esting way of looking at things, and could lead to more substantial progress before long. As Mackey and Glass observe, if we could really tie a disease to a specific description of some underlying physiological control process, then the search for therapies could be guided by the aim of manipulating control processes back into the normal range.

Ultraviolet lasers for purer silicon

from Andrew Holmes-Siedle

THE range of wavelengths at which laser action can be obtained has been widening as research on new laser materials has continued. That range now extends from the far infrared to the far ultraviolet. Engineers and spectroscopists have been making important advances by utilising the coherence, high intensity and low divergence of the laser in the visible and infrared. Chemists, in general, have had to wait until recently to obtain photochemical effects because few bonds are excited at wavelengths longer than the violet (410 nm, corresponding to a photon energy of ~3 eV). A few rare-gas lasers have been found which operate at very short wavelengths (xenon, krypton and argon at 173, 146 and 126 nm respectively). Since 1975, however, much greater interest has been aroused amongst photochemists by the appearance of a new class of laser—the rare-gas monohalide or excimer type. In these the emitting species is an unusual compound, formed only after excitation of a rare-gas atom, which can then combine with fluorine atoms. For example, the compound of argon would be written as ArF*, an excimer. The fact that this compound cannot exist in the ground state is important in the recycling of atoms to regenerate the excited state after emission. The net result of this unusual form of excitation is that the conversion of a pulsed electrical discharge to an intense, monoenergetic light beam of high photon energy is more efficient than obtained in most lasers. The wavelengths produced are rather conveniently spread about the near ultraviolet as follows

ArF*	193 nm
KrF*	248 nm
XeF*	350 nm

It is an indication of the intense interest that these sources arouse in chemists that these lasers are already available in a neat commercial package, yielding up to 100 mJ per pulse, and capable of many pulses without refill.

Perhaps the most obvious advantages of such a beam are that one may be able to produce chemical reactions very selectively because of the concentration of the beam energy into one wavelength. Up to now, flashlamps have had broad spectra and, even though one could filter out all but one band, one would lose a very large proportion of the available energy in the process. Two workers at the Los Alamos Scientific Laboratory have found a reaction which serves as a very good candidate for such an experiment. In *Applied Phys. Letters* (**32,** 46; 1978), John Clark and Robert Anderson describe the selective removal of impurities from silicon tetrahydride, SiH_4, a gas commonly known as silane. This compound is being used increasingly as an intermediate in fabricating silicon films for semiconductor devices, in which extreme purity is mandatory.

The separation depends on two features: silane does not strongly absorb light in the region of 200 nm wavelength, while the main impurities do so, and the photolysis products of the contaminants precipitate out from the gas. Thus, in principle, one can irradiate the mixture until all the impurities are precipitated. Such a form of purification is quite attractive and rare. Most separation methods rely on 'fractionation', in which the purification step (distillation for example) removes only a fraction—albeit a large one—of the impurities per step and hence several cycles may be necessary, to the detriment of yield of the product. In the present case, we can, in theory, remove the contaminants to the last molecule.

In order to design such a separation, one must have good measurements for the energy absorption and reaction rates of the compounds concerned. To measure these the authors had to overcome some practical difficulties such as the reaction of the gases with the walls of the spectrometric chamber, in order to obtain optical absorption coefficients but found that, in the range 190 to 200 nm, the absorption cross sections for the important impurities in silane, PH_3, AsH_3 and B_2H_6, were about 10,000 times higher than for silane, and that the photolysis products were indeed removed from the gas stream.

So far, only fairly simple separations have been carried out. The authors irradiated mixtures with ratios 10 : 1 and 100 : 1 of one hydride along with SiH_4 using an ArF* laser, of wavelength 193 nm. The changes in concentration were measured by sampling the gas stream with a gas chromatograph. After many laser pulses, the concentration could be reduced by 99% for AsH_3 and 40% for the other impurities. There is no reason to believe that one could go much further by longer or more intense irradiation. A small amount of silane was also lost but the proportion was probably not significant. The authors imply that this type of process promises unusual efficiency in energy use when compared with that used in competing purification methods.

The fact that silane is of growing use in making large-area thin-film electronic layers makes this finding one of some possible future technological significance. Only recently (Wilson *et al. Nature* **272,** 152; 1978), the fabrication of 4.8% efficient thin-film solar cells by the deposition of silicon from silane gas was reported, and p-n junctions in amorphous silicon have also been made from the same source (see *News and Views* **260,** 667; 1976). The greater control one can obtain over the impurities in the semiconductor layer, the greater scope one has for design of new device principles. It is thus encouraging to see that even at this early stage of development, ultraviolet lasers have made a contribution to a key area of purification technology. □

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NATURE

A hundred years ago

COMING TOTAL SOLAR ECLIPSE

There is no doubt whatsoever that the eclipse which will sweep over the United States next July will be observed as no eclipse has been observed before. The wealth of men, the wealth of instruments, and the wealth of skill in all matters astronomical, already accumulated there, makes us Old Country people almost gasp when we try to picture what the golden age will be like there, when already they are so far ahead of us in so many particulars.

From *Nature* **17,** 18 April, 481; 1878.

0028-0836/78/0272—0674$01.00