sult, while interesting, was once again insufficient to settle the question of the universe's fate, as was implied in the press release. "This is incredibly far-fetched," says one.

The ROSAT observations in question had revealed x-rays that appear to come from an otherwise invisible gigantic cloud of gas 150 million light-years away. The cloud encloses just three galaxies—not nearly enough mass to anchor it—so there must be some invisible form of matter holding the cloud together. Richard Mushotsky of the NASA-Goddard Space Flight Center and David Burstein of Arizona State University calculated that the cloud had to contain about 20 times as much dark matter as visible.

Extrapolated to other clusters of galaxies, the result implies that the universe contains more than enough dark matter to eventually pull it all back into one giant, collapsing reverse of the Big Bang. That's the extrapolation suggested by the press release. "If small groups of galaxies all have comparable ratios of dark to ordinary matter," it said, "...there might be enough mass in space to 'close the universe'...." And it's the extrapolation many press reports picked up on, though many astronomers considered it a weak link in the argument. Says one, "While the presence of hot gas in the region can be a signpost of a deep gravitational well, to go further is dangerous."

Even the principal investigators admit they don't have enough evidence for the kind of sweeping conclusion presented in the press reports. "Our results are as consistent with an omega of .4 [an expanding universe] as an omega of 1 [in between an expanding and collapsing universe]," says Mushotsky. "But that's not what the press wanted to hear."

Premature publication

Besides overselling legitimate findings, astronomers say, NASA's publicity machine sometimes promotes results to the public before other researchers have had time to evaluate them—and even before the investigators themselves know what they are seeing. Mushotsky says his team caught a mathematical error that forced them to change their claims by a factor of two just days before he was scheduled to announce them to his colleagues and the public. Luckily, he says, his recalculation didn't alter his conclusion enough to call off the press conference, though at the time, Mushotsky admitted to having trouble sleeping at night.

Complaints about premature announcements resounded after the 1992 AAS meeting in Atlanta, following media coverage of a striking Hubble Telescope image of a galaxy that looked like a huge black X. The researchers, led by the Space Telescope Science Institute's Ford, who also reported the dust disk mentioned earlier, guessed that the X might represent gas and dust surrounding a black hole—and that's how it was billed in the press release that went with the image. But most astronomers considered the image a mystery. "It's another interesting observation," says Caltech's Blandford, who studies such unusual galactic centers. "But there are better candidate black holes." And many months later, astronomers say, there's still no paper in a journal explaining why he claims to see a black hole. "I don't know what his [Ford's] evidence is that there's a black hole," says astronomer Sandra Faber of the University of California, Santa Cruz. "It's frustrating."

Steigman and other astronomers don't think the publicity process bears all the blame for what these researchers view as hype. NASA is simply catering to media tastes and public apathy. "NASA may be underestimating the public's taste by relying on spectaculars," says Steigman. Agrees Mushotsky, "Sometimes you have to hype it a little—how else can you get closing the universe to compete with Michael Jordan's sprained ankle?" Nevertheless, many researchers argue that NASA's publicity machine should be throttled back, or at least that more effort be put on explanation and less on promotion. "We should bring people along, not bring the word down from on high," says one astronomer.

But sometimes the current system of press conferences and news events is the only way to get science in the news at all, says AIP's Schewe. "If you let information pour out in a haphazard way you get less coverage," he says. As for claims that the system tends to lavish publicity, on results that don't deserve it, NASA's Maran calls some of the researchers' criticisms "press envy." "Whenever a result gets publicity, other scientists say it's wrong—they are expressing a general resentment that others in their field are getting press or getting quoted and they are not."

But Schewe and Weiler agree with their critics that however the job of informing the public about science is done, it's important to do it right. "When you get a new result you fill your heart with joy and you want to tell people," says Maran. That takes some hard work on the part of researchers, public information specialists, and journalists. "It behooves us," says Princeton theorist Peebles, to get the public honest information. "I try to tell the truth as well as make it comprehensible," he says. "It isn't easy." But it can be done.

–Faye Flam

SCIENTIFIC INSTRUMENTS

Calculator Adds Up the Dollars

Few modern-day scientists would care to have a Schuster-brand calculator in the lab. As big around as a dinner plate and heavy with metal gears, the Schuster can handle nothing but basic arithmetic—and that only when the operator turns a hand crank. But the Schuster's unwieldiness didn't stop a dealer in scientific instruments from paying £7.7 million ($11.9 million) for the instrument at an auction 2 weeks ago. The attraction: The Schuster, at approximately 170 years old, is one of the earliest versions of an ingenious type of calculator known as a step-drum—and is the only one of its type outside a museum.

CHRISTIE'S

Record breaker. 170-year-old calculator fetches $11.9 million.

Crafted by German instrument maker Johann Christof Schuster, the calculator contains unusual "stepped" gears with teeth of nine different lengths, each representing a number between 1 and 9. Schuster spent 2 years building the intricate machine, which includes a lacquered and gilded brass case outfitted with 20 dials to display the numbers.

An unknown astronomer-mathematician who worked for a prince in India once owned the calculator, which was passed down through the family to the unidentified seller, according to the auction house, Christie's of London. The astronomer probably got little use out of it, though, because "it was not particularly accurate or successful," says Gerard Turner, a professor of the history of science at the University of London and a consultant to Christie's. The price, which Christie's says is the highest ever for a "non-fine or applied work of art," surprised auction officials, who priced the Schuster at $23,000-$31,000 in the auction catalog. But no similar machine has hit the market in 70 years, and European museums own the four other step-drums made by Schuster or his father-in-law and master, Mattaüs Hahn. A bidding war with a German museum representative eventually forced the buyer, Edward Mannheimer, to shell out a sum Turner terms "ludicrous. The fact is, it's not novel, it's not from the [time] when mechanical calculators were particularly successful." Still, he concedes, for the fancier of calculating history, "it's a nice thing to have."

–Tracy Watson