

LETTERS (continued from page 15)

taries, some of whom remember the times when they had to erase multiple copies of onionskin on their typewriters.

▷ Another good person to acknowledge is the civil servant who, being your servant and having acted in a civil fashion, approved the grant that allowed you to do the work.

▷ If you are ever tempted to write, for instance, "We owe special gratitude to the people who generated the goods and services and who paid the taxes that allowed us to live in modest comfort and to do the hard but gratifying work reported here," forget it. Everybody will think you have gone mushy.

The obvious conclusion from this recitation of prevailing principles and practices is that neither a list of publications nor the *Citation Index* provides a solid basis for judging the merit of a person's work and that a source of higher-order information must be sought. For instance, we might attach to each of our reprints an affidavit from the person who gave us the idea. These affidavits would not take much time to write, and they could simply say something like "I hereby certify that Dr. X's basic idea to undertake a study of . . . was derived from a conversation held with me on. . . ." This would give us an opportunity to suck up to some big-name folks, who usually have so many good ideas that they can't keep track of which one they gave to whom. Several agencies of the Federal government are in the process of developing the joint funding of a massive research project entitled Higher-Order Acknowledgment and Citation Study (HOACS).

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Distant Supernovae Cast New Light on H_0 Value

Bertram Schwarzschild's recent news story (December, page 19) on new measurements of Cepheid-based distances to Virgo cluster galaxies with the Hubble Space Telescope ended by describing a major unresolved controversy about the cosmic distance scale: Two groups of astronomers have derived significantly different values of the Hubble constant H_0 from type-Ia supernovae. The controversy is particularly perplexing since both groups anchor their results on galaxies with well-determined Cepheid distances.

The story correctly notes that one

side of this controversy maintains that "type-Ia supernovae are not in fact standard candles" and that while "type-Ia supernovae are not monoenergetic, one can deduce the intrinsic luminosity of any one explosion from the time dependence of its observed brightness." This is our position, and indeed these results are derived from our work. The reference given in the news story, however, is to a paper¹ presenting a different analytical method applied to a set of supernova data taken predominantly from our studies.

Our group from the Cerro Tololo Inter-American Observatory of the National Optical Astronomy Observatories and the Cerro Calán Observatory of the University of Chile has just finished a four-year survey of supernovae. The Calán-Tololo survey² has discovered 50 supernovae, of which 32 are type-Ia supernovae out to redshifts of approximately 0.10. Previous papers³ based in part on the data taken during the Calán-Tololo survey have shown that type-Ia supernovae have a small, but real, variation in intrinsic luminosity that is closely correlated with properties in the light curve near maximum light. In our recent paper⁴ presenting the results for a subsample of 13 type-Ia supernovae with well-established light curves, we find values of the Hubble constant between 62 and 67 km sec⁻¹ Mpc⁻¹, with a typical error of 10 km sec⁻¹ Mpc⁻¹.

The advantage of the distant supernova frame for measuring the Hubble constant is that local velocity inhomogeneities in the Hubble flow are relatively unimportant at large distances. The relative supernova distances are apparently accurate to better than 10%. The large error bars on H_0 represent, in part, the uncertainties due to the small number of galaxies (two) for which Cepheid distances have been measured and that have hosted type-Ia supernovae. As emphasized in the PHYSICS TODAY story, we can expect significant improvement in the calibrations of the "secondary yardsticks" from the anticipated HST studies by Wendy Freedman's group and Allan Sandage's group.

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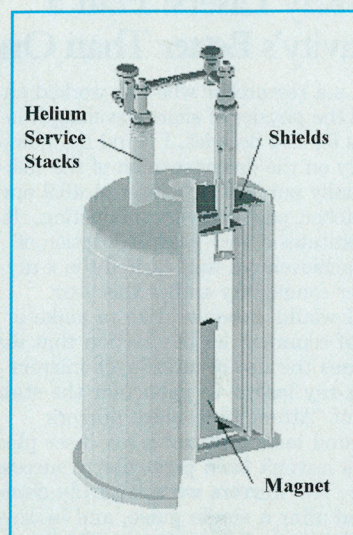
X-Ray Lasers: Half a Cavity's Better Than One

As a researcher who has worked on the physics of short-wavelength lasers for two decades, I found the news story on the demonstration of the collisionally pumped Ar⁸⁺ laser at 46.9 nm (October, page 19) very interesting. It constitutes a very good description of an achievement that excited the x-ray laser community earlier this year.

I would, however, like to make a brief comment on the section that discusses the use of multilayer mirrors in x-ray lasers, in particular the statement "Attempts to place mirrors around laser-pumped x-ray laser plasmas haven't been particularly successful: The mirrors were typically damaged after a single pulse, and in any case the conditions for significant gain didn't last long enough for the reflected radiation to be greatly amplified on the second or third pass." Not mentioned is the half-cavity configuration in which a spherical mirror is placed at one end of the plasma column, to allow a second pass through the medium. That technique has proven to be a very powerful tool in a number of laboratories. In 1991 a Mo:Si mirror employed in the half-cavity configuration boosted the output of a germanium laser at 23.6 nm by two orders of magnitude, resulting in saturation.¹ Moreover, double-passing the laser was seen to significantly improve the coherence.² In neon-like selenium at 20.6 and 20.9 nm, enhanced-efficiency saturation was obtained at Lawrence Livermore National Laboratory using a half-cavity arrangement.³ Finally, at the Laboratoire de Spectroscopie Atomique et Ionique-Laboratoire d'Utilisation des Lasers Intenses we have recently⁴ used a half-cavity arrangement to obtain an 80-fold intensity enhancement of the neon-like zinc laser at 21.2 nm. This latter device, pumped by only 400 joules, delivers 0.4 millijoules in a saturated x-ray beam, making this laser the most efficient demonstration of saturated x-ray operation to date.

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For the half-cavity configuration, mirror damage is not a critical issue. The damage is restricted to a spot of typically 2 mm in diameter, and each mirror can be used many times. With the use of a carefully designed system, we have not found mirror damage to be a limiting factor in x-ray laser design.

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Einstein Red-Baited and Revered

I remember vividly a scurrilous description of Albert Einstein in the popular press that I think might have been included in Abraham Pais's article "Einstein and the Press" (August 1994, page 30). During the McCarthy era of the 1950s, *Life* magazine—the sister publication of *Time*—published its rogues' gallery of photographs of American "fellow travelers" (suspected Communist sympathizers). Einstein and the author Thomas Mann were included. Mann, like Einstein a refugee from Nazi Germany, left the US to live in Switzerland. According to biographer

Ronald W. Clark in *Einstein: The Life and Times* (Abrams, 1984), Einstein considered leaving but decided to stay.

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The article about Albert Einstein by Abraham Pais brought back memories of my meeting Einstein in 1947, when I was a 19-year-old freshman at Princeton University. I still think of that meeting with awe and recently came across a description of it in a letter to my parents. Here is a substantial excerpt (with minor editing for spelling and punctuation):

"Almost invariably when I tell someone that I'm going to Princeton the first question asked is 'How's Albert Einstein?' Previously, I had to pass off the question by telling them that I hadn't any contact with Einstein, but not anymore.

"Last night we played Dartmouth basketball in our first league game of the season (we won). I was all set to go when one of the boys told me that Einstein was going to be at the first Jewish services ever conducted on Princeton's campus, so I changed my mind and became religious.

"Einstein didn't show up for the religious part at all, but afterwards he was brought in. He is a very old-looking man with a tremendous amount of hair and a big gray mustache. He seems so old that one gets the feeling of physical lack of power, and indeed he immediately sat down and remained seated for the whole evening. He spoke with a thick accent, but slow enough and clearly enough so that no one had any trouble understanding him. He explained that he had been invited to speak but now that he was here he wanted to know what we wanted him to speak on. The rabbi asked him to speak on a paper he wrote in 1940 giving his ideas on religion. Well, he outlined his thoughts about God (he didn't believe in one), religion and morals. Then he suggested that we ask him questions if we had any doubts or didn't understand his points. This part of the meeting was supposed to last from 8-8:30. It was 10 pm when it finally, reluctantly broke up. I am firmly convinced that I spoke to one of the greatest people alive. I have never heard a man who could so clearly (even with an accent) explain his point, so expertly find the core of the questioner's query, so logically and satisfyingly give an answer. Never did he reach a point where you could attack his logic, and never did he have to duck a question. There were some mighty rough questions also, such as: Why does he associate