measures of delinquency are critical omissions," say Emery and Marholin. "Although the techniques consistently demonstrate changes in behavior, the question of whether these changes are meaningful to the individual and society remains to be answered." □

X-raying special relativity

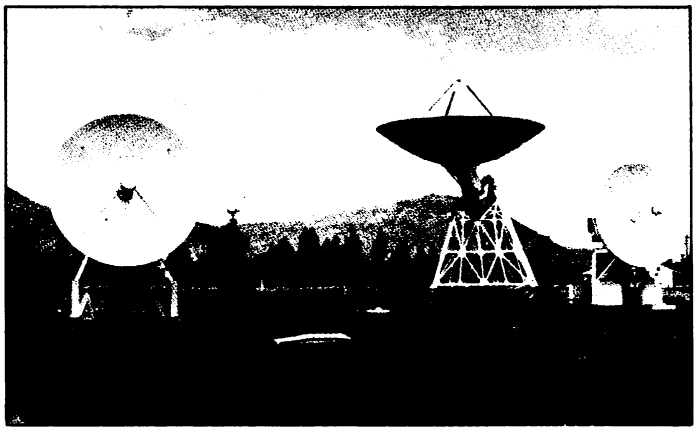
The special theory of relativity pervades all of contemporary physics. From the doings of subatomic particles to the astrophysics of peculiar stars, it is applied every day. The theory is based on two postulates. The first (called the principle of relativity) says that any law of physics that holds in one coordinate system holds in identical form in any other coordinate system moving at a constant velocity with respect to the first. The second is that the velocity of light is independent of the source.

There have been numerous laboratory proofs of the first principle, but, Kenneth Brecher of Massachusetts Institute of Technology writes in the Oct. 24 PHYSICAL REVIEW LETTERS, there have been few experimental proofs of the second, and some of those are ambiguous and not generally accepted. Brecher proposes a test involving binary X-ray sources that he says is more sensitive than those possible in laboratories.

The second postulate is responsible for much of the strange view of space and time that special relativity leads to. It makes light a special case in nature; anything else emitted by a moving object has a velocity with respect to an observer that depends on the velocity of the emitter. Proving the second postulate is not just an academic exercise because a self-consistent theory of electromagnetics can be derived, as W. Ritz showed in 1908, in which the velocity of light does depend on the velocity of the source.

To test the postulate one assumes that it does not hold. In that case the velocity of light reaching the earth from a celestial object would not be the familiar constant c (which is approximately 300,000 kilometers per second) but c plus the velocity of the source. This would make a difference in the observations of binary stars, because the orbital motions of such stars give them a constantly changing velocity with respect to the earth. The effect can't be tested with visual binaries, Brecher points out, because visible light is dispersed by the interstellar medium and comes to a velocity characteristic of the medium, which may not be moving with respect to the earth. X-rays are not so badly affected, and Brecher argues that the timing of a number of pulsing X-ray binaries can be used as a test. His survey indicates that the X-ray binaries support special relativity to an accuracy of 2 parts in a billion. The best laboratory tests are good only to about 1 part in 10,000. □

Listening for intelligent aliens



Univ. of Calif.

A special receiver to search for intelligent alien signals is attached to the middle telescope in this picture of the Hat Creek Observatory in California.

By their radio waves shall ye know them. Such might be called the general principle of scientists interested in the question whether there is intelligent life on other planets in the universe. The question has aroused a lot of interest but very little in the way of observation. The odds against finding anything in a reasonable time are so extremely long that managers of radio observatories are reluctant to devote time to such observations when there are many things needing to be done that will surely bring results, and current radioastronomical receivers are designed to discriminate against intelligent signals so as to filter out terrestrial broadcasts.

Special equipment has been proposed to look for intelligent signals, but some of it carries enormous price tags. One such proposal, called project CYCLOPS, could cost as much as $30 billion. A far less expensive system (one that has cost about $4,000 to date) has been put into operation by the University of California at its Hat Creek Observatory near Mt. Lassen. The system consists of a special receiver attached to Hat Creek's 85-foot radiotelescope, which will process all signals received by the telescope for evidence of intelligent signals.

The project, which is called SERENDIP (Search for Extraterrestrial Radio Emission from Nearby Developed Intelligent Populations), is under the direction of Stuart Bowyer. Working with him are Michael Lampton, Jack Welch, Jill Tarter, graduate student David Langley (who built most of the equipment) and Alvin Despain.

The search has to be of nearby objects since the telescope is much less sensitive (by a factor of hundreds or thousands) than the telescope array proposed for CYCLOPS, and that makes it something of a longer shot than CYCLOPS. However it will not cost observing time because it will piggyback on the observing program of the 85-foot telescope, which will be determined by astronomers' interests in the natural signals of the objects it is pointed toward. □

Dyes boost efficiency of solar concentrator

A transparent plastic seeded with dilute concentrations of dyes, such as rhodamine-6G, is able not only to concentrate sunlight falling on solar cells but also to extend the range of "usable" wavelengths (those able to transfer their energy to a silicon or other photovoltaic cell), according to Ahmed Zewail of the California Institute of Technology. (Photovoltaics transform light energy directly into electricity.) Zewail and colleagues Barry Schwartz and Terry Cole have seeded a plastic, polymethyl methacrylate with 0.0001 molar concentrations of each of three dyes. They found that certain dyes can convert energy entering the plastic at wavelengths around 4,000 to 5,000 angstroms —normally rather unusable wavelengths to silicon cells—to about 7,000 angstroms, a wavelength which silicon cells can convert to electricity with relatively good efficiency.

In this process, incident light absorbed by molecules of two "donor" dyes is transferred to molecules of a third, "acceptor" dye. The acceptor in turn reemits light at "near the narrow wavelength band most efficiently used by silicon cells," about 7,500 angstroms, Zewail says. The smaller the mismatch between the wavelength emitted by acceptor molecules and the narrow wavelength band preferred by the silicon cells, the better the solar-cell conversion efficiency, Zewail told SCIENCE NEWS.

Implanting a dye in plastic is not new, although harnessing a combination of them in a single concentrator like this is, Zewail says. The Caltech team plan to add more dyes in an attempt to further extend the range of usable wavelengths to between 3,500 and 7,000 angstroms.

Because the refractive index of the plastic is so different from that of air, about 75 percent of the "usable" incident light gets trapped within the concentrator where it makes its way, by in-