from a continuous-duty, argon-ion laser with two strong lines available, 4880 and 5145 nm. Interaction between the negative ions and the light beam occurs within the laser cavity. The kinetic energy of free electrons photodetached from the negative ions is measured with a hemispherical energy analyzer and an electron multiplier.

The experiment has also been run with hydrogen and deuterium negative ions, whose electron affinities are well known, as references, and the helium electron affinity has been found to be 80.0 ± 2 mV. The absolute total cross section for the photodetachment process was not determined from these experiments. It was found that detachment into the 2^3S state of neutral helium is seven times more likely than detachment into the 2^3P state, for electron ejection essentially parallel to the polarization of the optical field.

Self-Induced Transparency Found in Sulfur Hexafluoride

By applying a short, intense pulse from a Q-switched carbon dioxide laser to gaseous sulfur hexafluoride, Kumar Patel and Richard Slusher of Bell Telephone Laboratories have made the gas transparent to 10.6-micron radiation (*Phys. Rev. Letters* **19**, 1019, 1967). They have thus verified the self-induced transparency first found with a ruby laser system by Erwin Hahn and Samuel McCall of Berkeley (PHYSICS TODAY, August 1967, page 47). To observe the effect, one must match the exciting frequency to a strongly absorbing transition in the sample.

Unlike the Berkeley experiments, which were plagued by the erratic behavior of pulsed ruby sources, the density of absorbers can be easily varied in the gas to see how transmission varies with collision relaxation times of the absorbing levels, the inhomogeneous Doppler line width and the absorption coefficients.

In Hahn and McCall's theory of the effect, the light beam coherently excites the molecules; they interact with each other and emit light; this process delays and reshapes the pulse into one in which the electric field vector varies as sech (t/τ) (where τ is final pulse width) and under certain conditions widens the pulse. They make the simplification that the pulse is short compared with any relaxation time.

Patel and Slusher verified qualitatively the theory at sulfur hexafluoride pressures from 0.01 to 0.05 torr, and with intensities as low as 10 watts/cm^2. Then by adding a buffer gas (helium or hydrogen) to the sulfur hexafluoride they shortened the homogeneous relaxation time. They found that the pulse, besides being delayed (to an apparent speed in the sample 1/20 the speed of light) and reshaped, was narrowed by as much as one half.

In preliminary work Patel and Slusher tried to excite ammonia and ethylene with their carbon dioxide laser but did not succeed because absorption was too low.

The Bell physicists feel that they now have a promising technique for studying relaxation times of individual transitions in gases and gas mixtures.

Somewhere in the universe there may be short, intense, light bursts that pass through gases in space and may produce self-induced transparency in the dilute interstellar medium. Then an astronomer on earth would think the light source (such as the puzzling hydroxyl emitters, (PHYSICS TODAY, November 1967, page 69), is a lot farther away than it really is.

Venus Probes Report: Earth is the Oddball

The atmosphere of Venus is almost all carbon dioxide; below the atmosphere the climate is very dry and hot, and the pressure is 15 to 20 times that on earth. This is the forbidding picture of Venusian meteorological conditions that has emerged from the data sent back by Russia's Venus IV spacecraft and by the US Mariner V.

Spectroscopic observations from the ground had already shown the presence of carbon dioxide on Venus, but the concentration was not known. Estimates made since the first observation in 1934 have fluctuated widely between 1 and 90%. Measurements of the thermal infrared emission showed that the temperature is similar to the earth's at the top of the Venusian atmosphere, 235°K, but observations indicated that it is much hotter at the surface—perhaps 600°K.

Data from the two spacecraft agree that the carbon dioxide concentration is around 90% and that there is no detectable water and apparently only slight traces of oxygen. In addition the Russian Venus probe measured an atmospheric pressure rising from 5 atmospheres at 30 km to about 20 atm at ground level and a temperature range of 270°K at 25 km to 553°K at the surface. This high surface temperature could be an example of the "greenhouse effect;" the Venus atmosphere may be opaque in the infrared but transparent at other frequencies so sunlight is absorbed by the ground and the energy reëmitted by black-body infrared radiation is trapped in the atmosphere. Alternatively it may be due to adiabatic heating where the atmosphere is highly opaque in the infrared and visual (due to dust) and the surface of the planet is heated by the general circulation.

Now that the composition of the atmospheres of Mars and Venus is becoming known it is, strangely enough, earth, with only 0.3% carbon dioxide, that stands out among these inner planets as the "oddball." If, as appears likely, the inner planets were all formed the same way, they might be expected to have similar atmospheres. The explanation could be linked with the presence of life on earth; if all the carbon dioxide in our surface limestone rocks could be released into the atmosphere, its concentration would be 20 times higher than that of nitrogen now. But water trapped in limestone and other crust materials would represent 99% of the atmosphere if it had not been fixed. Any model of atmospheric formation has to account for the presence of all this water, which ought to have been lost from the top of the atmosphere during the first billion years, long before the development of life on the planet.

Ichtiaque Rasool, of the Goddard Institute for Space Studies, recently suggested that earth originally lost most of its atmosphere; the water, carbon dioxide and nitrogen subsequently released from the crust by volcanic activity were reduced by free iron to hydrogen, methane and ammonia. Oxygen was retained as iron oxide. Then the presence of ammonia in the upper atmosphere shielded water molecules