equipment that filters out frequencies in which human-made signals create interference, allowing astronomers to observe in peace at nearby frequencies.

Even when observatories can afford it, filtering out unwanted signals won't solve all of radio astronomy's interference woes, however. "Each time there's one of those new interfering signals, it means that's another frequency range that's lost for doing astronomy," explains Paul F. Goldsmith, director of the National Astronomy and Ionosphere Center, which operates the Arecibo Observatory. "It's like putting blinders on a horse so it can only look in certain directions."

The currently protected bandwidths don't encompass all the signals of interest to astronomers, either. Scientists have so far detected thousands of radiation frequencies emitted from more than 100 different molecules. At the far reaches of the cosmos, the expansion of the universe causes the radiation from these molecules to shift to lower frequencies, a phenomenon known as the Doppler effect.

At the NRAO's Green Bank site, a new telescope will include a feature that scientists hope will defeat some of the most troublesome interference. On traditional radio telescopes, a receiver that collects radiation is structurally supported by a tripod centered over the dish. A shortcoming of this design is that the legs of the tripod capture interfering signals and bounce them into the receiver, exacerbating problems.

The new Green Bank telescope, scheduled to be completed this year, moves the support structure to the side of the dish, which keeps it from reflecting unwelcome signals into the receiver.

Radio astronomy is fast approaching a crisis, say many scientists. Feats of engineering may help beat back the interference in the short term, but many radio astronomers are reluctant to rely solely on technical solutions to keep their field afloat.

Some scientists argue that more responsibility for curbing spurious emissions—those signals that leak outside their intended frequency range—should fall to the services that generate the problem. Satellite companies can minimize unwanted noise by designing transmitters more carefully or by using filters to block particular signals.

Whether or not companies choose to do this is partly a matter of economics. Filters, for example, add weight to a spacecraft, driving up launch costs. Some satellite makers voluntarily include filters and other precautions against spurious signals, but astronomers are pushing for requirements more stringent than the current rules.

Perhaps radio astronomers' greatest hope is for the use of frequencies above 71 gigahertz, where much of the cutting-edge research is turning. Commercial interest in these higher frequencies is only now emerging, and at ITU's next allocation meeting, in Istanbul, Turkey, next May, scientists will aim to preserve the relatively pristine landscape they now enjoy at such high frequencies.

"It's inevitable that the commercial organizations will continue to put pressure on," comments ITU's Roger N. Smith. "But I think radio astronomers have to draw a line in the sand to make sure the situation doesn't get any worse, because once they lose the spectrum, it's lost."

"We just have to go on fighting," says Goldsmith. "You're never going to say you've won. The best you can do is to say you haven't lost. And we want to hold on to as much as we can for the future."

It's easy to detect a note of resignation when radio astronomers talk about the noisy universe created by expanding wireless technology. Even as they describe ways to maintain a tenuous grasp on their few prized slices of spectrum, radio astronomers almost always add another quiet observation. If nothing else, maybe someday they can hide their telescopes in a place that's likely to remain quiet: the far side of the moon. □

Chemistry

From New Orleans at a meeting of the American Chemical Society

Treatment makes cotton permanent-fresh

A simple and inexpensive treatment makes fabrics lethal to odor- and disease-causing bacteria, says Jeffrey F. Williams of HaloSource Corp. in Seattle. Such antimicrobial textiles could find uses in sportswear, towels, hospital gowns, and bandages.

Williams and his colleagues grafted compounds called *N*-halamines to cotton fibers with a process developed by Gang Sun of the University of California, Davis. The method resembles that used to give fabrics a permanent-press finish by binding resin to cotton. In the new method, the *N*-halamines hold onto chlorine atoms that then kill any microorganisms the fabric contacts. The researchers report that after 2 minutes on treated cloth, the detectable number of microbes on the fibers drops from 1 million to zero.

The team even conducted a smell test with the help of 10 brave volunteers. Williams and his group placed cat urine and bacteria on treated and untreated fabric. This foul combination "generates ammonia in prodigious amounts within minutes," says Williams. After 4 hours, the smell of the untreated fabric caused volunteers to gag and cough, whereas the treated fabric gave off only a light chlorine odor.

The grafted *N*-halamines stay on the fabric for at least 50 washes, Williams says. A dilute bleach rinse refreshes the molecules with chlorine and restores their antimicrobial activity. Such fabrics could help prevent the transmission of disease in hospitals and may be useful for burn victims, who are especially vulnerable to infection. —*C.W.*

Vanishing ink could bolster recycling

An erasable printer ink could offer a better way to reuse and recycle office paper, say scientists at Toshiba Corp.'s Research and Development Center in Kawasaki, Japan. Erasing a printed document would allow workers to use a piece of paper several times before sending it to a central plant for recycling.

The prototype ink developed by Shigeru Machida and his colleagues contains three components: a dye, a developer, and an erasing agent. When the dye is bound to the developer, it looks black. Dripping a solvent over the ink, however, breaks the bond, turning the dye invisible. A new bond then forms between the developer and the erasing agent. That way, "the color never returns," Machida notes.

The researchers have demonstrated the process by running a pen containing the solvent over a document. So far, they've printed and erased each document as many as 10 times. Machida says, "The printing quality doesn't change, but the paper eventually gets mechanically damaged." Then, dog-eared paper could be hauled to a recycling plant, where heat treatment would make the ink colorless. This could result in whiter recycled paper.

Currently, recycled paper made from office waste often appears yellowish because the ink can't be completely removed. Repeating the conventional ink-removal process does result in whiter paper but requires large amounts of electricity and water. —*C.W.*

Low-fat ice cream can still satisfy

A taste test conducted at the University of Missouri in Columbia finds that most people like low-fat chocolate ice cream as much as its full-fat counterpart. Previous tests with vanilla ice cream found that people tended to dislike low-fat versions, complaining of a harsher, less-smooth taste.

"Chocolate is a very complex flavor" resulting from about 500 different compounds, says chemist Ingolf U. Gruen. This complexity probably masks any taste change due to the lack of milk fat, he says. A panel of eight trained tasters, however, could tell the sinful from the saintly desserts. —*C.W.*