and calculate parameters of the image, such as the mean distance between features or the number of features per unit volume. In addition, several statistical and graphical operations can be done.

Heyden & Son, Inc., a longtime publisher of scientific, technical, and medical texts, has broadened into the software business. The enterprise, new in January, is Heyden Datasystems. At the Pittsburgh Conference, Heyden exhibited its Spectrafile infrared spectroscopy data station built around the Apple IIe personal computer.

According to Nina Sammon of Heyden, Spectrafile is intended for the spectroscopist who has not yet automated his existing equipment. Choice of the Apple followed interviews with prospective customers that showed it to be most in demand. A feature of the software is a set of 21 spectroscopy-specific functions that the user can string together to construct a data acquisition and manipulation procedure. A single command, for example, tells the computer to search a spectrum library for one that matches an experimentally obtained spectrum. The user can also write and add to the program up to four functions to carry out any mathematical routine.

Cost of Spectrafile is about $6000, including the computer and interface device. Heyden also exhibited software for cataloging and retrieving information, an "electronic filing clerk." Priced at $75, Microfile could be used for such purposes as maintaining a library of scientific literature references.

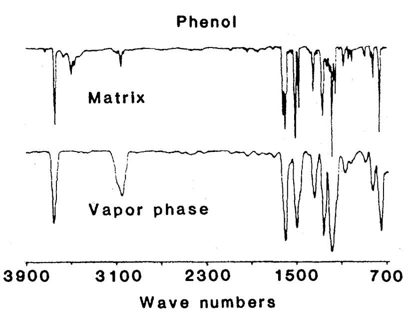
Another publisher, Elsevier Science Publishers B.V., is taking an altogether different tack to software. Extending its role as a publisher of science texts, Elsevier is publishing software written by outside scientists or authors. The main difference between book publishing and software publishing is that the software is not sold but licensed. Licensees must sign an agreement not to make more than four copies of the programs and not to distribute it to other users. The idea is not unique to Elsevier—other publishers have been marketing educational and medical software in a like manner—but it is new to the Pittsburgh Conference.

An Elsevier spokesperson explained that the company got into software publishing when it discovered its book authors were also writing software. The company's role is quite parallel to that in book publishing. It acquires programs from authors, turns them into "user-friendly" packages including a diskette and manual, and uses its marketing expertise to sell them. All software is refereed by two sets of third parties to guar-

Ultrahigh Sensitivity from GC-IR

A new technique that increases the sensitivity of gas chromatography–infrared spectroscopy (GC-IR) by three orders of magnitude was introduced at Atlantic City by Mattson Instruments, Inc. The key to the increased sensitivity is a new interface, called the Cryolect Matrix-Isolation interface, developed by Gerald Reedy and his colleagues at Argonne National Laboratory.

The heart of the device is a slowly rotating polished metal cylinder held at 12K within a vacuum chamber. About 1 percent argon is added to the carrier gas in the GC. After separation in the GC, part of the sample is split off to a detector for peak identification. The majority of the sample stream, however, is directed onto the surface



Sharper spectra

Sample molecules immobilized in a matrix produce sharper spectra.

of the cylinder where the argon and sample condense. The cylinder is then rotated 180° so that the sample is at the focal point of reflective IR optics.

In a conventional GC-IR interface, the IR spectrum is obtained while the sample is passing through a light tube. The investigator thus gets only one chance to obtain a spectrum, and typically only part of the sample is in the light tube at one time. With the Cryolect, virtually all of each peak is collected on the disk and the investigator can examine it at leisure—it remains intact as long as the cylinder is cooled. Sensitivity is thus higher; spectral quality is also improved because the transparent argon matrix prevents IR band broadening or shifting due to rotational absorption or intermolecular bonding.

In several papers presented at the meeting, Reedy and his colleagues reported that the technique could detect and identify samples in the picogram range, and that for many applications, GC-IR using the interface was actually more effective in identifying unknowns than was GC–mass spectroscopy. Unfortunately, the price of this sensitivity is high—about $104,000 for the interface alone.

—T.H.M.

A New Library for GC Unknowns

Gas chromatography (GC) is one of the most widely used techniques available for quantitative analysis. In the past, however, it was not very good for qualitative analysis because retention times and retention indices for a given compound could vary significantly from column to column, and often even for different runs on the same column.

That situation changed markedly in 1979 when Ray D. Dandenau and E. M. Zenner of the Hewlett-Packard Company reported on the use of flexible fused-silica capillary columns for GC. Retention times on these columns were highly reproducible from column to column (*Science*, 21 October 1983, p. 259). The new columns, combined with microprocessor control of GCs (which further increased reproducibility), made GC a realistic option for identification of unknown compounds.

Recognizing the utility of this new technology, Sadtler Research Laboratories—a company already well known for its spectral libraries—is bringing out the "Sadtler Gas Chromatography Standard Retention Index Library," a four-volume set containing data on 2000 compounds. Data for each compound are presented for four different columns. For the two bonded-phase columns, data are presented for four set temperatures and two temperature programs. For the nonbonded-phase columns, it is presented for five temperatures and two programs. In each case, aliphatic hydrocarbons are used as internal standards and the results are presented as both retention times and retention indices.

Sadtler plans to expand the index

on a continuing basis. Meanwhile, the initial 2000 compounds include a variety of pollutants and solvents that elute under the given conditions, as well as a range of simple and complex compounds selected from the firm's infrared collection. Until September the cost of the index is $695 for the bound version, and $1195 for lease of a database and search program for the HP-85 microcomputer.—**T.H.M.**

Why Buy When You Can Rent?

It is now possible to rent an analytical instrument rather than buy it. United States Instrument Rentals, Inc., a company that has found a highly successful niche for itself renting instruments to the electronics industry, has established a new division called United States Analytical Instruments (USAI) to do the same thing for the chemical industry. The San Mateo, California, company has already begun acquiring and leasing instruments and says it will have purchased $8 million worth by the end of the year. USAI has also made arrangements with various manufacturers for installation of the instruments in the potential user's laboratory.

General manager Gerard M. Farren says USAI will offer a full range of instruments, but many observers predict that the company's greatest volume will be with gas and liquid chromatographs, optical spectrometers, and similar instruments—which can be brought in and set up quickly. "It would simply be too expensive and time-consuming to set up a large NMR or mass spectrometer if it's only going to be used for a couple of months," says one critic.

Farren predicts that the major users of rental instruments will be industrial laboratories and other groups that need something in a hurry to finish off a specific project. The company has four regional centers already used for electronics instruments, so most instruments can be delivered within a day. But the cost will be high, about 10 percent of the list price per month plus transportation and installation—although the cost is all tax-deductible. Long-term leases may cost as little as 4 to 5 percent per month, however, and purchase options will be available. Farren has set his sights for the company high: "I predict that very soon we will be accounting for 5 to 6 percent of the analytical instrument industry's yearly sales."—**T.H.M.**

Superfast Time-Resolved Optical Spectroscopy

How fast can a physical process be and still be measured? If the probe comprises waves of electromagnetic radiation, the duration of one period (the time to move one wavelength) would seem to set an upper limit. To anything happening in a much shorter time, the wave would appear to be frozen in place and would not be able to interact with the process. In the visible, orange-yellow light has a frequency near 5×10^{14} hertz for a period of 2×10^{-15} second (2 femtoseconds).

As it happens, Charles Shank of AT&T Bell Laboratories, reported at the Pittsburgh Conference that Bell Labs researchers have recently been able to construct a pulsed, visible laser with a pulse length of less than 15 femtoseconds or about 7 periods. As discussed in separate talks by Benjamin Greene of Bell Labs and by Shank, it is possible to do quite elegant time-resolved spectroscopic and kinetic studies, such as the measurement of the lifetimes of transient excited states of molecules, even though photodetectors with femtosecond response times do not yet exist.

Detectors are improving, however. At the Pittsburgh Conference, the Hamamatsu Corporation displayed the newest models of its established line of streak cameras. The fastest visible detector shown can resolve light pulses of 2×10^{-12} second (2 picoseconds) or less. An ultraviolet–x-ray instrument is only slightly slower, at 10 picoseconds or less. Hamamatsu spokesperson Norman Schiller mentioned that femtosecond versions are under active development.

Streak cameras work by transforming the time coordinate of a light pulse into a spatial coordinate on a recording medium. For example, photographic film bent into a cylindrical shape and rotated rapidly in front of a light beam would record a streak whose head corresponded to the leading edge of the pulse, and so on.

Hamamatsu's streak cameras accomplish this feat electronically. Light strikes a photocathode, releasing a pulse of electrons. The electrons are accelerated toward a phosphor screen. But before reaching it, they pass through a rapidly scanning electric field that deflects the electrons according to when they pass through. After being amplified, the spatially dispersed pulse of electrons strikes the phosphor screen to generate a streak of light, which is recorded by a silicon intensifier tube (a type of television camera).

It is possible to get three-dimensional intensity-time-wavelength data by passing the light signal through a spectrograph before it enters the streak camera. The spectrograph disperses light in one direction (horizontally, say) while the streak camera disperses it in another (vertically in this example), so that the dispersed light forms a two-dimensional pattern on the television camera. A digital analyzer can assign one of 64,000 intensity levels to each element of an array comprising 512 time channels by 512 wavelength windows.

For time-resolved optical spectroscopy, Hamamatsu introduced its Universal Streak Camera model C1587. It features three plug-in units. One is to cover relatively slow events (nanoseconds to microseconds). One is to cover exceptionally fast events as short as 2 picoseconds.

The third synchronizes the streak camera with a repetitively pulsed laser for recording of events as fast as 10 picoseconds. Synchronization provides the ability to separate out weak light pulses from nearby (in time) strong pulses, a case in point being the dim pulse of Raman scattered light that precedes a bright pulse of fluorescence following optical excitation of a sample.

A complete system with television camera, digital analyzer, and video monitor–control console runs in the neighborhood of $100,000.

For ultraviolet and x-ray spectroscopy in the energy range 10 electron volts to 10,000 electron volts, there is the Streak Camera model C1936 with time resolution of 10 picoseconds or better. The camera alone is about $80,000, while a complete system is about $150,000.—**A.L.R.**