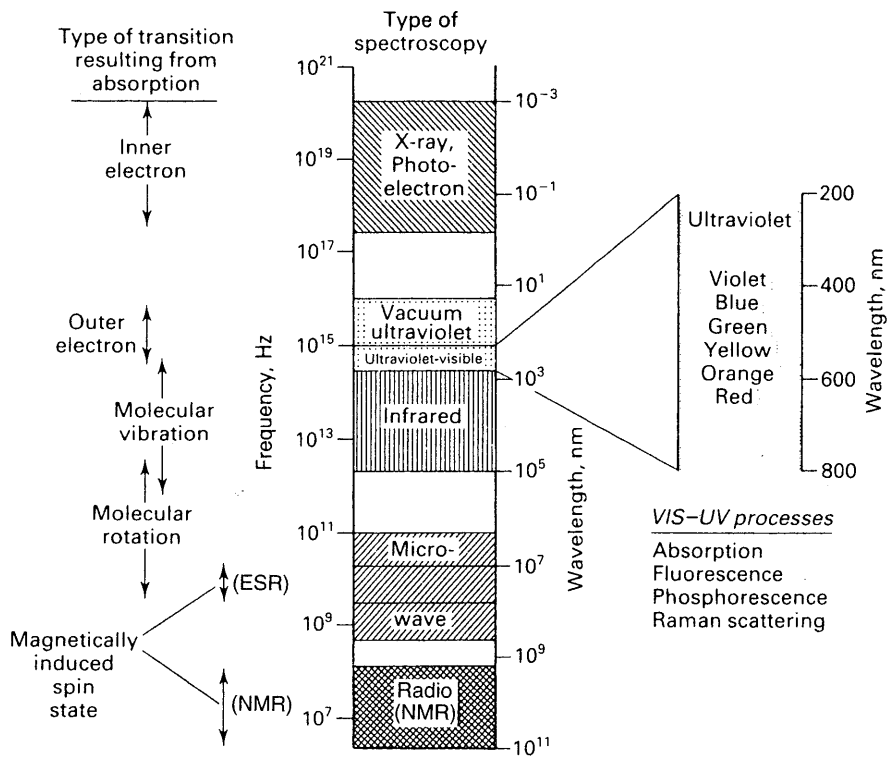

Type of transition resulting from absorption
Inner electron
Outer electron
Molecular vibration
Molecular rotation
Magnetically induced spin state
(ESR)
(NMR)
Type of spectroscopy
Frequency, Hz
10^{21}
10^{19}
10^{17}
10^{15}
10^{13}
10^{11}
10^{9}
10^{7}
X-ray, Photo-electron
Vacuum ultraviolet
Ultraviolet-visible
Infrared
Micro-
wave
Radio (NMR)
10^{-3}
10^{-1}
10^{1}
10^{3}
10^{5}
10^{7}
10^{9}
10^{11}
Wavelength, nm
Ultraviolet
Violet
Blue
Green
Yellow
Orange
Red
200
400
600
800
Wavelength, nm
VIS–UV processes
Absorption
Fluorescence
Phosphorescence
Raman scattering

FIGURE 16
Schematic diagram of a simple prism spectrograph. Short wavelengths are refracted more than long wavelengths. The collimating lenses are multielement achromats to provide a sharp image at the exit slit for a broad wavelength range.

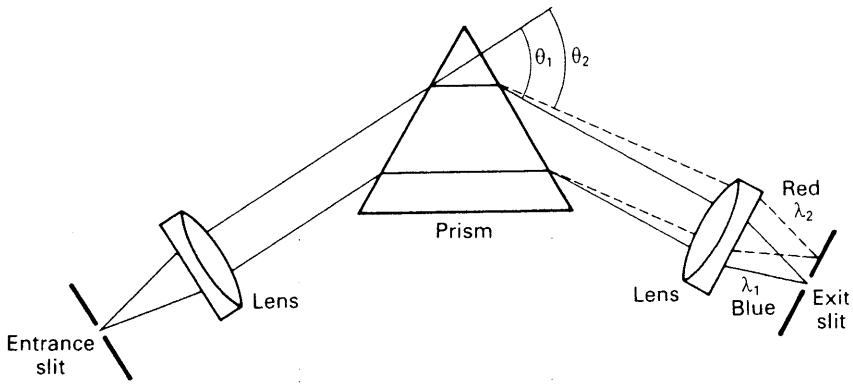


FIGURE 18
Cross section of a reflection grating with groove spacing d and blaze angle θ_0. Here α is the angle of incidence, β that of diffraction, and ϕ that of reflection. The blaze arrow, usually scribed on the back or top of a grating, indicates the direction (left or right) of enhanced diffraction of a beam incident along the grating normal.

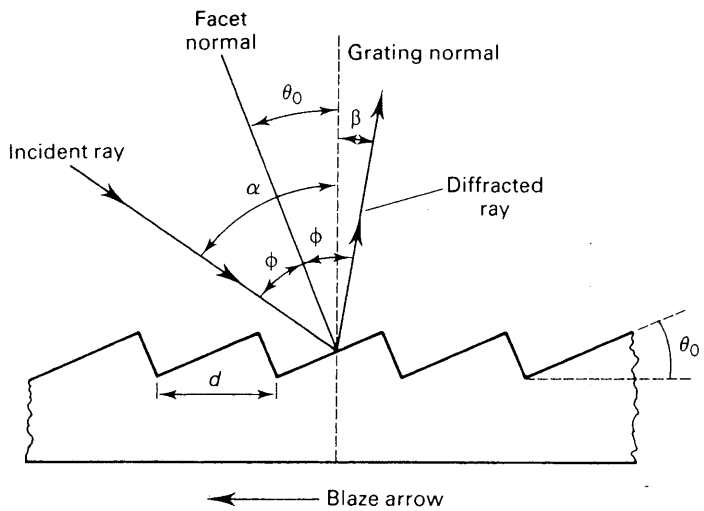


FIGURE 26
Optical diagram of Varian-Cary models 219 and 2000 series double-beam spectrophotometers (available as models 400 and 500 from Varian).

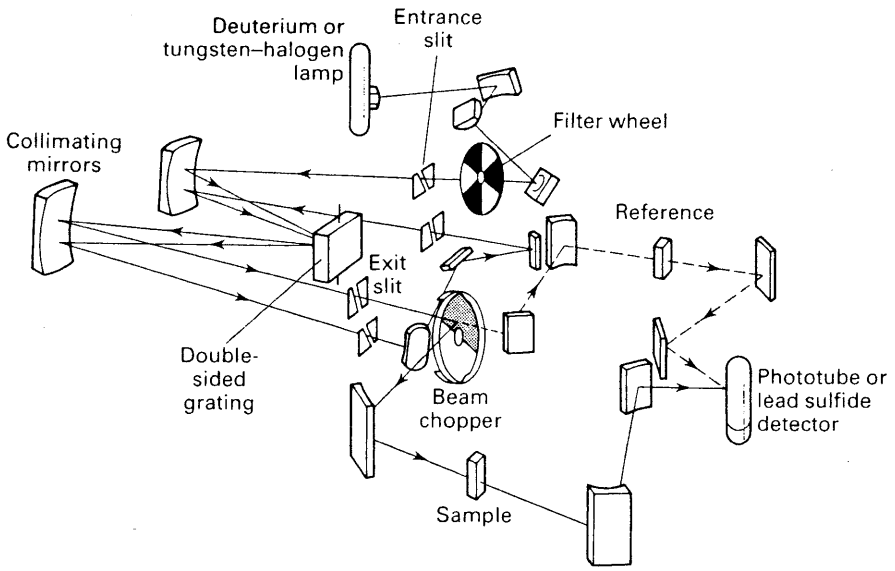
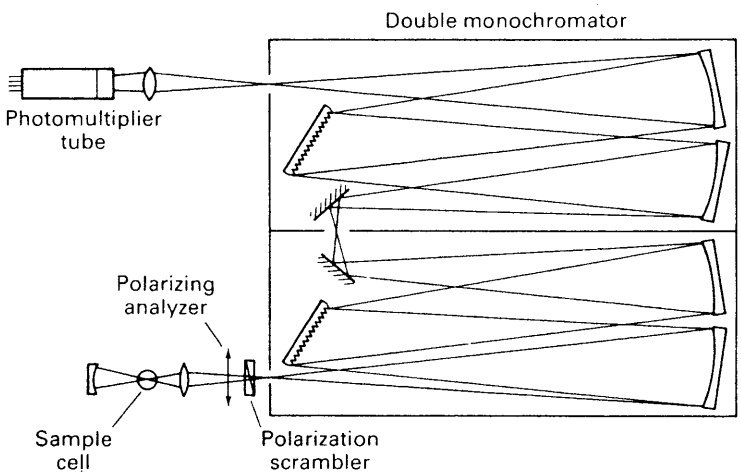


FIGURE 27
Schematic diagram of a Raman spectrometer. The exciting laser beam enters from below (⊥ to the plane of the drawing).



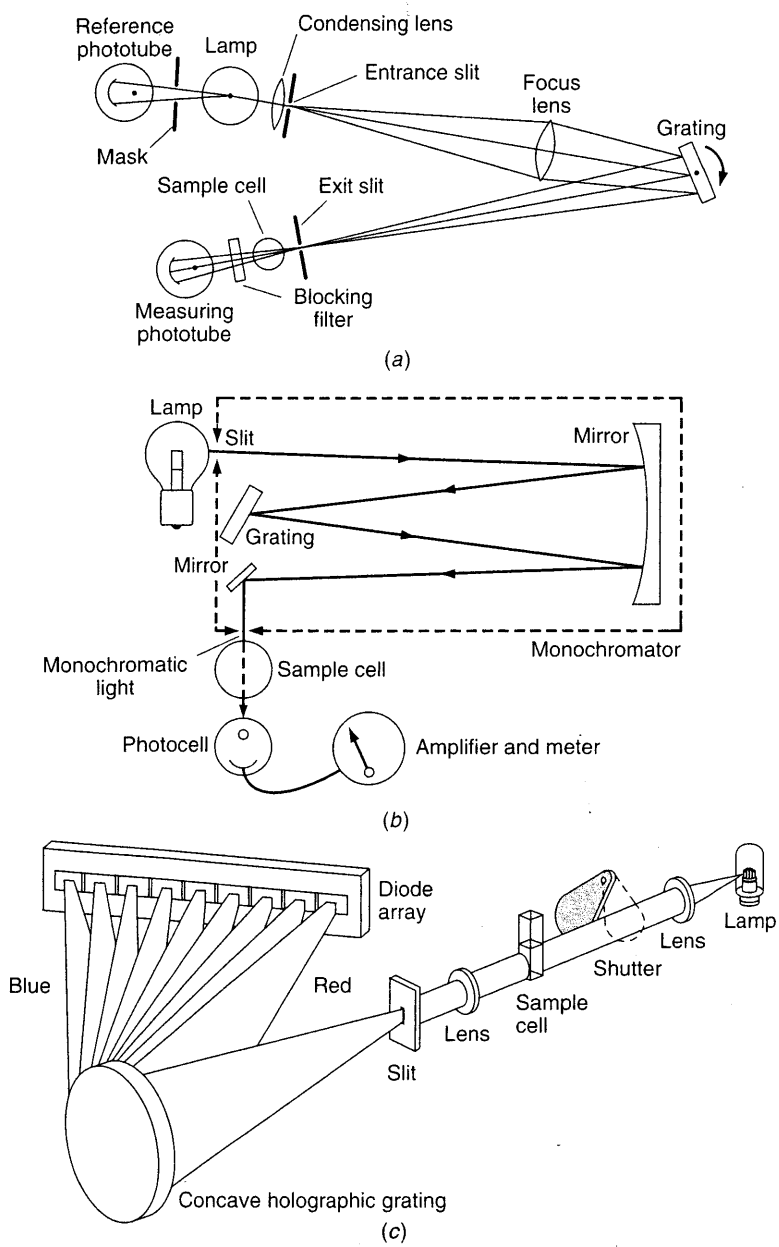


FIGURE 25
Examples of single-beam spectrophotometers. (*a*) Spectronic 20 (available as Spectronics 20+ with photodiode detector from Thermo Spectronic); (*b*) Turner 350 (available as model 340 from Barnstead/Thermolyne); (*c*) HP 8452A multichannel diode-array spectrometer (available as model 8453 from Agilent Technologies).

FIGURE 28
Schematic diagram of a Michelson interferometer. The detector signal variation as a result of mirror motion is displayed for the cases of monochromatic and polychromatic sources.

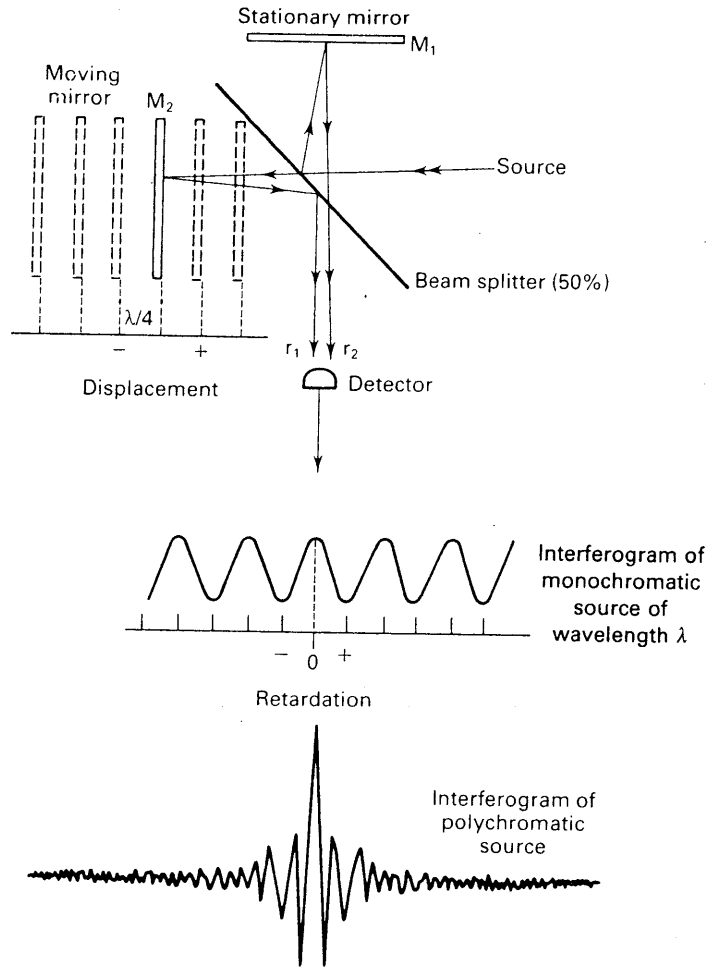
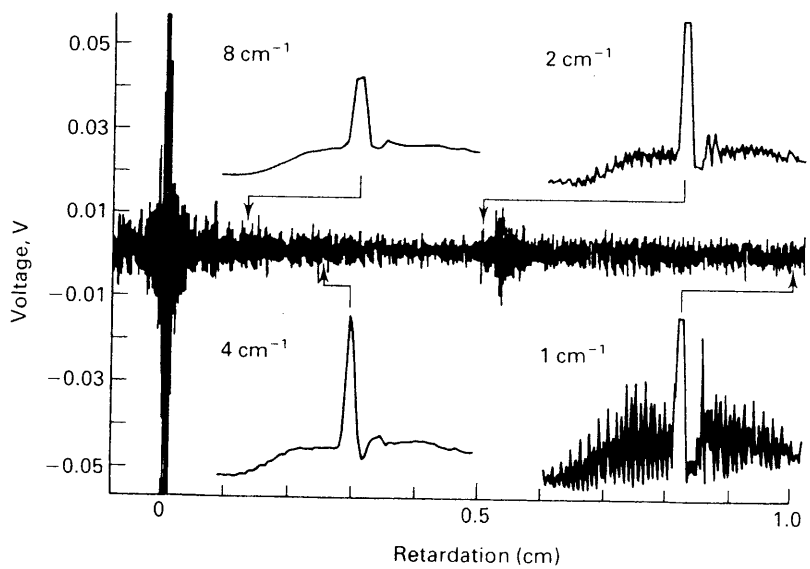


FIGURE 29
Interferogram and transformed spectra for acetylene in the 670 to 800 cm^{-1} ν_5 bending region. The transformed spectra show the effect of retardation distance on the spectral resolution; the 1-cm^{-1} case corresponds to a total mirror travel of 0.5 cm. The vertical scale of the interferogram is greatly expanded; the peak-to-peak voltage at zero retardation is ~4 V.



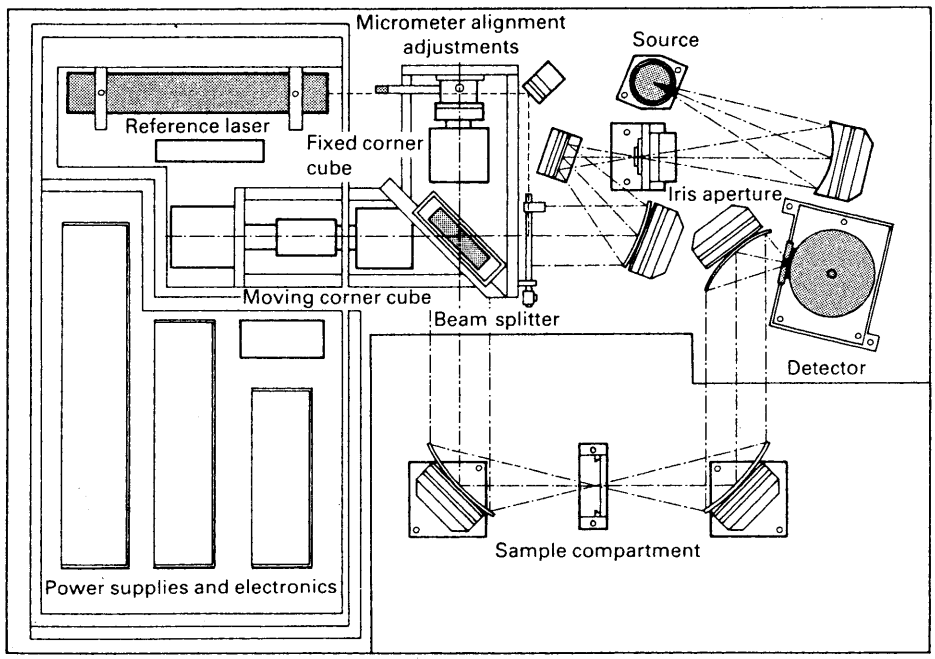


FIGURE 30
Typical optical diagram of the Mattson series of FTIR instruments. Courtesy of Mattson Instruments, Inc.