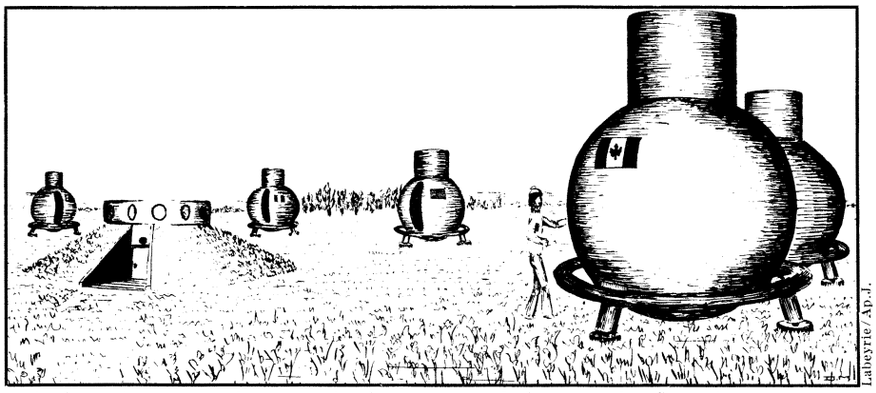
Large optical interferometer proposed



Labeyrie's proposed array of telescopes, each bearing the flag of its nation.

Among the legacies of Albert A. Michelson's concern with the behavior of light is the instrument called a Michelson stellar interferometer. It takes two images of a star formed some distance apart and combines them by mirrors to form an interference pattern in which parts of the light wave front that are in phase with each other reinforce and those that are out of phase cancel, producing a pattern of light and dark fringes. From the fringe pattern fine details about the size and shape of the object can be learned that are impossible with a single image.

Unfortunately, if the images are taken more than a few meters apart, atmospheric distortion (the twinkling effect) renders the phases so hopelessly confused that interferometry is useless. Recently, however, astronomers have been developing techniques that use fast image taking and autocorrelation analysis on computers to reconstruct the images the atmosphere distorts (SN: 8/24-31/75, p. 132). This makes possible the contemplation of really big Michelson interferometers. At least one astronomer, Antoine Labeyrie of the Paris-Meudon Observatory in France, has been experimenting with such things. As a result of his work, he proposes the construction of an international multitelescope array for optical interferometry. (The analogous technique is common in radioastronomy because the atmosphere does not distort radio waves appreciably.)

Labeyrie has been working at the Nice Observatory with an apparatus composed of two 250-millimeter telescopes 12 meters apart that reflect their images into a shed between them, where photoncounting cameras record the combined image. He reports in Astrophysical Journal Letters (196: L71) that he has been able to get a fringe pattern of the star Vega. Not much astrophysical information is yet provided by the observations, he says, but they do show that the star's image is less than five-thousandths of a second of arc across.

The next step is to go to bigger telescopes. Labeyrie believes that 1.5 meters is the most cost-effective size, and he proposes international funding of an array of such instruments, all reflecting their images into a central bunker for combination, recording and analysis. □

Lead and mental retardation

It has been well demonstrated in children, experimental animals and tissue culture studies that lead exposure can lead to neurological damage. For instance, it has been known for many years that children suffer neurological damage, often permanent, from lead poisoning. Hyperactive children have been diagnosed as having significantly higher amounts of lead in their blood and urine than control children (SN: 12/19/72, p. 377). Feeding lead to suckling rats made them hyperactive and depressed nerve transmitters in their brains (SN: 2/15/75, p. 104). In tissue culture, lead inhibited brain enzymes.

So it should come as no surprise that a group of investigators in Glasgow has found a firm correlation between ingestion of lead from drinking water and mental retardation in children. A. D. Beattie of Stobhill Hospital and his team report their findings in the March 15 Lancet. They conclude that "lead contamination of water may be one factor in the multifactorial etiology of mental retardation and that every effort should be made to reduce the lead content of drinking water."

The subjects of their study were 154 children between the ages of two and five years. Seventy-seven of the children were attending clinics in Glasgow because of retardation in mental development, and 77 were nonretarded healthy children forming a control group matched for age, sex and geographic location within the city. The intelligence quotient was below 70 in each of the mentally retarded children being studied.

Beattie and his team collected water samples from the taps of the homes where the children lived. Then they collected blood samples from their subjects. As they report in Lancet, the amount of lead in the water was significantly higher for the retarded group than for the control group—up to 2,000 micrograms per liter versus a ceiling of 800 micrograms per liter. And the probability of mental retardation was markedly increased when the lead in water exceeded 800 micrograms per liter. The 11 children from homes with the highest levels belonged to the group who were mentally retarded. The levels of lead in the blood of the retarded children were also much higher than in the blood of the control children, strongly suggesting that lead from tap water could get into the children's bodies and exert brain damage and lead to retardation.

But how might lead in tap water trigger brain damage? Although the investigators aren't sure, they have some theories. For instance, they suggest that "an increase in lead in the blood may be associated with biochemical abnormalities in the child brain. The energy requirements of the infant brain are greater than those of the mature brain, and it seems probably, therefore, that a substance such as lead, which inhibits enzymes and mitochondrial respiration, will be harmful to the development of the infant brain."

Since lead is capable of crossing the placenta to the fetus, and brain development in intrauterine life is of paramount importance, Beattie and his colleagues also attempted to see whether tap water lead might threaten children as much, if not more, before birth as after birth. However, they were unable to come up with an answer because the water their subjects were exposed to after birth was usually the same as the water they were exposed to before birth.

Although lead is probably only one of many causes of mental retardation, Beattie and his team believe that lead's importance lies in the fact that lead contamination can be eliminated or at least reduced. "The amount of lead in drinking water," they explain, "can be reduced by removing lead from plumbing systems (eg., water tanks and pipes). This is the most satisfactory solution, but will take several years to achieve. The alternative short-term solution, already initiated in Glasgow, is to treat the water supply in the holding reservoirs with calcium salts such as lime at 2-4 parts per million." □