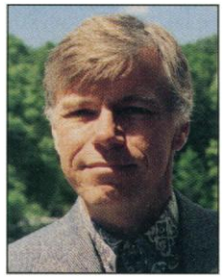
SCIENTIFIC PUBLISHING

Cut the Communications Fog, Say Physicists and Editors

CHICAGO—It's an opening sentence that seems designed to put off even a physicist: "The need to obtain adequate ELMy H-mode energy confinement simultaneous with operation near the neoclassical tearing mode beta-limit and at/above the Greenwald density limit suggests that careful optimization of plasma performance will be required to obtain the desired fusion power performance, and that 'active means' to control or inhibit the onset of neoclassical tearing mode activity—a common precursor of plasma energy collapse or disruption in present experiments operating near the beta and/or density limits—will be required."



"You lose all your readers, but at least you can't be accused of being an idiot."

—Phillip Schewe

Take a breath, and don't worry if that quote from a recent physics journal seems as impenetrable to you as ancient Mayan script. In the past, physicists have fretted over their inability to communicate with the lay public. Now, the flood of unexplained acronyms, cryptic symbols, endless sentences, and nightmarish graphs has risen so high, say some leaders in the field, that physicists can no longer understand each other.

No one is claiming the problem is unique to physics. "My impression is that the state of communication is about the same in astronomy, chemistry, and biology," says Mitio Inokuti, a physicist at Argonne National Laboratory in Argonne, Illinois. But it has become especially painful in physics, in part because of the humbling example of the great writers and lecturers in physics of decades past, such as Enrico Fermi and Richard Feynman. And it's gotten so bad that a band of reform-minded physicists and journal editors has decided to take action. Their first step was a meeting here last April, organized by Inokuti and Ugo Fano of the University of Chicago, to discuss what they see as a fog of poor writing and ideas about how to dispel it. Since then, meeting participants have settled on what Fano hopes is "a gospel that can be accepted in the community"—a set of guidelines for clearing the fog.

The written guidelines will be presented in November to the publications board of the American Institute of Physics (AIP), which publishes many physics journals, in hopes that the AIP will consider officially adopting them. The guidelines suggest that journal editors make clarity of presentation "an [explicit] condition of acceptance of an article," that abstracts be made more generally intelligible and that the best-written articles receive special recognition by the journals. In short, says Steven Rothman, chief editor of the *Journal of Applied Physics*, he and others intend to tell authors: "I can't make you do anything, but I can sure make you wish you had."

Along with cajoling authors, the largest physics organizations are taking steps of their own to mend the communication lines in physics. *Science* has learned that AIP and the American Physical Society (APS) are quietly seeking an editor for a new electronic publication, tentatively called *Highlights*, which would aim to report on selected journal articles in a form comprehensible to physicists in any specialty. The publication, which has secured initial funding but has no firm publication date so far, would likely employ a staff of several science writers and be loosely patterned after the online *Physics News Preview*, now written by AIP's Phillip Schewe and Ben Stein. "The idea is to make a small dent in this loss of general understanding," says Martin Blume, editor-in-chief of the APS. "It is very much along the lines of the [Chicago] conference."

How effective any specific measure will be is a matter of open disagreement among editors, physicists, and science writers. Even the agreement on the "gospel" of good writing didn't come easily. But there's little dispute about the severity of the problem: The state of physics communication was universally deplored at the April conference, held on the campus of the University of Chicago.

The new electronic publication aims "to make a small dent in this loss of general understanding."

—Martin Blume

"We had a disastrous colloquium here yesterday," grumbled Fano, a quantum physicist who has worked with Werner Heisenberg and Fermi. "[The speaker] lost me after three or four minutes." The sin was compounded, said Fano, because unlike departmental seminars, such colloquia are supposed to be tailored for a general audience of physicists. Ben Bederson, the previous editor-in-chief of the APS, added that the colloquia in his own department at New York University are often so bad that he wonders whether it is counterproductive to encourage young students to attend. Instead of kindling their interest, said Bederson, the ordeal "sometimes turns them off from physics."

As the discussion turned to journal papers, the complaints multiplied quickly. "There are papers one-third of which are acronyms," said John Light of the University of Chicago and editor of the *Journal of Chemical Physics*. Obscurity begets more obscurity, said Anthony Starace of the University of Nebraska, Lincoln, and an editor at *Reviews of Modern Physics*, since poor communication between subfields often leads researchers to invent new jargon for slight variations on existing physics. The physics of many-body interactions is similar in chemical, atomic, nuclear, and condensed-matter physics, for example, but each field has its own terminology, said Starace. And since some of the most fertile areas of physics are interdisciplinary, those kinds of barriers may do disproportionate harm.

Starace and others observed that the weakening humanities background of many physicists may be contributing to the trend. Major universities in the United States, for example, have eliminated most literature and language requirements—even foreign languages—for the physics Ph.D. The preponderance of foreign authors—many of whom don't have a full command of English—in journal submissions may also be a factor. Sometimes, though, the reasons behind obscure, techie writing boil down to "basic psychology," said AIP's Schewe: "You lose all your readers, but at least you can't be accused of being an idiot. Instead, the readers are made to feel like they're the idiots."

No one at the meeting saw a quick way out of this communications miasma, but there was no shortage of ideas. Schewe suggested rethinking the role of journal abstracts. Instead of serving as a telegraphic summary that only specialists can follow, he said, an abstract could act as a prose "invitation," or short introduction, to the subject of the paper. Argonne's Inokuti put forth the notion of formally recognizing well-written papers—either by publishing them in a special section of a journal or by issuing periodic awards. "It becomes a line in your curriculum vitae," said Inokuti.

Others focused on catching physicists-to-

be as undergraduates, before poor writing habits have become irreversible. Christopher Fasano of Francis Marion University, a liberal arts college in Florence, South Carolina, described a recently instituted requirement that all physics majors take a minimum number of "writing-intensive" courses there. That category includes certain offerings in the physics department itself, such as lab courses in which reports are stringently graded not just on content, but also on clarity, organization, and style. "Students get better [at writing]," said Fasano. "Practice helps dramatically." If such programs ever find acceptance at the large research institutions that produce most future physicists, Fasano thinks, the journals could see that same dramatic improvement.

What's needed most is "basic training," agreed Argonne's Nghi Q. Lam, editor of *Applied Physics Letters*. "We should have some kind of standardized textbook so that every [physics] student—not only in the United States, but also in other countries—receives the same fundamental training in this area." The text would cover everything from sentence structure and style to the proper organization of a good paper, said Lam.

The group has now distilled these discussions into a set of written suggestions for reform—watering down their recommendations in some areas of persistent disagreement, such as the proper role of journal abstracts. Although they expect a sympathetic hearing from AIP's publications board in November, any proposal that requires new resources could face an uphill battle. For writing awards, for example, "there's simply not enough staff, not enough people to be able to judge," says Peter D. Adams, editor of *Physical Review* and the board's chair. Meanwhile, *Highlights* won't be launched until the right editor turns up, says Blume. "The best we could do is get started by the beginning of next year," he says.

To skeptics who say that the reformers' goal of markedly simplifying communication in an increasingly complicated field is unrealistic, Fano responds: "People are very much looking for this kind of guidance." A word from physicists who have seen better days, he says, could make all the difference.

–James Glanz

ARCHAEOLOGY

BLM Accused of Neglecting Clovis Sites

TUCSON, ARIZONA—Over the years, five classic excavation sites have made Arizona's San Pedro River Valley a world-famous source of information about the Ice-Age Clovis people—possibly the first Americans. Yet researchers say that archaeological renown hasn't been enough to secure adequate protection for at least two of the sites. They contend that erosion and vandalism are carrying away research material and limiting the sites' ultimate contribution to knowledge of the earliest Americans. "These sites are some of the most sacred in the New World, but they're being left to the wind. They're washing away in the rain," says Paul Martin, a geoscientist at the University of Arizona in Tucson (UA).

Martin and others lay the blame on the U. S. Bureau of Land Management (BLM), part of the Interior Department, which assumed control of the two most sensitive sites in 1988, when they were incorporated into the San Pedro Riparian National Conservation Area. BLM officials concede there are problems but say they are doing the best they can, given the tight funding imposed by U.S. budget problems.

The two sites that researchers are worrying about have proved a rich source of finds about the Clovis people. One of them is located on the ranch of Ed Lehner; it yielded, for example, the first radiocarbon dates of Clovis materials, as well as projectile points associated with mammoth bones. The other, the nearby Murray Springs site, revealed the first undisturbed Clovis "living floor"—an 11,000-year-old hunters' camp preserved in full stratigraphic context. In the 1980s, however, interest waned as excavation slowed.

Early in its tenure, BLM took steps to conserve the sites. The agency solicited a paper from C. Vance Haynes, the UA geoarchaeologist who excavated Murray Springs, on how to protect and interpret the mammoth sites. And in 1990, BLM gave the Friends of the San Pedro, a volunteer group, $5000 to improve access to Murray Springs with a path and two wooden bridges across Curry Draw, the dry wash that yielded the finds.

Since then, the bureau's efforts have faltered, say Martin and Haynes. At the Lehner plot—now only a series of sandy mounds and trenches overgrown with saltbush—Martin says there are signs in one arroyo wall of wildcat bonedigging. And at Murray Springs, erosion has washed away a 10-meter swath of unexcavated ground that Haynes says is "potentially rich in Pleistocene material."

H. TEIWES/ARIZONA STATE MUSEUM

Better days. Arizona's Murray Springs site, shown here in 1967, has yielded many Clovis artifacts.

Haynes believes the Murray Springs site in particular would yield handsome discoveries with more excavation and the use of new analytical methods. So do others. "There's a potential for much more information," contends geologist Larry Agenbroad of Northern Arizona University. "Just last month, we found new mammoth bones at Murray Springs." But, he adds, "they've really let this place go to seed."

In May, the Tucson-based Southwest Center for Biological Diversity, an environmental group, added its voice to the concerns. The group asked the U.S. attorney for Arizona to investigate BLM for violating federal archaeological and antiquities laws. It accused the bureau of failing to maintain the Clovis sites and claimed that grazing cattle were trampling Indian ruins in the area. The center's Robin Silver says that BLM is "doing nothing" to conserve the sites and because of that, "we're losing these resources."

BLM officials dispute the contention that their agency is "doing nothing." They note, for example, that BLM secured a $10,000 heritage grant from the Arizona Parks Department to install an interpretative kiosk and signs for Murray Springs by 1998. The agency also created a photocopied brochure on the sites for visitors. Outdoor recreation specialist Dorothy Morgan admits, though, that the agency had to scrap plans for a visitor center, as well as conservation efforts—both of which have fallen victim to a tight budget. Tony Harrell, program manager for lands and resources, says that BLM's Tucson field office, which oversees the sites, is struggling to manage nearly 345,000 hectares with a staff of 23 and a budget of $799,000 this year. "There's never any funding or staff," says Morgan.

Despite that, Haynes, Martin, and Agenbroad say that BLM should at least take steps to slow erosion and secure the sites from vandalism. They suggest, for example, frequent monitoring and the installation of a wing dam above the Murray Springs site on Curry Draw to divert rainy-season torrents—an intervention that BLM official Howard Kahlow terms "doable." As to the alternative of doing nothing, the scientists call it no option at all. "This [involves] origins, mammoth kills, critical knowledge about earliest America," exclaims Paul Martin. "It would be tragic to lose this."

–Mark Muro

Mark Muro writes for the Arizona Daily Star *in Tucson.*