letters

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(extreme) confusion.

Although to the science-oriented individual the specific (particular) meanings of such words are obvious and may be determined readily from context, people who are not science-oriented may fail to understand what they are reading or hearing simply because they don't realize the words are being used in any sense other than the common ones. Because they are not understanding what appears to be ordinary English, they assume they can't possibly understand science, and we are on our way to reinforcing the alienation from the scientific and technological fields that has developed over the past decade.

As scientists and educators we have an obligation to do what we can to reverse this alienation. One step is to recognize jargon when we use it in the classroom or community, and a second is to be sure our listeners realize that such words are indeed technical terms. Science teachers in college and high school should not assume that discussing or illustrating technical concepts is sufficient. The best explanation of potential difference will not be successful if the student is thinking "possible" or "different ability" rather than "voltage." The whole concept of ideal gas behavior is lost if "ideal gas" is assumed to be the brand of gasoline that gives the best mileage.

Admittedly, this awareness will not in itself make the public more supportive of science education; but if those who are not science-oriented become more comfortable with the language itself, then they might find that science is not quite so strange and intimidating after all. And that would be a beginning.

Reference

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Identifying the Higgs boson

In the article entitled "Has the Higgs boson been seen in the Crystal Ball?" (October, page 18), there is a common misconception that your readers should be alerted to in case other small, narrow resonances are discovered in the $c\bar{c}$, $b\bar{b}$ or $t\bar{t}$ resonance regions.

You state that a normal $b\bar{b}$ resonance "would obey e–μ–τ 'universality.' That is to say, because it couples to lepton pairs only by way of an intermediate virtual-photon state, a decaying heavy meson would have roughly equal branching fractions to e^+e^-, $\mu^+\mu^-$ and $\tau^+\tau^-$." The statement is true for the example you use, the upsilon (9.46 GeV), but many other $b\bar{b}$ states decay to lepton pairs in a "universality"-violating way. Consider, for example, the $^1S_0$ state of a bound $b\bar{b}$ system. The lepton-pair decay modes of this pseudoscalar meson strongly favor the $\tau^+\tau^-$ channel. As a matter of fact, the decay width is proportional to the square of the lepton mass just as it is for the Higgs—but, at first sight, for an entirely different reason: helicity suppression. Vector (and pseudovector) couplings prefer to conserve helicity. Vertices that involve helicity flip pay a penalty depending on the lepton mass. This argument is familiar to many particle physicists as the explanation for the π meson's preference to decay to $\mu\nu$ rather than $e\nu$.

In the case of the Higgs decay, there is no vector coupling. The reason the Higgs prefers to decay to the heaviest possible lepton pair is linked to its role as generator of mass. The cancellation of ultraviolet divergences in the $SU(2)\times U(1)$ gauge-field theory depends on the mass dependence of the Higgs coupling to leptons being the same as the mass dependence of helicity-suppressed decays. So it is no accident that the Higgs and $^1S_0$ mesons decay to lepton pairs in the same way.

I have attempted to calculate the decay rate for all $b\bar{b}$ states into lepton pairs. Those that violate e–μ–τ "universality" also tend to have exceedingly small decay widths, even to $\tau^+\tau^-$; these widths are much smaller than those that a Higgs in the 10-GeV mass region would exhibit. (These calculations have very large uncertainties, however.)

In conclusion, if a narrow resonance is found in the mass region of the $c\bar{c}$, $b\bar{b}$, or $t\bar{t}$ mesons, whose decay rate to a lepton pair is proportional to the square of the mass of the lepton, it is not necessarily the Higgs. It might be one of the many meson resonances that must decay to leptons of equal helicity.

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The gyroscope experiment

The article by Barbara Levi (May, page 20) on the "Orbiting test of general relativity" is misleading in several respects. A subsequent letter by C. W. F. Everitt (August, page 84) partially clarified the situation in one respect but then confused it in other ways.

Referring to the work of B. M. Barker (University of Alabama) and myself, Everitt quoted a 1974 paper of mine, completely ignoring many relevant subsequent contributions. In addition,