implications for pollution by stationary sources as well as automobiles. Even if it applied only to the areas with relatively pristine air, such as southeastern Montana, the impact on the energy crisis and the nation's economy could be great. Utilities are building, or planning to build, large complexes of coal-burning power plants in plains and desert regions in the West to supply power to West Coast and Midwestern cities (SN: 3/4/72, p. 156). Ruckelshaus admitted at the press conference that the decision may mean "you cannot put up power plants anyplace," but added, "I don't think it means that." However, one thing is obvious, he said: Fossil-fueled power plants cannot be built any longer in badly air-polluted cities. If the nondegradation decision is strictly interpreted, neither can they be built in the remote areas. Even if the strict interpretation does not hold up, it seems clear that electric utilities must begin looking hard at techniques for curbing growth in energy consumption.

According to Ruckelshaus, some 170 million Americans are now exposed to air pollution violating the "primary," or public health, standards (see map). The implementation plans announced at the press conference will reduce this figure to 80 million by 1975 and to zero by 1977, Ruckelshaus believes. Twenty-seven cities, including Washington, D.C., Baltimore, San Francisco, Los Angeles, Denver, Boston and New York, were granted the two-year extensions on meeting the 1975 goals. Completely approved were plans submitted by Alabama, Connecticut, Florida, Mississippi, New Hampshire, North Carolina, North Dakota, Oregon, West Virginia and South Dakota. Other states all had at least portions of their plans rejected. The primary standards are to be met by 1975, except where extensions were granted. □

A redshift explanation that subverts cosmology

Here and there in the sky are objects that do not appear to be as far away as the redshifts in their light would suppose them to be. According to the traditional belief, the redshift in a body's light is a Doppler shift caused by motion away from the observer: the faster, the redder. The expanding universe hypothesis turns this to a velocity-distance relationship: the faster, the farther away. But there are non-redshift reasons, often connected with energy output, to suppose that some objects are closer than they ought to be.

There didn't use to be many such objects, and what there were were often astrophysically weird, like quasars or Seyfert galaxies, so that cosmologists could ignore them or find explanations based on the weirdness, such as gravitational redshift. Now there are more anomalous redshifts, and some observers have reported instances where two apparently normal galaxies appear physically connected and yet have different redshifts. Cosmologists are being forced to consider anomalous redshifts, in many cases reluctantly because in a well structured physical science consideration of anomalies often amounts to letting the camel's nose into the tent.

If an international group of theorists (French and Australian) is correct—and their proposal is a radical one—anomalous redshifts may be the petard that hoists 20th-century cosmology and does strange things to modern electrodynamics by the way. In the May 26 NATURE J. C. Pecker of the Collège de France in Paris, A. P. Roberts of Monash University in Clayton, Victoria, Australia, and J. P. Vigier of the Institut Henri Poincaré in Paris propose to explain the anomalous redshifts by endowing the photon, the particle of light, with a rest mass.

Although the modern theory of electrodynamics (special relativity) regards the photon as massless, experimenters have repeatedly tried to measure the rest mass of the photon (SN: 7/17/71, p. 46), some out of a desire to confirm the theory, others hoping possibly to overthrow it.

The results of the experiments indicate that if there is a photon rest mass, it is less than 10^{-48} grams. This is nevertheless big enough to do what Pecker, Roberts and Vigier have in mind: namely, to permit inelastic collisions between photons, collisions that transfer energy between them and can thus change their frequencies.

The proposed theory is that photons on their way out of the source collide inelasticly with other photons of the radiation field or cloud of photons near the surface of the source, and the cumulative effect of these collisions is to redden the photons coming out. The three theorists derive an equation whereby the density of the photon cloud and thus the redshift of photons going through depends on the temperature of the source. In this way the anomalous redshift differences between two galaxies that are obviously close to each other would be due to a difference in their internal temperatures. Similarly the hypothesis can explain a discrepancy in the redshift at the edge of the sun.

The proposal has several other consequences: It can explain a troublesome anomaly in the distribution of pulsating stars within our galaxy. In electrodynamics it would mean that photons do not move at the universal limiting speed (the "speed of light"), and the mathematics would have to be reworked to account for that. Finally it would explode modern cosmology by explaining the redshifts of the most distant objects—the evidence for the expanding universe and the rest of modern cosmology—as the result of scattering of their light by the universal background radiation, the so-called three-degree blackbody. Calculating the temperature of the background radiation on the assumption that it causes the redshifts yields the currently accepted measured temperature.

Pecker, Roberts and Vigier propose an experimental test of their theory in which a gamma-ray beam and laser pulses would traverse the same horizontal path. If there are inelastic collisions, photons of different frequencies from the original would show up. "If it works," NATURE remarks editorially, "some tiny discrepancies will be resolved, cosmology will be shattered and electrodynamics will be in disarray. Relativists will await experimental results with interest." □

Radio detection of intersteller formaldimine

A team of Australian scientists have reported the detection of a cloud of formaldimine (CH_2NH) near the center of the Milky Way galaxy. This adds to the growing list of amino acid precursors detected in galactic space. Thioformaldehyde and acetaldehyde were detected from Australia last year.

The formaldimine discovery was made with the 210-foot radio telescope at Parkes, N.S.W. The compound was located in Sagittarius B2, a gas cloud near the center of the galaxy, where astronomers believe new stars are forming.

In order to know what spectral lines to look for, chemists from Monash University had to make formaldimine in the laboratory and record its microwave emissions. Since the compound can survive only a few seconds under laboratory conditions, they had to use fast detection equipment.

Ten days later (May 27 and 28) they detected identical signals from the galactic center; these left them no doubt that formaldimine exists in space. One of the investigators, Ron Brown of Monash, says he has evidence that the total mass of the formaldimine in Sagittarius B2 would about equal the mass of the earth. This would make the volume of the cloud of formaldimine about 500 times bigger than the volume of the solar system.

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