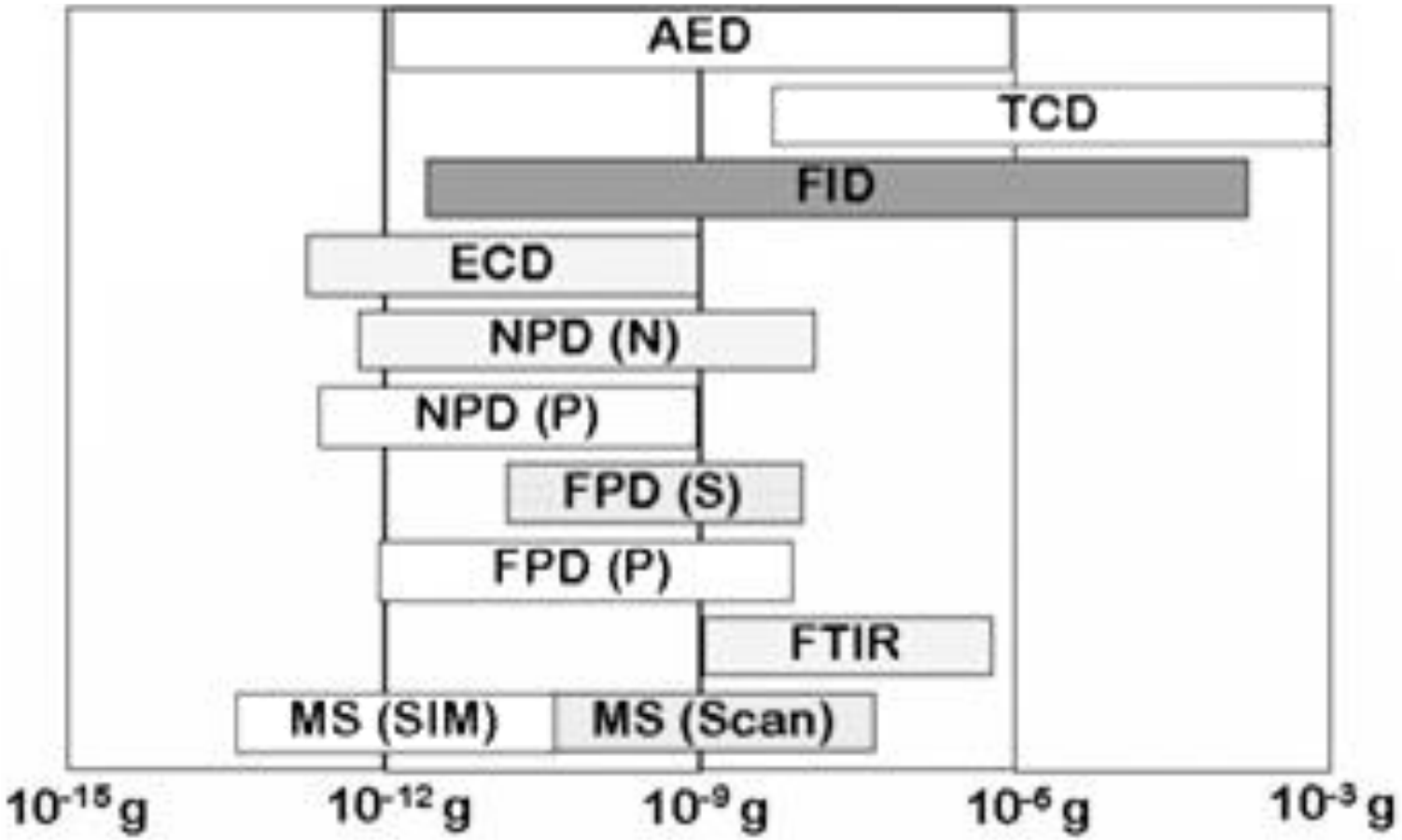
DETECTORS IN GAS CHROMATOGRAPHY

Thermo-conductivity	Thermal conductivity
Flame-ionization	Ionization (hydrocarbons)
Nitrogen-phosphorus	N,P – specific forms
Electron capture	Electronegative structures
Atomic-emission	Emission light
Flame-photometric	P, S - specific forms
Photoionization	UV absorption
Chemiluminescence	Excitation (O_3; F_2)
FTIR	IR + Fourier transformation
Mass spectrometric	Ionization

DETECTORS IN GAS CHROMATOGRAPHY

LOD and working range of GC detectors

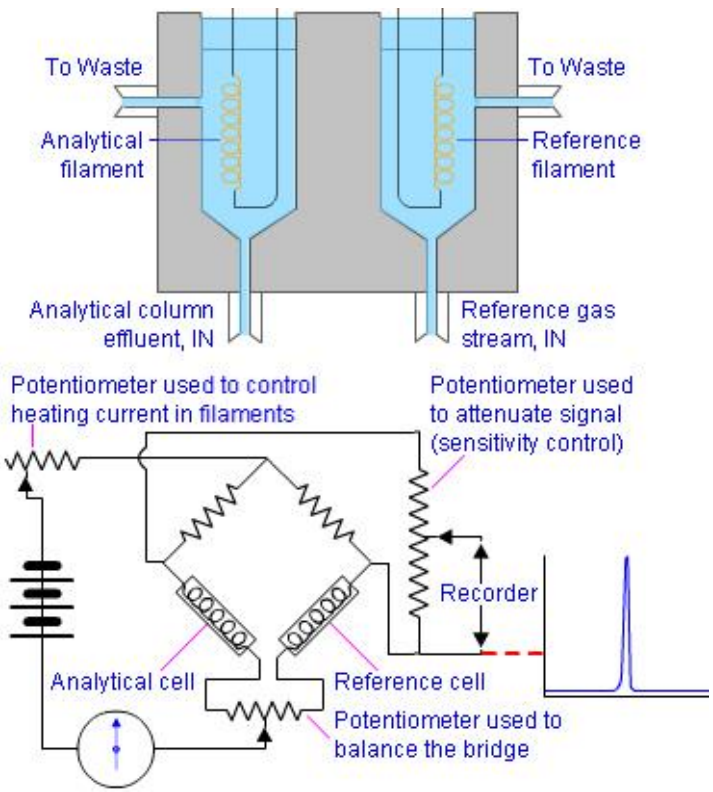


(FIGURE:Hewlett-Packard (Agilent Technologies))

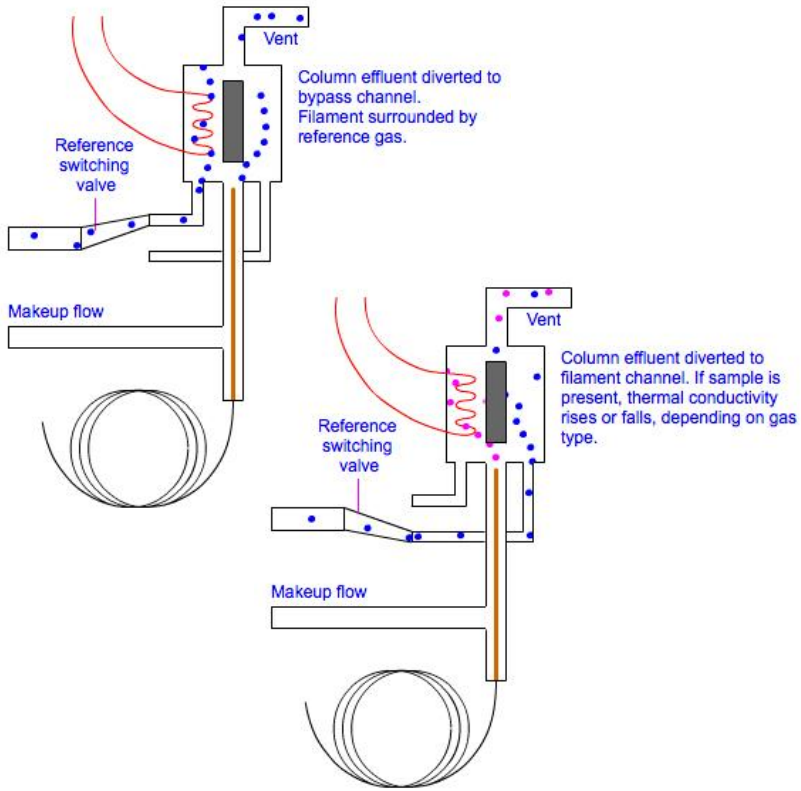
DETECTORS IN GAS CHROMATOGRAPHY

Thermal conductivity detector (TCD) - *katharometer*

Traditionally a two-fiber system (Wheatstone Bridge)



Single-fiber switching system frequency ~ 100 ms



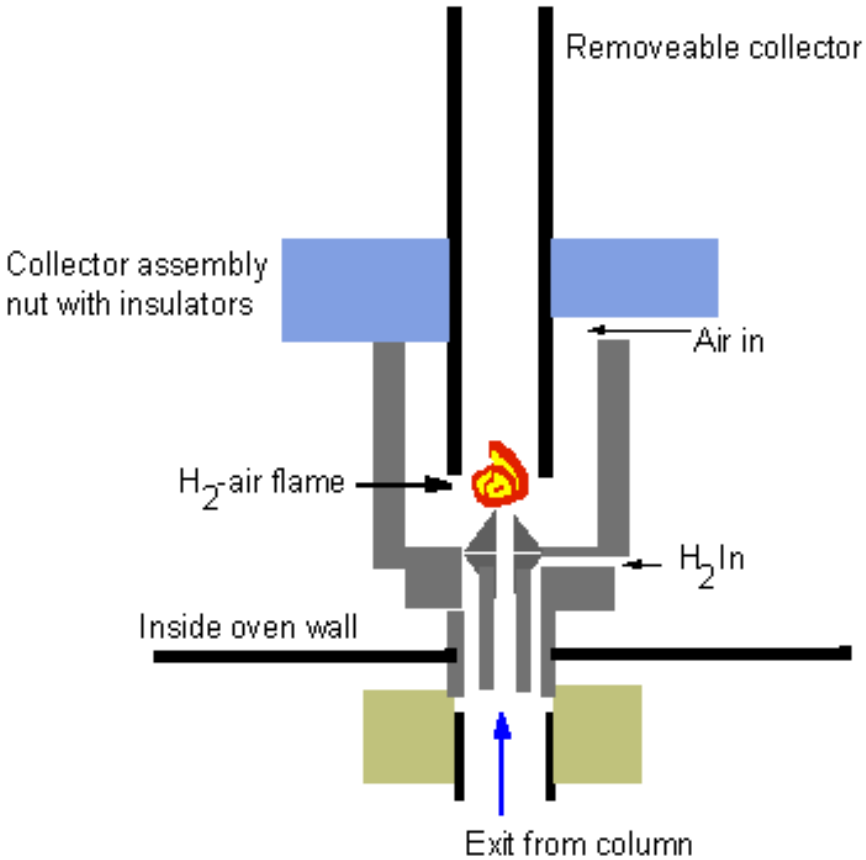
DETECTORS IN GAS CHROMATOGRAPHY

Flame-ionisation detector (FID)

$CH\bullet + O \rightarrow CHO^+ + e^-$

- various hydrocarbons

Non-detected: H_2O, N_2, CO_2, CO, CS_2, O_2, NH_3



(FIGURE:Hewlett-Packard (Agilent Technologies))

DETECTORS IN GAS CHROMATOGRAPHY

Nitrogen-phosphorus detector (NPD)

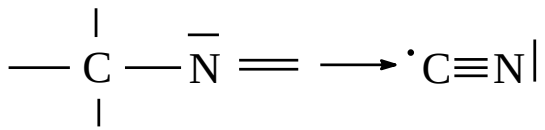
N or P presence

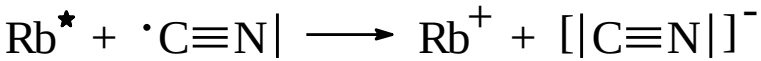
$$Rb + 2H \rightarrow H_2 + Rb^+ + e^-$$

N/C = 10^4

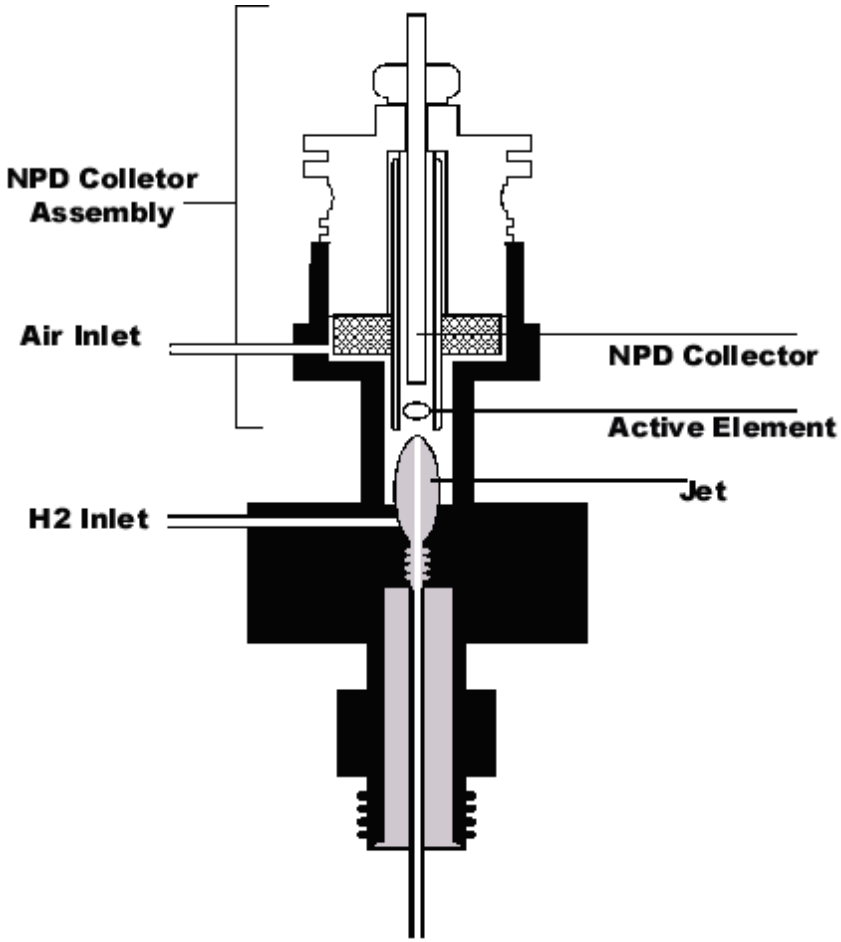
P/C = 10^5

N: CN





P: PO, PO_2

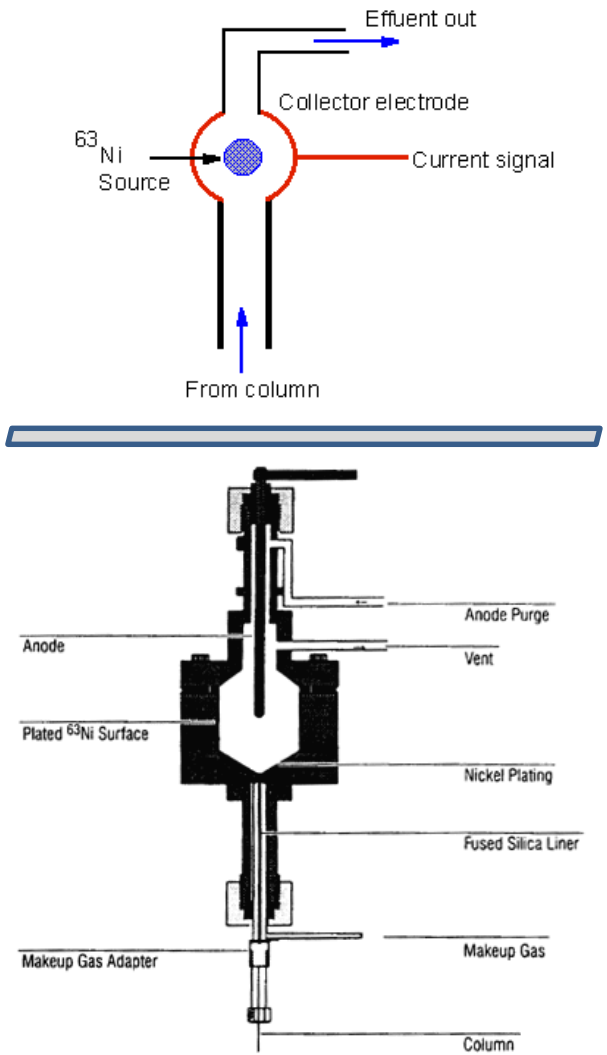


(FIGURE:Hewlett-Packard (Agilent Technologies))

DETECTORS IN GAS CHROMATOGRAPHY

Electron capture detector (ECD)

Compounds	*Relative Response*
Hydrocarbons	**1**
Ethers; esters	**10**
Aliphatic alcohols; ketones; amines; mono - Cl, F	**100**
mono - Br; di - Cl, F	**1000**
anhydrides; tri - Cl	**10 000**
mono - I; di - Br; poly - Cl, F	**100 000**
di - I; tri - Br; poly - Cl, F	**1 000 000**



(FIGURE:Hewlett-Packard (Agilent Technologies))

DETECTORS IN GAS CHROMATOGRAPHY

Atomic emission detector (AED)

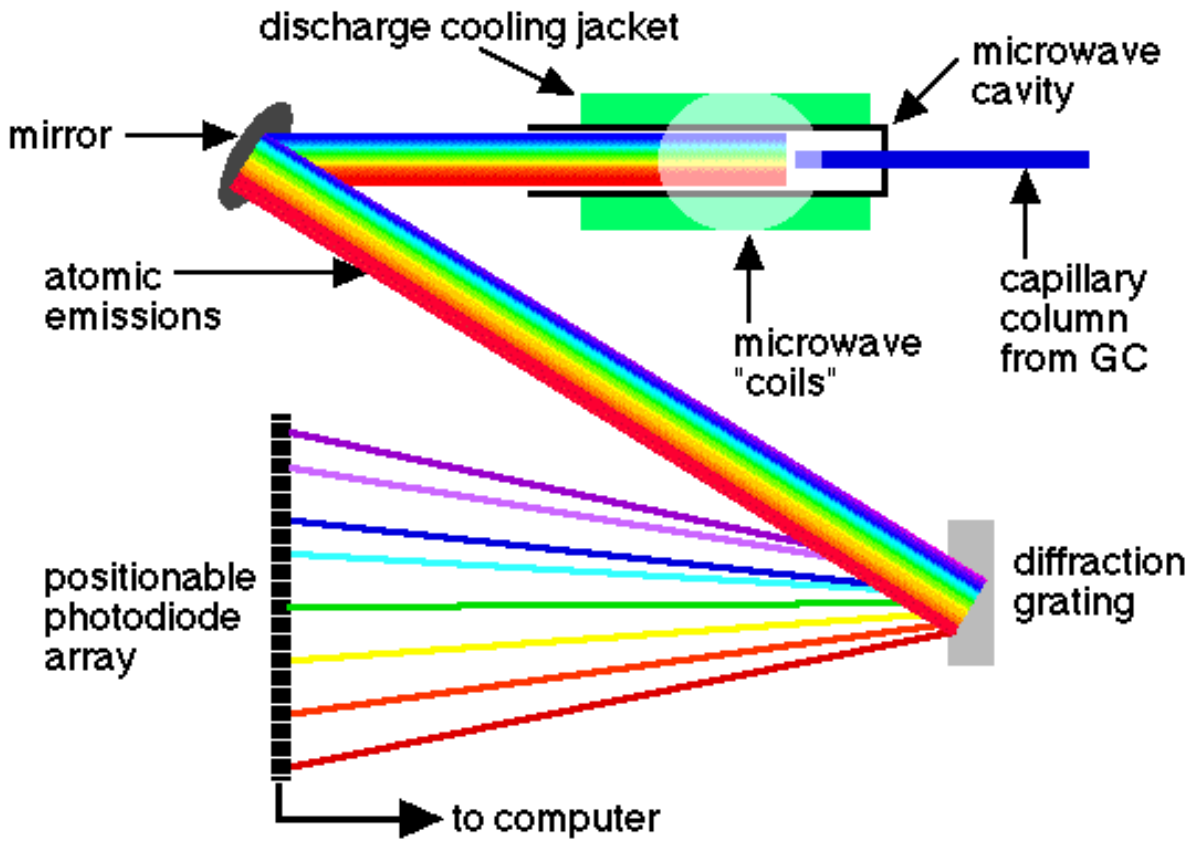
Measuring of atomic emission of various elements at selective λ

Parallel records possibility

E.g. compounds containing

C, Cl, S, P

Universal use – various LODs



(FIGURE:Hewlett-Packard (Agilent Technologies))

DETECTORS IN GAS CHROMATOGRAPHY

Flame-photometric detector (FPD)

Specific for P and S

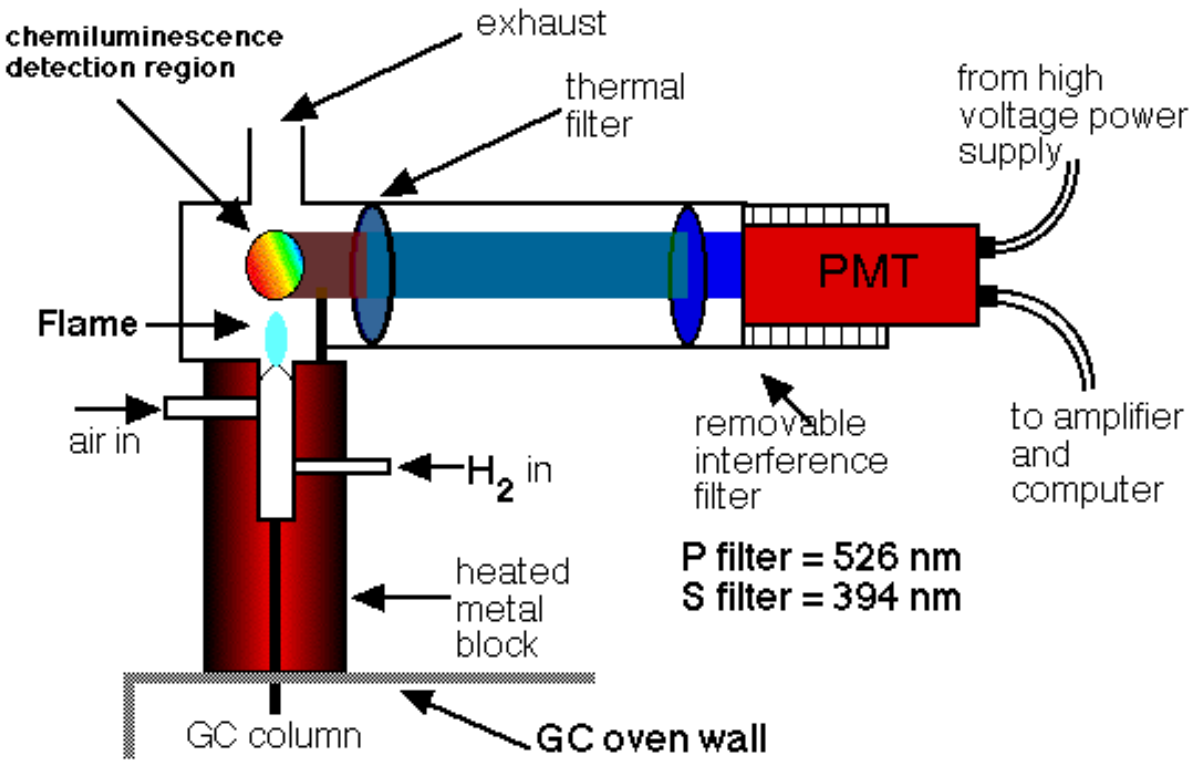
Formation:

HPO*

S=S*

P/C = 10^5

S/C = 10^5



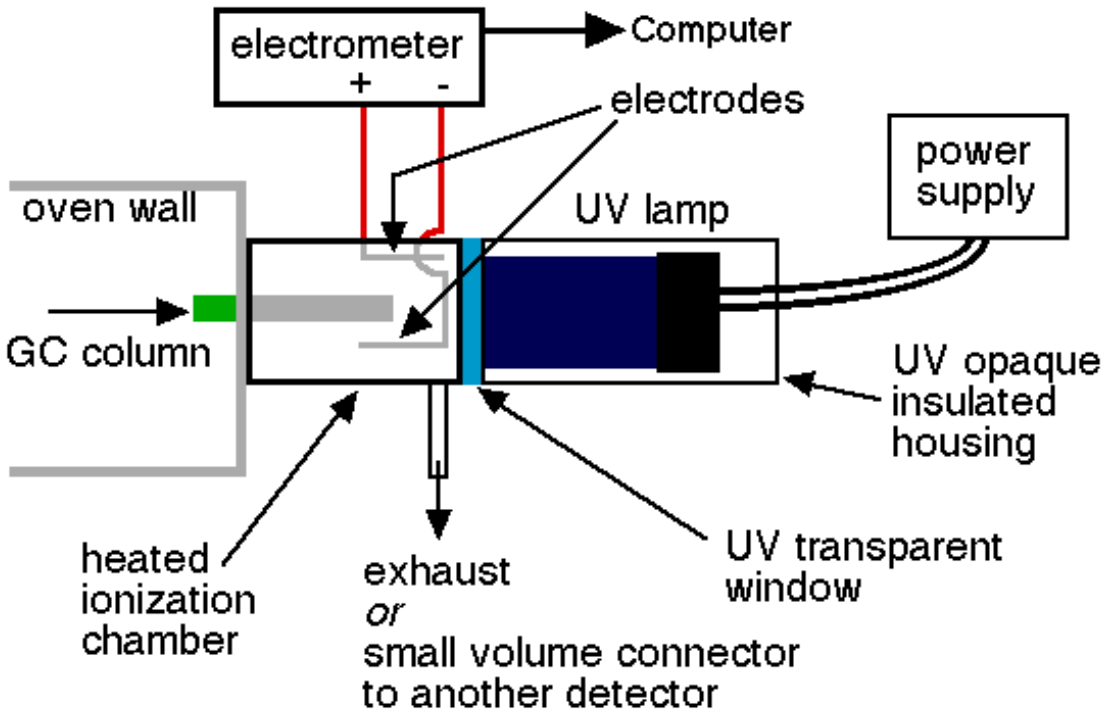
(FIGURE:Hewlett-Packard (Agilent Technologies))

DETECTORS IN GAS CHROMATOGRAPHY

Photoionization detector (PID)

$$R + h\nu \longrightarrow R^{+} + e^{-}$$

Ionization by UV light - PAHs (10.2 eV)



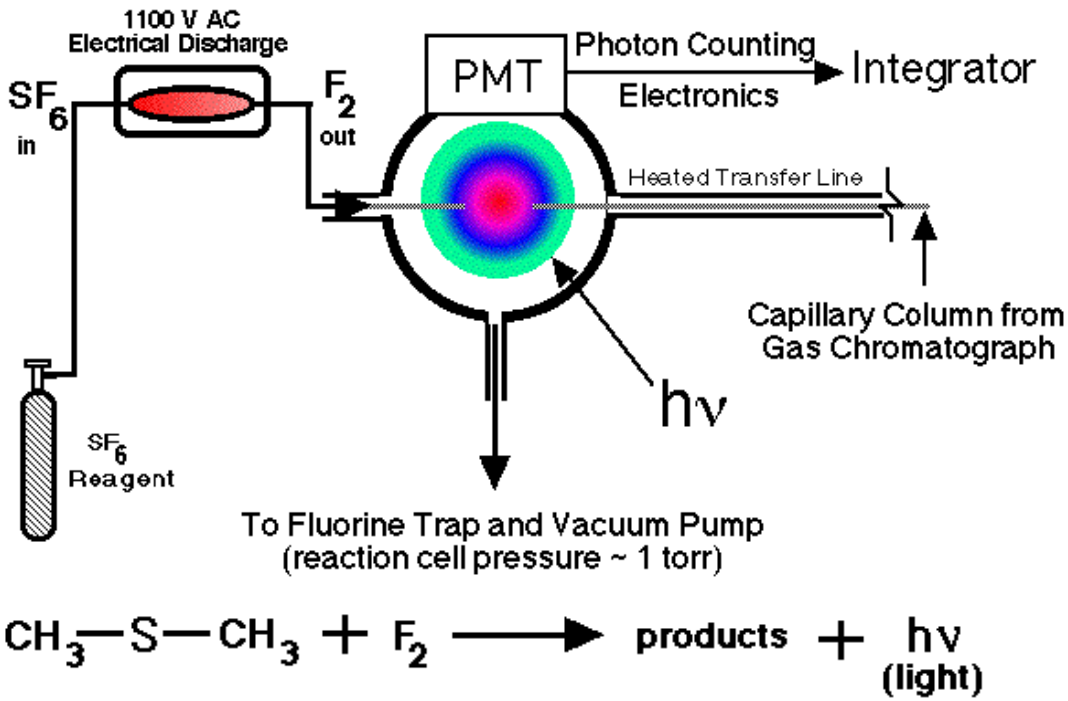
(FIGURE:Hewlett-Packard (Agilent Technologies))

DETECTORS IN GAS CHROMATOGRAPHY

Chemiluminescence detector (RCD, TEA)

Specific – according to specific reaction

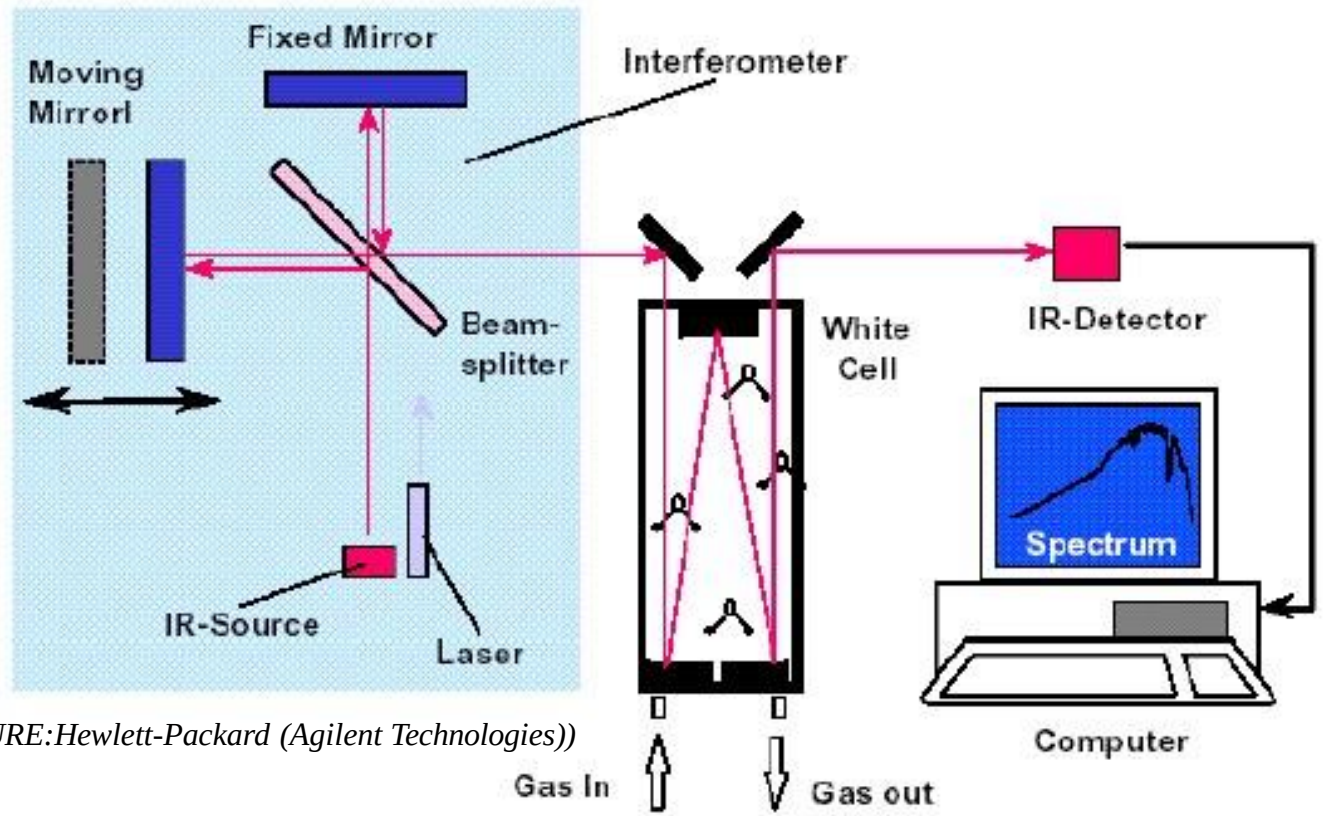
$$NO + O_3 \rightarrow NO_2^* + O_2$$
$$NO_2^* \rightarrow NO_2 + h\nu$$



$$CH_3—S—CH_3 + F_2 \longrightarrow \text{products} + h\nu\ (\text{light})$$

DETECTORS IN GAS CHROMATOGRAPHY

Fourier transform infrared detector (FTIR)



(FIGURE:Hewlett-Packard (Agilent Technologies))

Spectral information; higher LODs

DETECTORS IN GAS CHROMATOGRAPHY

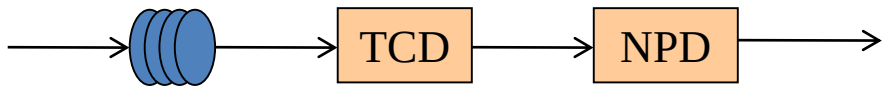
Characteristics of detectors and multiple detection

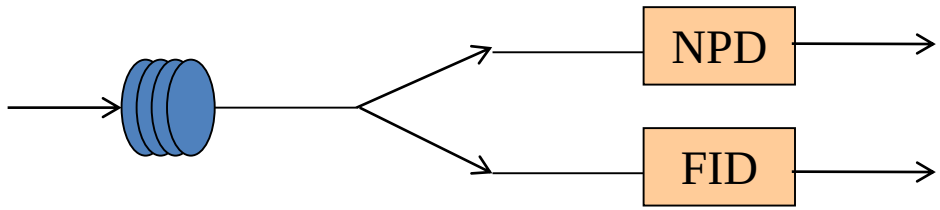
Destructive ……X…… Nondestructive

Mass ……X…… Concentration

FID, NPD, FPD .....X….. TCD, PID, FTIR

A. Serial configuration





B. Parallel configurations