Our office strives for honesty, accuracy, and clarity in translating Hubble results for the news media. We also work to visualize astronomical research to further educate the public. Besides incorporating this work into our own educational materials (video animation, posters, newsletters), we also work closely with textbook authors who readily incorporate Hubble's scientific results into their latest editions.

I can state unequivocally that press releases about Hubble research are derived from genuine enthusiasm and excitement over the results. These releases undergo many levels of review and scrutiny by co-investigators, program scientists, and project managers. To belittle this process as an exercise in hype or misinformation demeans the research of those astronomers who have gone to the extra effort to share their results with the public.

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I fear that Flam's article "NASA PR: Hype or public education?" may leave readers with the impression that NASA and astronomers have deceived the media and the public concerning my analysis of Hubble Space Telescope observations of the deuterium abundance in the universe. Flam correctly explains that the ratio of deuterium to ordinary hydrogen only measures the density and thus the gravitational force of ordinary matter in the universe. In my statements to the press at the January 1992 meeting of the American Astronomical Society in Atlanta, I made it clear that if there were no missing or "dark matter," then the universe would expand forever, but that there is dynamical evidence for much dark or exotic matter, perhaps enough of it to halt the expansion eventually. The other participants at the press conference supported this conclusion, and the subsequent articles in the *New York Times*, *Washington Post*, and elsewhere cited this important point. While it is unfortunate that the NASA press release included the words "endless universe" in its title, the text made it clear that dark matter could eventually halt the expansion. Contrary to Flam's assertion, NASA's press release made it clear that this result was not a "new discovery," but rather a far more accurate measurement that agrees with previous results obtained, for example, with the Copernicus and International Ultraviolet Explorer satellites. In this case it appears that some members of the media overstated my conclusions and what was actually said in the NASA press release.

In my experience, many reporters are primarily interested in "newsworthy" results, which they consider to be only those extraordinary observations that definitively refute or spectacularly confirm previous ideas or suggest entirely new directions for scientists to pursue. Alas, such results are rare.

I believe the public would be better served, and scientists would be more comfortable, with media people who describe most important scientific results as what they really are—incremental steps in the evolution of scientific understanding.

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## Earth's Early Mantle

I was surprised by Richard A. Kerr's report of the favorable reception given at the recent meeting of the American Geophysical Union (AGU) to V. Rama Murthy's theory about the siderophile element abundances in Earth's mantle (Research News, 18 June, p. 1724). My impression was that most geochemists remained skeptical. The "barely constrained outrage" with which geochemists

are supposed to have greeted Murthy's original paper (*1*) had nothing to do with legitimate questions such as the extent to which the early Earth was molten. The "outrage" was over the fact that a substantial number of scientists, including respected geophysicists, could swallow as "heuristic" an exercise that violates fundamental scientific principles. Murthy's calculation should not be extolled as "simplistic"; it is straightforwardly wrong, and there is an important difference. Basically it boils down to a violation of the principle of conservation of mass (*2*, *3*). This would have been clear originally if iron had been included in the elements considered.

Reasonable methods for extrapolating experimental data to the high temperatures invoked by Murthy can be found in textbooks of physical chemistry. The high-temperature scenario can be tested with the use of existing experimental data (*3*) and can readily be shown to be inadequate; this, rather than an epidemic of intellectual myopia, is why most geochemists moved on long ago to less simple models.

It is worth noting that the algebra Murthy used in his extrapolation imposed a systematic trend on the way partition coefficients change with temperature, so that they tended toward unity with increasing temperature. A similar trend in direction is predicted by thermodynamics (*3*), but the effect is orders of magnitude less pronounced. That his measured partition coefficients tend toward unity with increasing temperature is presumably the reason for David Walker's otherwise inscrutable statement that Murthy "hasn't done a bad job of predicting what goes on." In his presentation at the AGU meeting, Walker showed preliminary results for metal-silicate partitioning at two impressively high temperatures. Discussion of the reliability of these data is best left until the study is ready for publication (the two experiments contained several surprising anomalies); taken at face value, however, the partition coefficients presented by Walker refute rather than confirm Murthy's hypothesis, in that they do not give a satisfactory explanation of the mantle siderophile abundances.

The tone of Kerr's article implies that a satisfactory explanation of the siderophile element abundances in Earth's mantle does not already exist. In fact, it was pointed out a decade ago that heterogenous accretion could account for the main features of the observed abundances (*4*); and I have recently given this model a quantitative gloss, in the context of a wider model for the Earth-moon system (*5*). It is true than any heterogenous accretion model must multiply entitities over homogenous accretion, but not excessively so; and the essence of the heterogenous accretion model can be summarized in three simple steps: (i) accretion of approximately 85% of the present Earth under reducing conditions, with near-contemporaneous metal segregation to the core; (ii) addition of about 15% oxidized, volatile-rich material (cosmochemically these go together), with further separation to the core of the sulfur contained in this material; and (iii) addition of about 0.5% "late veneer."

Murthy found that his algebraic manipulation could not explain the overabundance of nickel in the upper mantle and was accordingly forced to invoke the olivine flotation hypothesis (*6*). His model is thus effectively two-staged. For a mere 50% increase in complexity, the heterogenous accretion model gives an exact match with the observed cobalt/nickel ratio and the chondritic rhenium/osmium ratio plus chondritic relative abundances of the other nobel metals, and explains the remarkably low abundance of sulfur in the mantle, all of which Murthy's calculation does not achieve.

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## Quantum Wave Measurement

I would like to correct a misleading impression that a recent Research News article by David H. Freedman ("Theorists to the quantum mechanical wave: 'Get real' " 12 Mar., p. 1542) may have created. The article does an excellent job of explaining the physical idea of "protective" measurement, but it attributes this idea to "two theorists," Yakir Aharonov and myself. The idea originated with the work of Aharonov, who is at the University of South Carolina and Tel Aviv University, and Lev Vaidman of Tel Aviv University (*1*). I, who did not interact with Vaidman on this subject, joined the collaboration later on.


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## Corrections and Clarifications

In Marcia Barinaga's Research News article "The brain remaps its own contours" (9 Oct. 1992, p. 216), the cause of the eye's natural blind spot was incorrectly stated. The blind spot corresponds to the point where the optic nerve enters the retina.

The first sentence in Charles P. Casey's Article of 12 March, "Organorhenium chemistry" (p. 1552), should have read, "In 1925, rhenium, the last of the elements with a nonradioactive isotope, was discovered."

The poll of aspiring physicians reported in the Random Samples of 11 June (p. 1587) and published in the May issue of *Academic Medicine* was not commissioned by the Association of American Medical Colleges, as stated, but by Alpha Omega Alpha Honor Medical Society.

Throughout the item "Addressing the envelope" in the 2 July This Week in *Science* (p. 9), the word "luminescence" incorrectly appeared instead of "luminance."