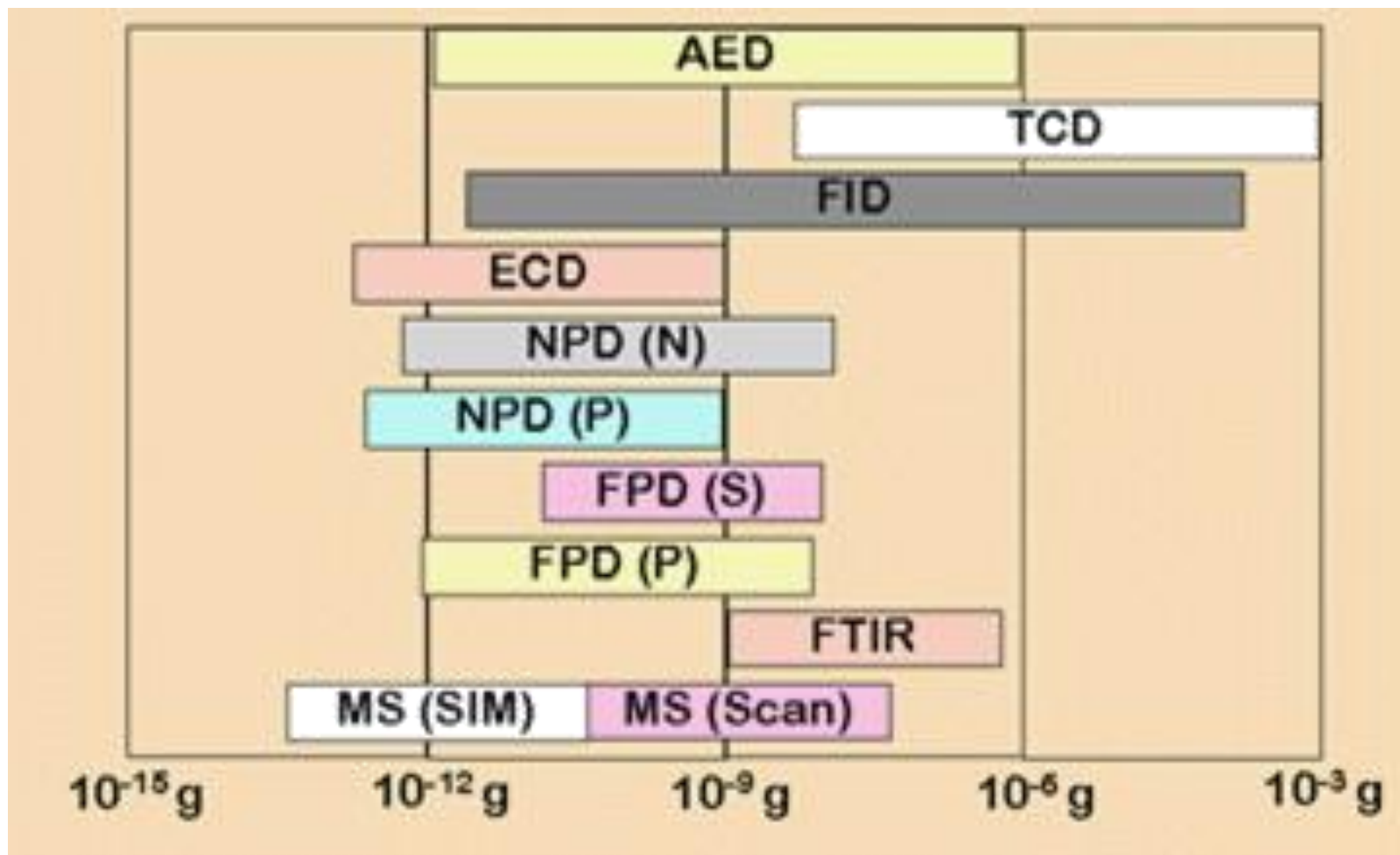


## Detectors in gas chromatography

<b>Thermo-conductivity</b>	<b>Thermal conductivity</b>
<b>Flame-ionisation</b>	<b>Ionisation (hydrocarbons)</b>
<b>Nitrogen-phosphorus</b>	<b>N,P – specific forms</b>
<b>Electron capture</b>	<b>Electronegative structures</b>
<b>Atomic-emission</b>	<b>Emission light</b>
<b>Flame-photometric</b>	<b>P, S - specific forms</b>
<b>Photoionisation</b>	<b>UV absorption</b>
<b>Chemiluminescence</b>	<b>Excitation (O<sub>3</sub>, F<sub>2</sub>)</b>
<b>FTIR</b>	<b>IR + Fourier transformation</b>
<b>Mass spectrometric</b>	<b>Ionisation</b>

# LODs and operating range of GC detectors

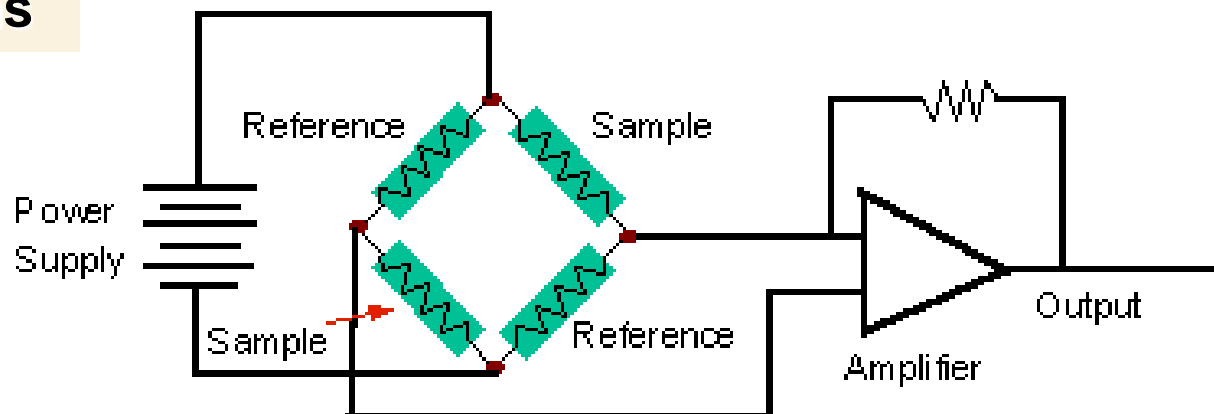
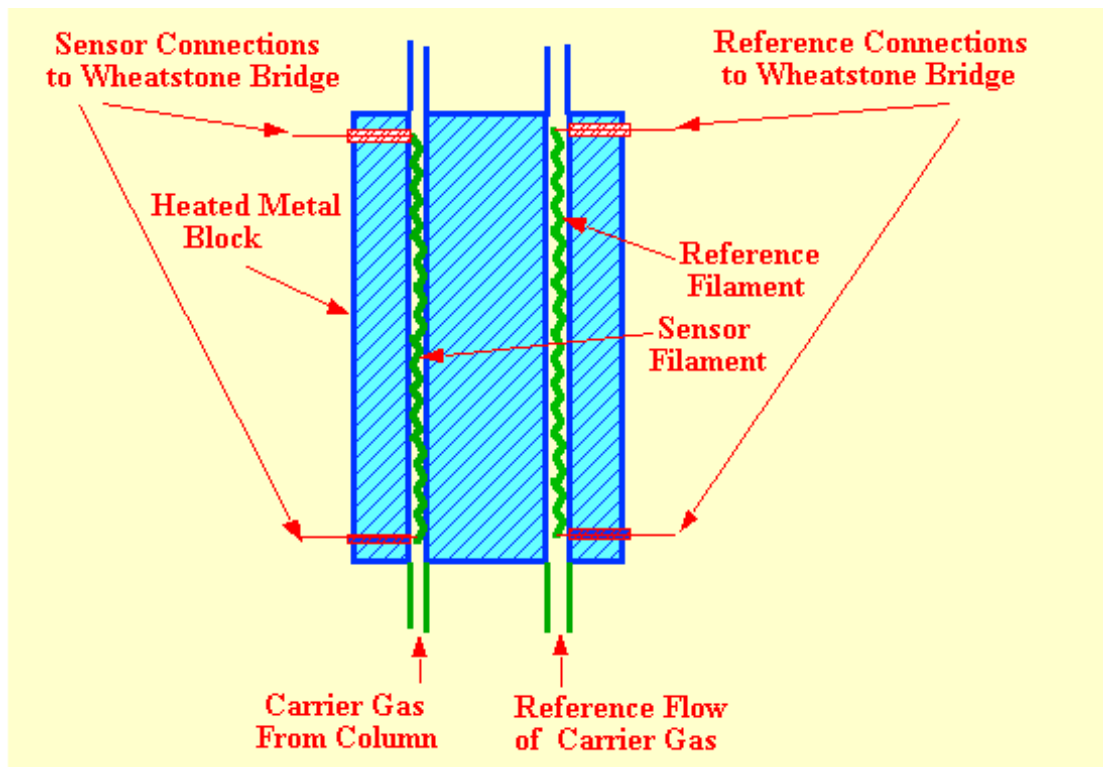


# Thermal conductivity detector (TCD)

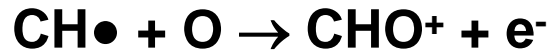
## *Katharometer*

Traditionally two- or four- filaments

Single – filament switching system  
effluent X reference frequency ~ 100 ms

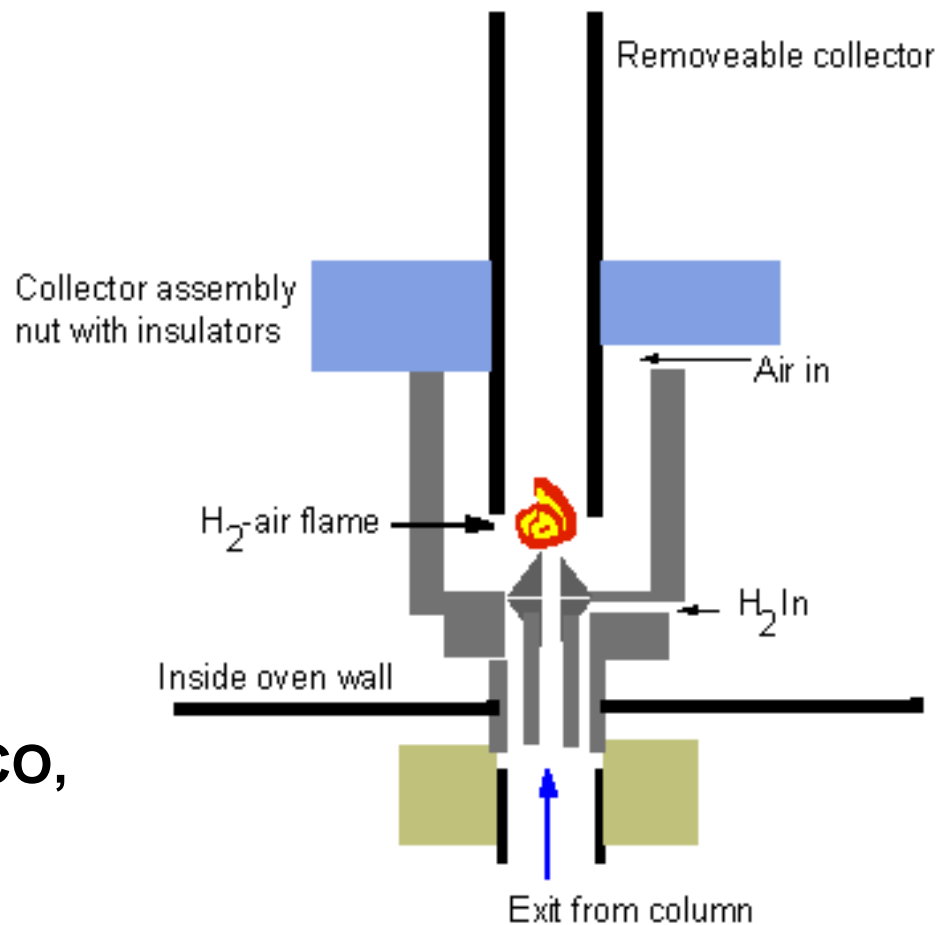


# Flame-ionisation detector (FID)



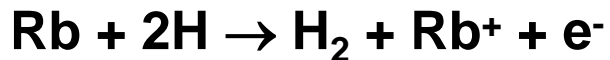
- various hydrocarbons

Invisible:  $\text{H}_2\text{O}$ ,  $\text{N}_2$ ,  $\text{CO}_2$ ,  $\text{CO}$ ,  
 $\text{CS}_2$ ,  $\text{O}_2$ ,  $\text{NH}_3$



# Nitrogen-phosphorus detector (NPD)

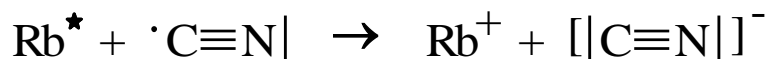
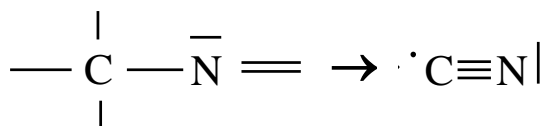
## N or P presence



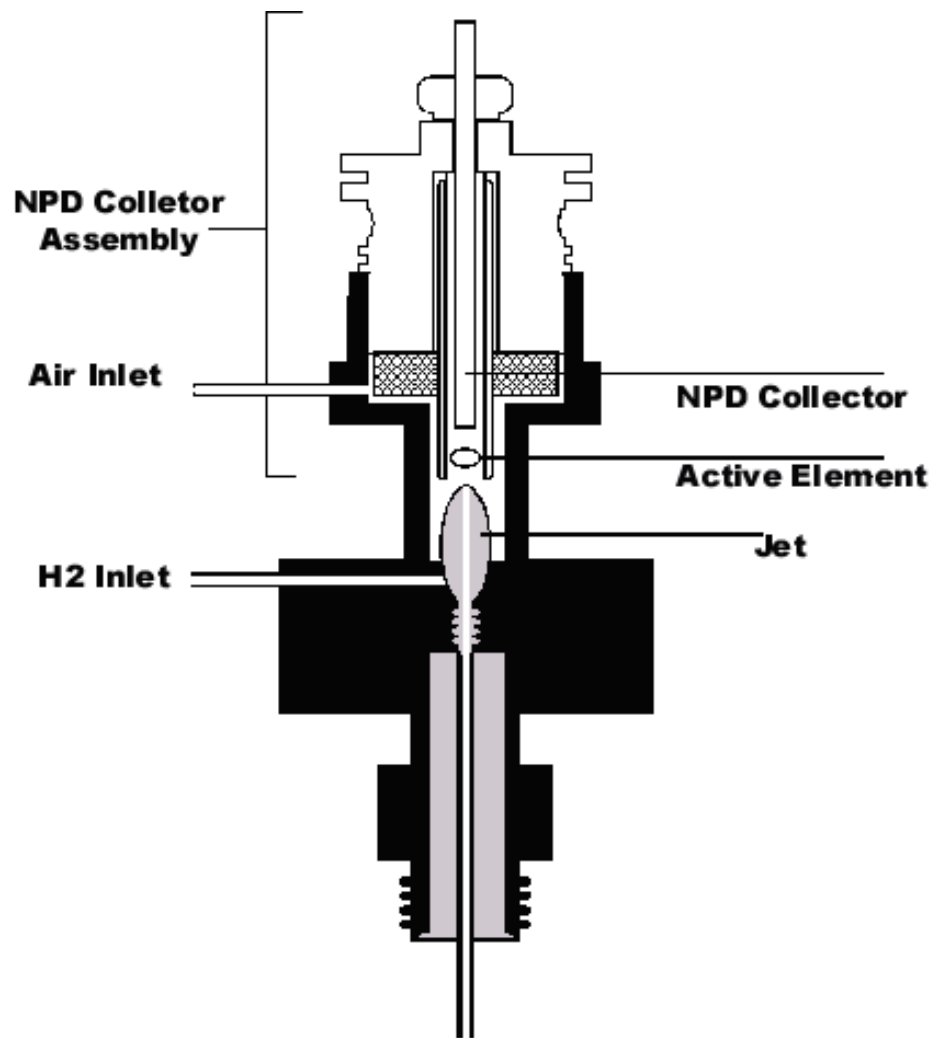
$$\text{N/C} = 10^4$$

$$\text{P/C} = 10^5$$

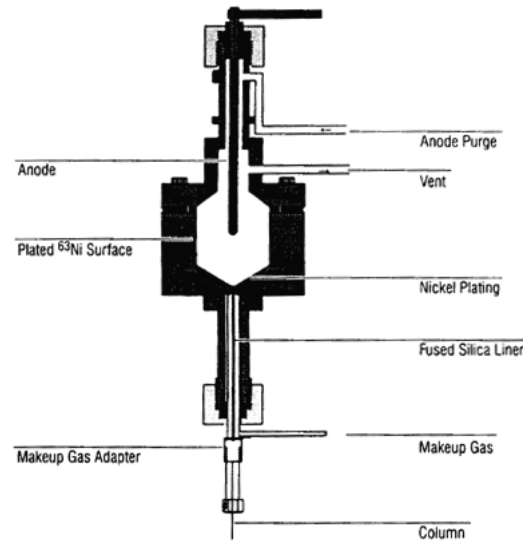
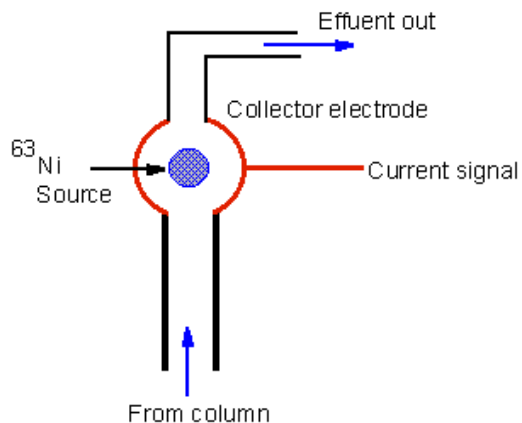
## N form detected: CN



## P form detected: PO, PO<sub>2</sub>



# Electron capture detector (ECD)



<i>Compounds</i>	<i>Response</i>
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

# Atomic emission detector (AED)

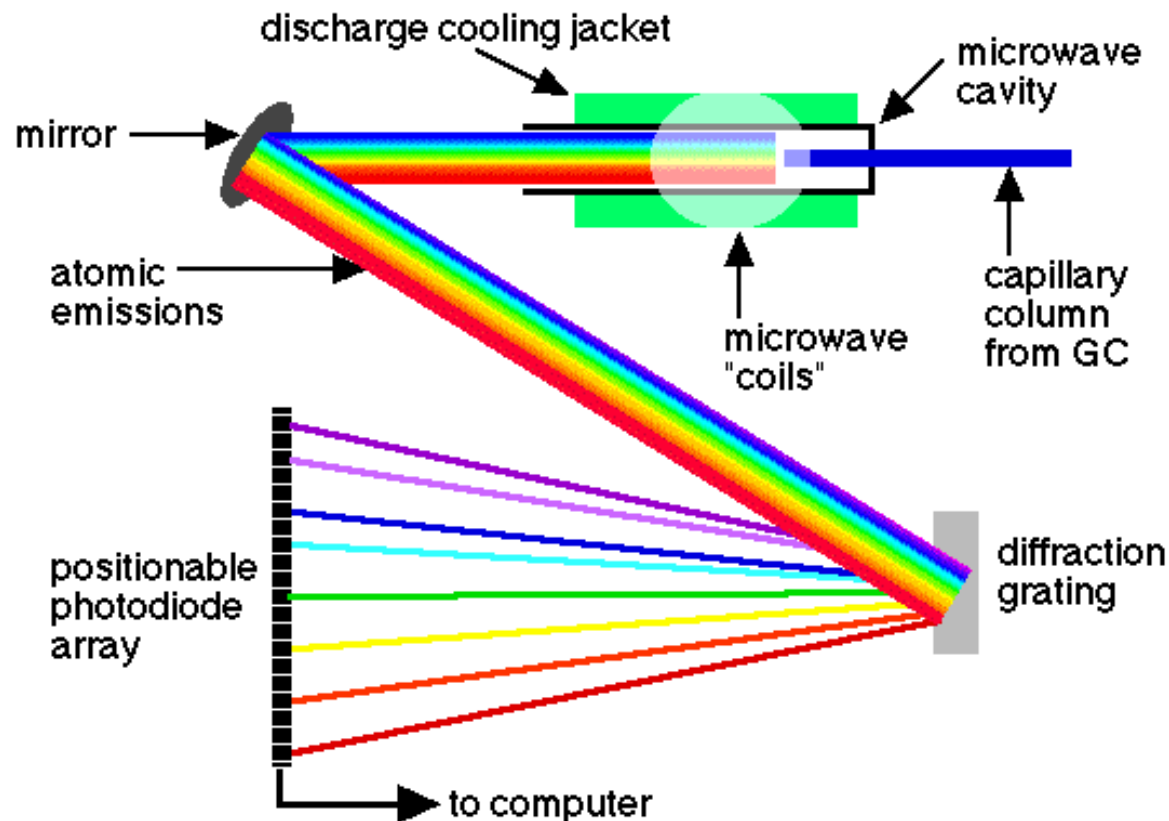
Measuring of atomic emission of various elements at selective  $\lambda$

Parallel records possibility

E.g. compounds containing

C, Cl, S, P

Universal use – various LODs



# Flame-photometric detector (FPD)

**Specific for  
P and S**

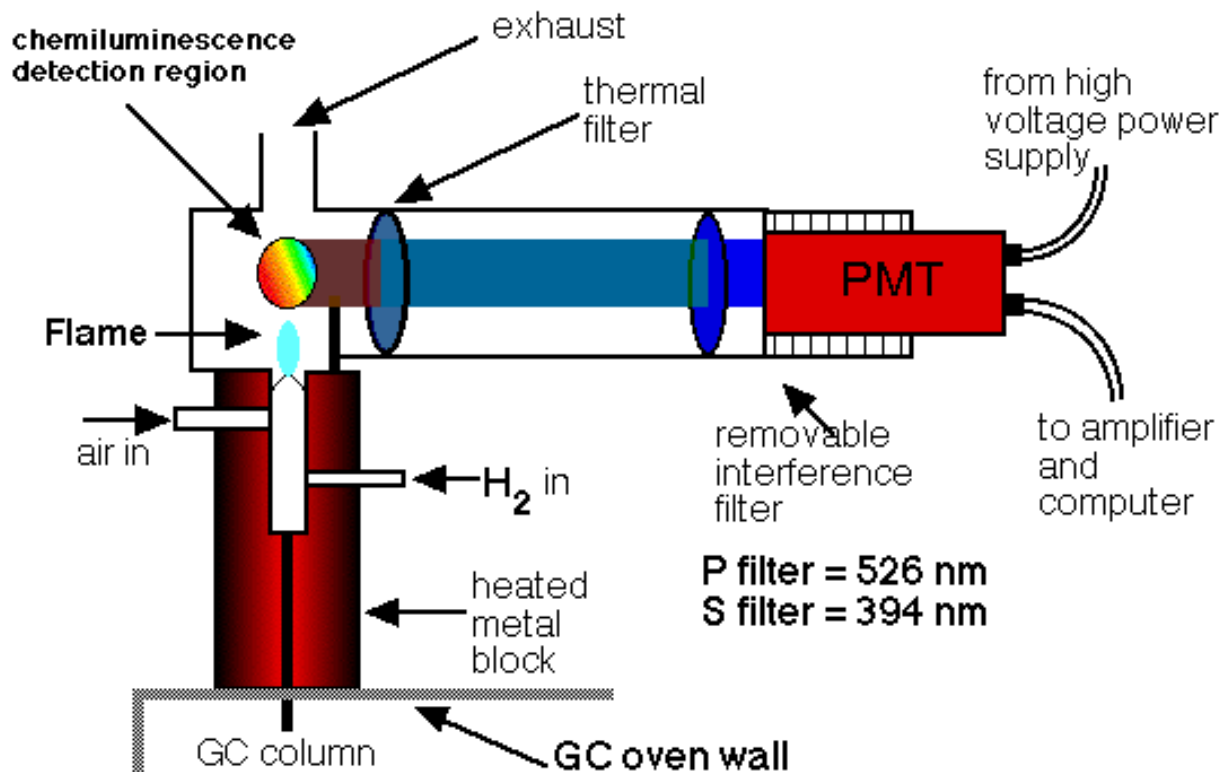
**Formation:**

**$HPO^*$**

**$S=S^*$**

**$P/C = 10^5$**

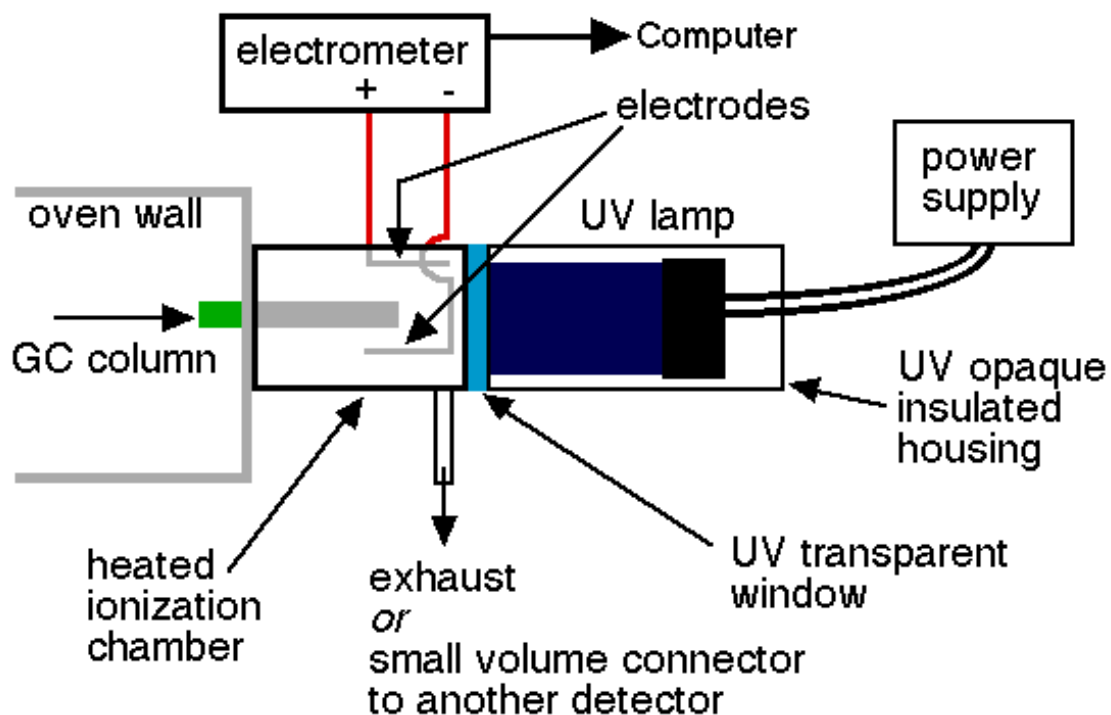
**$S/C = 10^5$**





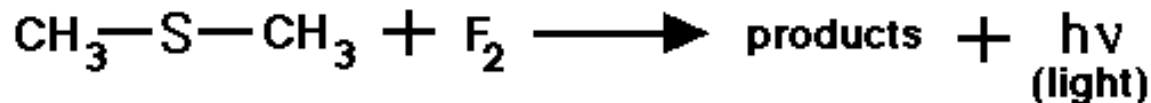
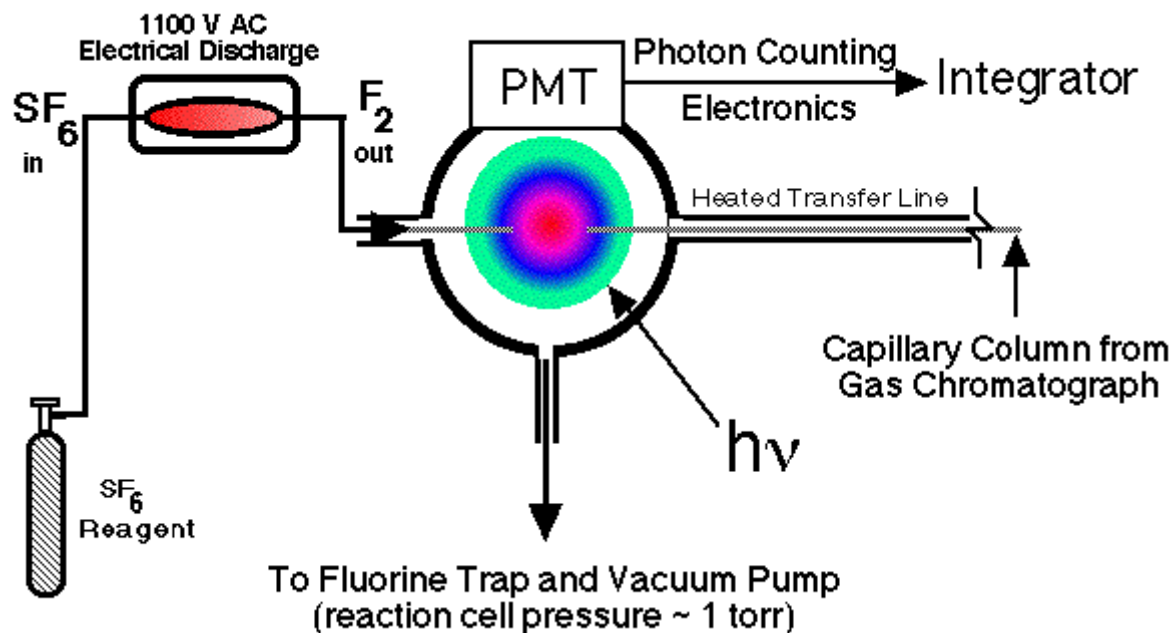
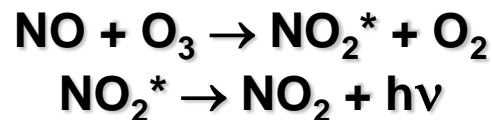
# Photoionisation detector (PID)

Ionisation by UV light - PAHs (10.2 eV)

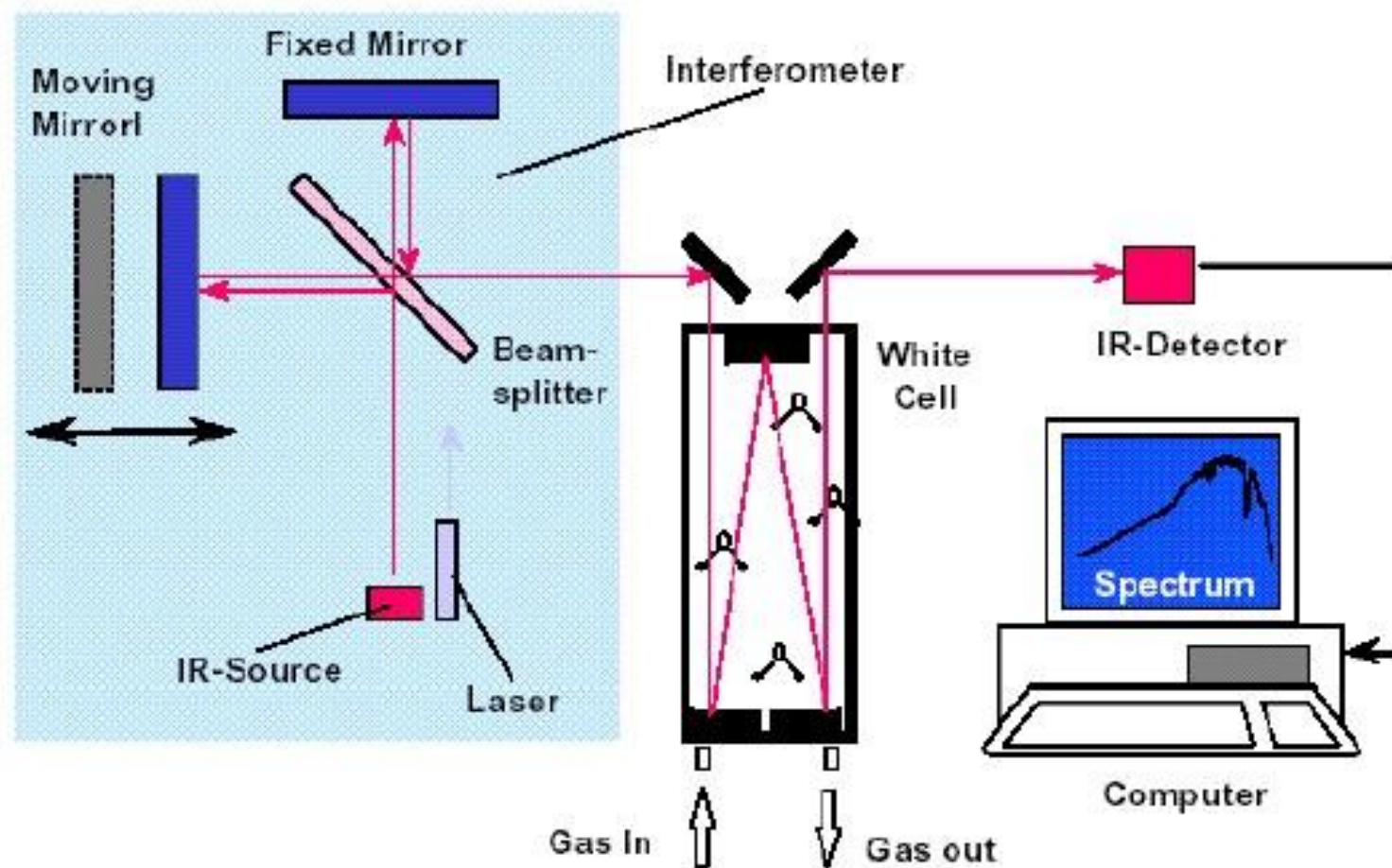


# Chemiluminescence detector (RCD, TEA)

Specific – according to specific reaction



# Infrared detector with Fourier transformation (FTIR)



**Spectral information – higher LODs**

# Characteristics of detectors and multiple detection

Destructive ...X... Nondestructive  
 Mass ...X... Concentration  
 FID, NPD, FPD ...X... TCD, PID, FTIR

## A. Configuration in series



## B. Configuration in parallel

