channel." Experimenters are guided mainly by their own intuition and by the phenomenologists, who are highly undervalued in this debate between theory and experiment. The phenomenologists analyze the experimental information without too much prejudice from unreliable theories. They then attempt to provide guidance regarding profitable directions in the search for new knowledge. Their papers are generally criticized by nitpicking theorist referees and judged by comparison with published theoretical papers that will probably turn out to be wrong. Phenomenologists can thank Paul Ginsparg, who established the online electronic print archives at http://arXiv.org, for giving them a way to reach the experimenters who need their advice without having to deal with obnoxious referees.

Here is one small example of the problems faced in looking for clues to new physics. In 1998, I noted that decays like $D^+ \to K_S + \pi^+$ had contributions from Cabibbo-favored and doubly suppressed decays, and that this might lead to a direct *CP* violation between charge conjugate D^+ and D^- decays. The standard model says that both the favored and doubly-suppressed amplitudes depend on the same Cabibbo-Kobayashi-Maskawa matrix elements and there should be no *CP*-violating relative phase. But suppose some new physics contribution has a *CP*-violating phase. This new physics could give a direct *CP* violation between charge conjugate D^+ and D^- decays. This can be easily verified when data are available. Even if there is no effect, and no new physics theory that predicts an effect, such data provide information that can be used to constrain future new physics models.

When I suggested this idea to my experimental friends, the response was, "Interesting! Too bad you didn't tell us sooner. It would have been trivial to check this at the early stages of our experiment, but now it will involve remounting many tapes and a lot of work and expense. We cannot justify that without a good theoretical reason." I wrote up my suggestion and put it on the Web as http://arXiv.org/abs/hep-ph/9810375. I tried to tell all my experimental friends who were planning future experiments so that they could test this and similar ideas in time. Of course I never sent the paper for publication. At my age I don't need the credit, and I have no patience for ridiculous arguments with referees.

Today, progress in particle physics depends on the work of postdocs who analyze the tremendous amount of data accumulating at accelerators, and who must establish some record to get future jobs. They need input from good phenomenologists who can point them in profitable directions. Theorists are only marginally useful.

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Kepler's Singular Harmony

In George Gibson and Ian Johnston's article on the physics of music (PHYSICS TODAY, January 2002, page 42), box 2 on Johannes Kepler's "The Harmonies of the World" contains two interesting errors. Because a final *s* on a Latin word normally designates a plural, at first glance the title of Kepler's *Harmonices mundi libri V* suggests the translation "harmonies." However, Kepler was being erudite, taking harmonice as a Greek word and giving it the Greek genitive singular ending. Because he passionately believed in the unity of the cosmos, he used the singular form; for him the title was *Five Books on the Harmony of the World*.

In book 5, chapter 3, Kepler stated his newly discovered harmonic law as the constant proportion between the cube of the planet's mean distance from the Sun and the square of its period. Concerning his "wonderful speculations," he wrote in his preface to book 5,

> I yield freely to the sacred frenzy; I dare frankly to confess that I have stolen the golden vessels of the Egyptians to build a temple for my God far from the bounds of Egypt. If you pardon me, I shall rejoice; if you reproach me, I shall endure. The die is cast, and I am writing the book—to be read either now or by posterity, it matters not. It can wait a century for a reader, as God himself has waited six thousand years for a witness.

Incidentally, Kepler did not call that harmonic relationship a "law" or single out three particular relationships. The idea of a "law of nature" was introduced into English when Robert Boyle used the expression decades later. "Kepler's laws" were apparently first selected and numbered by the French astronomer Joseph-Jérôme de Lalande in his *Abrégé d'astronomie* of 1774.

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New Era for Physics Includes Outreach

I recognize that a great deal of work went into the Physics Survey Overview Committee's report *Physics in a New Era: An Overview*, which was discussed by Thomas Appelquist and Donald Shapero (PHYSICS TODAY, November 2001, page 34). However, I am disappointed by the generalities and platitudes in the recommendations. There can be little disagreement with any of them, but I wonder if we needed to expend all the time and money to come up with just these. Such reports have little more result than has come from congressional hearings to eradicate drug smuggling or to improve Scholastic Aptitude Test scores in high schools.

A major problem confronting society is the lack of knowledge among the public as to what science is, what constitutes scientific thinking and analysis, and what science's criteria are for determining the correctness of statements about the phenomenological world. Given this lack of knowledge, it is not surprising that pseudoscience, antiscience attitudes, and calls to return to medieval, anthropocentric, and scriptures-based worldviews abound. There needs to be a carefully considered plan of action to promote science and to inculcate appreciation for, and sensitivity to, science as a cultural enterprise that is beyond laboratories and the intellectual ivory tower of academic seclusion.

As is done occasionally with public service messages about charitable acts, respect for other cultures, and tolerance to all nonhurtful belief systems, the basic results and worldviews of science and scientists could be shown briefly on TV screens during commercial slots of popular shows. One can learn from Madison Avenue in this context. If we can