

continued from page 15

Perhaps if methods for determining distances without using redshift are developed that are very reliable at large distances, we will be able to reliably know the cosmic distance scale.

Any region we can imagine surveying completely in three (or even two) dimensions is so small that the light travel time across it is a small fraction of the age of the universe. Therefore the tests of changes in the geometry of space-time or in the large-scale clustering of galaxies that Shepard proposes would merely show noise. Some studies using narrow, deep "pencil" surveys have been under way for years, trying to accumulate enough data to reliably perform tests related to the ones he proposes, but based on galaxy counts.

ADRIAN L. MELOTT
University of Kansas
Lawrence, Kansas

5/87

SHEPARD REPLIES: I assume in my proposal that galaxies manifest redshifts determined by their recessional velocities (at the times their observed energies were emitted), that the distances between the galaxies' locations then and Earth now increase monotonically with those redshifts, and that galaxies are distributed isotropically in space (at any given time). I do not assume knowledge of an independent distance scale or of properties of early galaxies (as is required for inferring distances via "galaxy counts").

I proposed that we estimate distances by monotonically transforming redshifts to render features in the redshift diagram consistent with spatial isotropy. We can remove systematic elongations (or contractions) of intergalactic voids along their radial directions from Earth by differentially contracting (or expanding) corresponding regions of the redshift scale. (We can also conformally map the transformed diagram to a curved manifold, to ensure that perimeters of concentric circles around Earth increase with their radial distances in the nonlinear way that renders the implied smaller scales of the earlier universe consistent with distances in the resulting mapping.)

Present redshift surveys may not extend sufficiently in angle or redshift to constrain the required transformation. I suggested only that cosmic distances might be established in this way "eventually."

ROGER N. SHEPARD
Department of Psychology
Stanford University
Stanford, California

9/87

ETHICS FOR FUTURE PHYSICISTS

The APS directed-energy weapons report in the May 1987 issue (page S1) is certain to bring to mind in many readers the ethical problems that scientists who do SDI and other weapons research must face. They will remember these problems even more sharply if they flip ahead a few pages in that issue to read the budget report (page 59) and note how much of the 1988 science budget is allocated for military R&D. While SDI poses special and immediate concerns for the scientific community, the underlying issue behind the SDI debate is that of science's role in weapons research in general. The scientific community seems to have divided into three camps: those who oppose weapons research and won't do it, those who favor it and those who are not in favor of it but who do it anyway because a lot of good research can be done with the money. Soon there will be another group, however, composed of scientists who are undergraduates now and who just don't care as long as there is prestige and money involved in what they are doing.

This is extremely evident here at the University of Dayton. The university's department of physics and the University of Dayton Research Institute's applied physics labs are closely tied in with the R&D labs at Wright-Patterson Air Force Base. With a few exceptions, all junior or senior physics majors at Dayton work on projects for the Air Force through UDRI and Wright-Patterson. Engineering and chemistry majors are also accepted for defense-related work, either through the research institute or the base or through one of the many businesses in the Dayton area whose sole reason for existence is Wright-Patterson.

Whether it is unethical for these young scientists to work for the Air Force is a matter of opinion. But what is not so much a matter of opinion is the attitude with which students approach this work. The "get ahead" ideal that has infested many other undergraduates has also afflicted physics majors. No one at Dayton so much as considers whether DOD research is the sort of work a scientist should pursue. Some are doing the work for the money. Many are doing it for the prestige involved and the benefits such work gives to their resumé. Certain jobs under certain researchers at UDRI and Wright-Patterson seem to carry a sort of honor with them, supposedly because these researchers need

brighter assistants for their work. The bright student who gets one of these "special" jobs does not give any consideration to the fact that the research he is so proudly working on will ultimately lead to the destruction of other people.

Because this sort of attitude seems so prevalent, and because the scientific community is still debating the ethics of DOD research, professors of physics should attempt to instill in students an ethical concern for their work. They do not need to turn students away from DOD research, for at this point in history a national defense is needed and therefore defense research needs to be done. But students should be encouraged to consider the implications, beyond personal gain, of the jobs they are taking.

CHRISTOPHER GRANEY

5/87

Dayton, Ohio

QUASAR MISINTERPRETATION

We wish to correct any misunderstanding that may have resulted from John Kierein's letter (March 1987, page 112). Kierein's letter implies that we had detected relative proper motion between the quasars 3C 345 and NRAO 512, and that we had estimated the parallax distance of one of them. In fact, we detected *no* relative proper motion and obtained *no* parallax distance. In the first instance, for the "cores" of the quasars, we set only a firm upper bound of 20 microarcseconds per year in right ascension and 50 microarcseconds per year in declination. In the second, we set a lower bound of 15 kiloparsecs, valid only on the assumption that the two quasars are at sufficiently different distances from Earth. Thus, in a strictly logical sense, our results prove nothing about whether or not quasars are "local."

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5/87

ARE THE UCS'S SDI SURVEYS BIASED?

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ing SDI, I would like to make one comment on that issue.

As readers of this column may or may not know, the Union of Concerned Scientists periodically mails out surveys to some segment of the American public to compile statistics regarding public opinion on arms control issues. Predictably, questions concerned with SDI account for a significant fraction of the questionnaire. I will not argue for or against SDI here, but I would like to point out a feature of these mailings that strikes me as disturbing, namely, that the surveys are accompanied by letters and leaflets that are severely critical of SDI. To add weight to the UCS's arguments a list of prominent anti-SDI scientists is also included. As an example, question 6 of the January survey reads: "If the Reagan Administration proceeds with Star Wars (SDI), do you think this would be more likely to improve the prospects for arms control or more likely to result in an escalation of the arms race?" For guidance, the accompanying letter reads, "He [Reagan] has done all of this for only one reason: his stubborn pursuit of the futile fantasy that Star Wars can make nuclear weapons 'impotent and obsolete.'"

It seems to me that if you want a person's unbiased opinion about an issue, you don't first tell them how you and "more than half of the living American recipients" of the Nobel Prize feel about this issue. It strikes me as inevitable that this will skew the statistics in favor of the views the UCS holds. I am certain that when all the prominent scientists listed go back to their laboratories they make sure that their experimental data aren't tainted by systematic errors, so I am surprised that similar efforts to achieve unbiased data collection aren't applied in this case. Simply mailing out the opinionated part of the package after mailing the surveys would help a great deal.

Those who have not yet formed an opinion on SDI are probably very confused already. It's not clear to me who gains by having experts hurl questionable statistics at each other.

PAUL SUNI

University of Pittsburgh
Pittsburgh, Pennsylvania

1/87

THE CHAIRMAN OF THE UNION OF CONCERNED SCIENTISTS REPLIES: Paul Suni suggests that UCS is compiling statistics regarding public opinion on arms control in a manner that is bound to yield skewed results. He implies that we are doing so to demonstrate that public opinion favors our position on SDI.

The question of whether a survey accompanied by a letter outlining our position will yield skewed results is certainly debatable. Knowing this, and also that the self-selected nature of the sample negates any statistical validity that such a survey might have, we have never endeavored to publish or otherwise publicize the results of our surveys. They are designed and used only for the purpose of giving UCS some general guidance as to how one particular segment of the public—those who happen to be on the mailing lists we rent or buy and who also choose to fill out the response form—feels about the nuclear arms race. In short, the surveys have been, and will remain, for internal use only.

In contrast to this kind of direct mail survey is the poll of American physicists done for us by an independent polling firm, Peter D. Hart Research Associates, in February of 1986. [See *PHYSICS TODAY*, June 1986, page 81.] This poll consisted of 549 half-hour telephone interviews with members of The American Physical Society, selected by scientific random means. With a statistical margin of error of $\pm 4\%$, the results of this poll demonstrated that by a 2:1 margin physicists viewed SDI as a step in the wrong direction for America's national security policy. These results were publicly released by UCS and widely reported in the press.

We at UCS understand very well the need to apply the same standards of integrity to our public advocacy work that any good scientist would apply to laboratory research.

HENRY W. KENDALL

5/87 Cambridge, Massachusetts

'HALF-TRUTHS' OF US-JAPAN TRADE

I was astonished to find William C. Norris's editorial (February 1987, page 168) in a scientific magazine instead of a trade publication. Many economists and business analysts have stated that there are many reasons other than technology for US trade deficiencies. An article by Hajime Karatsu explains that the superiority of Japanese products based both on high-tech and conventional technology, including semiconductor chips, carbon fibers and air conditioners, does not come from technology flow but mainly from Japan's mode of production.¹

The six reasons for the trade imbalance that Norris gave as a partial list include rumors and half-truths. I

would like to counter some of his points:

▷ Access to US research is almost equal among many countries, including Japan. The NATO countries, Israel, Taiwan and Korea might have better access to military-related research than Japan does.

▷ Japanese labs, both in the government and at universities, are open to foreign researchers, though financial support may not be as liberal as in the US because of the Japanese budgetary system. Though they publish their results mainly in Japanese, important results are usually published in English too. Japanese scientists and engineers often complain that Americans do not pay much attention to Japanese publications even if written in English, dismissing them as inscrutable just because they are written in "Japlish." In this sense Russian scientists, who are eager to read Japanese publications, are less chauvinistic than Americans. Of course proprietary research these labs do for private companies is not freely accessible to other parties, including the Japanese—just as in the US.

▷ The best Japanese graduate students usually do not come to the US but enter the best graduate schools in Japan, join the government or work at big corporations. Graduate students, or for that matter any students, who go overseas do so on their own accord and using their private resources. If they get US support, they get it based on individual merit in competition with other candidates. US intellectual support of Japanese graduate students or researchers is not a one-way street.

▷ I wonder whether Norris would propose that a \$10 000 fee for each foreign student be paid by governments of European countries, Korea, Taiwan, Hong Kong or any country that has a trade surplus with the US. If not, where is the fairness that the US always insists on in arguing about trade with Japan? (For fairness' sake, the trade surplus should be computed on a *per capita* basis for each country.)

▷ The Japanese government, academics and even industries are keenly aware of the shortfall of basic research in Japan. This is due mainly to the facts that basic research started less than 100 years ago, suffered severe damage during World War II and started to recover only 20 years ago. Norris's proposal that the Japanese provide a fund to be administered by the NSF seems to me to be similar to the USSR's proposing that a successfully developing country