# A new way of making spectral redshifts

In science and technology, people have proceeded on the assumption that once a beam of light has left its source, its properties – particularly the shape of its spectrum – do not change. It has caused some surprise, therefore, that Emil Wolf, a professor of physics at the University of Rochester, N.Y., proposes that in general this is not so: The spectrum of a given source should vary, he says, as the light moves through space (SN: 9/13/86, p.166). It is becoming even more surprising that recently reported experiments support his contention.

The light from a source such as a lamp, a star or anything sized in between is the sum of the outputs of millions or billions of individual microscopic radiators. Traditionally physicists have believed that the spectrum of the light depends only on the physical characteristics of those individual radiators, and that the sum of the individual outputs, which provides the spectrum of the total source, is the same wherever one looks at it.

Wolf, who has been studying the coherence properties of light sources, contends that there is another factor to be taken into account: the coherence relations among the individual radiators. The output of each one of them fluctuates, and whether these fluctuations are more or less coherent or incoherent with one another produces the extra factor. This factor happens to be variable, and it will make the spectrum vary as the light proceeds through space, so that observers at different distances will see a different spectrum. In an experiment reported in OPTICAL COMMUNICATIONS earlier this year, Wolf's colleagues G. Michael Morris and Dean Faklis of the University of Rochester showed that in some cases spectra are in fact not constant.

For hundreds of years no one working with light had noticed such an effect. The reason is that most of the natural and artificial light sources that people deal with are thermal sources, in which the light arises from thermal agitation of the emitting material. These all tend to have a particular degree of incoherence that nullifies the effect, and so their spectra do not change, Wolf told SCIENCE NEWS. Stars, even galaxies, are thermal sources, Wolf points out, but there is one important class of astrophysical sources, quasars, that is generally believed to be nonthermal, and to which his theory might apply.

Believing that the redshifts (a change in frequency and wavelength toward the red portion of the spectrum) of the lines in the quasar spectra are due to velocity alone, astrophysicists use them as estimates of distance, and from such estimates they draw many important cosmological conclusions. Lines are resonant emissions of particular chemical substances that stand out brightly against the rainbow. In the latest experiment, reported in the June 22 PHYSICAL REVIEW LETTERS, Mark F. Bocko, David H. Douglass and Robert S. Knox, also of the University of Rochester, show that lines from a partially coherent source can be shifted to the red or the blue according to Wolf's prediction.

After determining that Wolf's theory applies to acoustics as well as to optics, Bocko, Douglass and Knox set up an acoustical experiment with a partially coherent source because it was easier than an optical one. As radiators they used a pair of loudspeakers. They used electronic circuitry to produce two line-like shapes centered on 1,180 hertz and 1,020 hertz. One of these was split and fed to both speakers equally as a correlated component. The other was split, and half of it was inverted to form an anticorrelated component. Each half was fed to one of the speakers.

With two speakers operating together, the researchers heard a tone that was "redshifted" by 160 hertz from what they heard with each speaker operating alone. By changing the central frequency of the anticorrelated component, they could also produce a blueshift. This, they say, confirms Wolf's prediction.

The significance goes beyond astrophysics, as these developments seem to open a new way of modulating signals for communications technology. In communications, signals have been modulated by amplitude or by phase. Now it may be possible to modulate them by coherence relations. Wolf says he does not know whether such a procedure would have practical use in communications, but he and his colleagues are trying to find out. *– D. E. Thomsen*

# Human fetal-cell transplants planned

Last week's announcement that Swedish scientists had for the first time successfully implanted brain tissue from a human fetus into animal brains – and that similar experiments might soon follow in humans – provided some new hope for victims of Parkinson's disease, but may have opened an ethical Pandora's box as well. The report was presented at an international symposium on mammalian transplant of nerve tissue – the first such meeting to convene since scientists began experimenting with dopamine-producing tissue transplants in humans with Parkinson's disease (SN: 4/18/87, p.244).

More than 30 such human trials, which have so far been limited to transplanting cells from patients' adrenal glands into their brains, were described at the University of Rochester-sponsored symposium. But several of the researchers predicted that brain tissue from aborted human embryos may prove more effective than adrenal tissue for stimulating dopamine production in patients' brains.

"It has been well documented from research with rats and mice, and also to some extent in primates now, that adrenal cells – although beneficial – are not as efficient as 'the real thing' [brain cells] in counteracting Parkinson's symptoms," such as tremors and muscular rigidity, says Åke Seiger of the department of neurosurgery at the University of Miami in Coral Gables, Fla. "Brain cells taken from the embryo have a substantial capacity to grow, whereas the adrenal cells do not normally grow. And these [brain] cells are more likely to be sensitive to the chemical cues normally found in the brain."

Two Swedish groups at the Rochester meeting said they had alleviated Parkinson-like symptoms in animals by implanting human fetal brain tissue, and that they plan to perform such transplants on humans, perhaps within a year. Although none of the U.S. researchers at the meeting announced similar plans, the technique, if successful, is bound to stir both interest and controversy in the United States. Abortion foes have already denounced the practice of using fetal tissue for medical or experimental purposes, arguing that such procedures may make abortions more acceptable.

"The issues at this point are probably more ethical than legal," according to George J. Annas, professor of health law at the Boston University School of Medicine. In most states the experimental use of fetal tissue is legal with the mother's approval, he says. "The question is, if people saw that this was being done, would they try to change the law and make it illegal?"

It's possible, some researchers say, that related research may make the issue moot. There is hope that fetal brain cells from other animals may work in humans, or that genetically engineered cells may do the trick. In addition, says Abraham Lieberman, professor of neurology at the New York University School of Medicine, "Many people are working to develop cell lines of human fetal cells," thus eliminating the need for actual fetuses. "There are going to be problems in doing this," he says. "But it certainly is an exciting approach, and one that is within the feasibility of our current technology." *– R. Weiss*