The LIGO Controversy

I would like to clarify my views as presented in John Travis' article "LIGO: A $250 million gamble" (News & Comment, 30 Apr., p. 612). As I explained to Travis, I see the LIGO (Laser Interferometer Gravitational-Wave Observatory) conflict in terms of the difference in communal values of physicists and astronomers. Physicists place great value on establishing upper limits on the detection of new quanta, so that even if there were a null result, physicists would believe that something valuable had been learned about how to measure gravitational waves. Astronomers place primary value on increasing their store of information about the cosmos, and because there can be no guarantee that LIGO will produce astronomical results, they are uneasy. There is therefore bound to be conflict over the expenditure of such large resources on a project that uses astronomical sources to make physics measurements. I see merit in both points of view and am aware of the pain that the LIGO affair is causing both communities. I allowed to Travis that they will not easily forget this pain.

This comment, the only one of mine Travis quotes in the article, is placed in a context which makes it appear that I am among those who complain about LIGO. My remark, meant to express neutrality, was "added" to that of an anonymous individual who was far from neutral.

Because I am the chair of the National Research Council's Board on Physics *and* Astronomy, my primary concern is to improve communication between the astronomy and physics communities, so that we can perhaps learn how to deal better in the future with issues on the interface between them.

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A Competitive Education

The AAAS, the National Research Council (NRC), and the National Science Teachers Association (NSTA) all are involved in projects intended to improve science education in the United States. Their efforts, Project 2061 (AAAS), National Science Education Standards (NRC), and Scope, Sequence, and Coordination of Secondary School Science (NSTA), are being coordinated and staffed by scientists and teachers of the highest competence and unswerving devotion. It is unfortunate, therefore, that the projects are likely to have little impact on the effectiveness of U.S. science education.

One of the goals of a restructured science education program is to produce graduates who would become workers as productive as those in the advanced economic nations who are our industrial competitors. Thus it is relevant to compare our system of science education with those of other industrial nations. The following features stand out.

On the average, U.S. secondary school students spend about 179 days in classroom instruction annually. Students in Germany, Israel, France, Italy, Japan, and other economically advanced nations attend school for about 240 days a year; the school days, themselves, often are longer than ours. Our short school year was set in concrete 200 years ago when children were needed to work on farms during the summer—a situation no longer reflected in modern day reality. Our 18th-century school year does not fit the needs of the 21st century. When they graduate from high school, U.S. students will have had one-third less classroom instruction than their counterparts in economically competitive nations.

Science teachers in the United States, if they wish to improve their competencies, must spend their own funds to attend evening classes or summer sessions. In Japan, science education centers are located in each prefecture. As part of their periodic responsibilities, Japanese science teachers are assigned to the centers for instruction designed to upgrade their competencies.

In theory, what is taught to students in American schools is determined by 15,300 local school boards and 50 state departments of education. However, because 70 to 90% of the instruction in schools is based on the textbooks used, the role of the textbook publisher is paramount. Textbook publishing in the United States is a highly competitive business and publishers cannot be faulted when they favor profits from sales over educational effectiveness. Consequently, they produce insipid books that are neither challenging nor interesting to students, but are profitable because no one objects to anything they contain. Other economically advanced nations, recognizing that education is of significant national importance, recruit some of their best scholars and practitioners to produce guidelines for what should be taught in their schools. Regardless of how textbooks are produced in those overseas nations, they are required to conform to those guidelines.

In summary, the greatest respect is due the devoted people involved in science education programs. To improve science education, however, the schools must be restructured. Required are a substantial increase of the time students spend in the classroom, year-long employment of teachers with a built-in retraining program, and the mandating of a curriculum designed by the groups mentioned above.

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The Science and Policy of Risk

The letters by Robert K. Adair and H. Keith Florig (18 Dec. 1992, pp. 1868 and 1869) concerning the potential health effects of electromagnetic field exposure do not tackle head-on the pertinent central questions in the interaction of science and public policy. Most of us can clearly identify the positive evidence needed to identify a risk. But how much *negative* evidence do we need to discount a particular suspected risk relative to other lines of necessary research? We must answer this question to the satisfaction of both the scientific and the general public before we can design and evaluate a meaningful research program. Inherent in the discussion of Florig is a second important question: Who decides what fears are justified and what levels of voluntary and involuntary risk deserve attention? The National Academy of Sciences set up by Abraham Lincoln to advise the government? Lawyers for self-appointed public interest groups? Elected officials or public forums?

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