson, and proposes that "one can crudely estimate the rate at which humanity is progressing in its ability to detect massive particles: about 1.5 GeV/c^2 per year. Thus, if Nature is kind enough to provide light superpartners, one might still expect about a century to pass before a superparticle is directly observed."

A more appropriate extrapolation would be from the discovery of the bottom quark ($mc^2 \simeq 4.5$ GeV) in 1977 to the 1995 discovery of the top quark ($mc^2 \simeq 175$ GeV), a rate of approximately 10 GeV per year. Given that 10 years have passed since the top discovery, using these two points to extrapolate might lead Gates to conclude that we're already overdue for another discovery.

Neither of these extrapolations is relevant, however. The timing of discoveries at accelerators will be determined by investment in facilities such as the Tevatron, the Large Hadron Collider, and the International Linear Collider, and in talented people who work on the machines and detectors and who analyze the data, including theorists who develop the techniques and tools necessary to compare the data to standard model predictions. I hope these efforts have Gates's full support and that of the string theory community.

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Gates replies: A longer article would have indicated that the advance of the energy frontier is a complicated function. Henry Frisch has made reasonable suggestions for some of its independent variables.

Though possessing a career-long interest in supersymmetry, I recall from graduate school that given a scatter-plot of data to make a linear fit to a complicated function, one generally does better using the longest possible baseline. Thus, my estimate is likely the more accurate. Besides, when a theorist finds a number that is correct to within an order of magnitude, victory is usually declared.

Researchers excited by superstring/M-theory are foremost and thoroughly dedicated and well-trained *physicists*. Accordingly, they are rooting most enthusiastically for the success of their experimentally driven colleagues, if for no other reason than the opportunity for vindication. It would be a point of great pride to have clearly perceived "the mind of God."

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Salivating over chocolate

Erich Windhab's Quick Study item about the complex rheological characteristics of chocolate (PHYSICS TODAY, June 2006, page 82) seems to be missing one ingredient—saliva. Doesn't the combination of chocolate's taste and odor stimulate the generation of saliva and thereby affect the fluidity of the product even while it is melting? Therefore, doesn't this factor alter the conclusions of the study?

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Windhab replies: Saliva does interact with the chocolate during consumption. That interaction affects not only the flavor of the chocolate but also its flow properties. However, the effects are taken into account in the article's conclusions that refer to sensory properties. Consumers' strongly differing saliva productions during chocolate consumption could make sensory testing results inconsistent, but we did not see such differences among our test participants.

Erich Windhab
ETH
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Corrections

February 2007, page 40—The energy of attraction given by equation 2 should have a minus sign.

February 2007, page 41—In equation 4, the area *A* should be in the numerator, not the denominator. ■