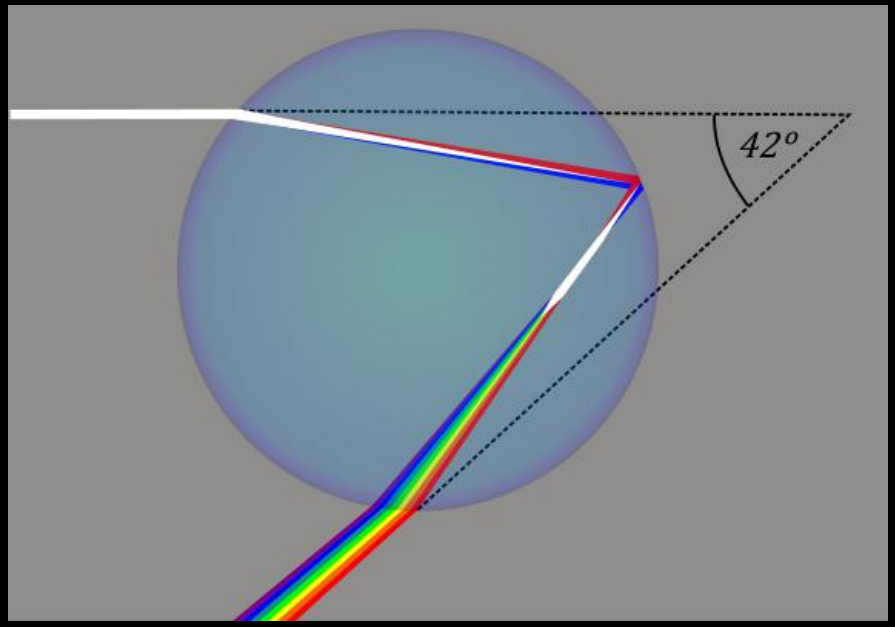
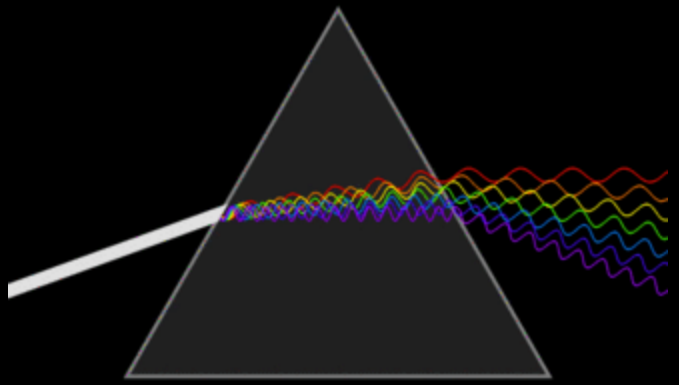
Monochromator

A **monochromator** is an optical device that transmits a mechanically selectable narrow band of wavelengths of light or other radiation chosen from a wider range of wavelengths available at the input

Mono - single,
Chroma - colour
Ator - denoting an agent.



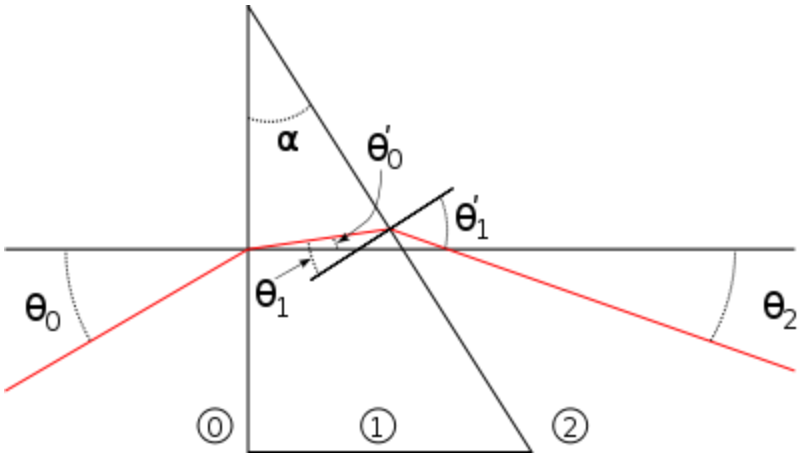
White light separates into different colours on entering the raindrop due to dispersion, causing red light to be refracted less than blue light.

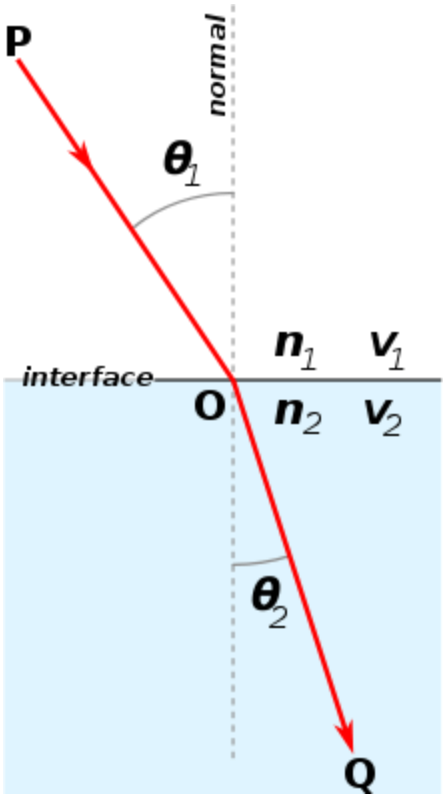


1. Optical dispersion in a prism

2. Dispersion by a diffraction grating

1. Optical dispersion in a prism





$$\theta_0' \approx \frac{n_0}{n_1}\theta_0$$

$$\theta_1 = \alpha - \theta_0'$$

$$\theta_1' \approx \frac{n_1}{n_2}\theta_1$$

$$\theta_2 = \theta_1' - \alpha$$

$$n_0 = n_2 \simeq 1$$

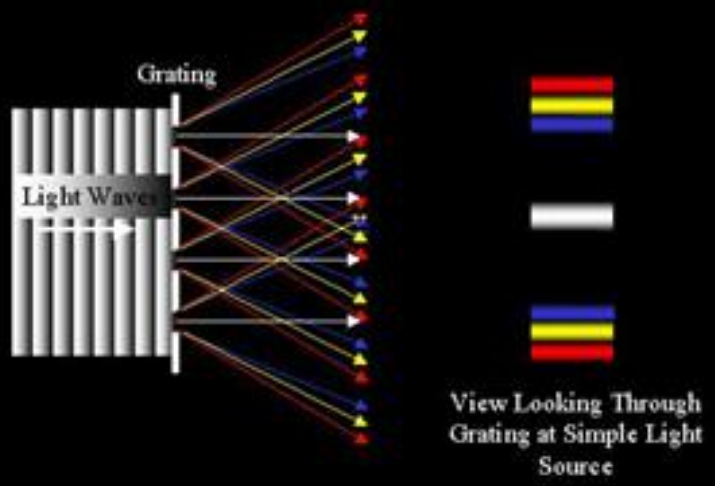
Snell's law

$$\delta = \theta_2 + \theta_0 \approx n\theta_1 - \alpha + \theta_0 = n\alpha - n\theta_0' - \alpha + \theta_0 \approx (n-1)\alpha$$

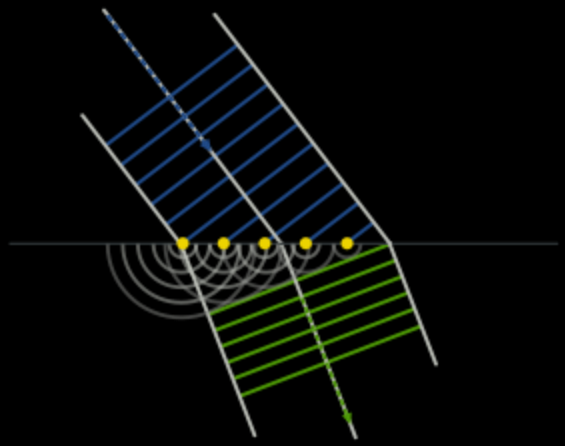
$$\delta(\lambda) \approx [n(\lambda) - 1]\alpha$$

wikipedia

Dispersion using a diffraction grating



Christian Huygen's wave principle

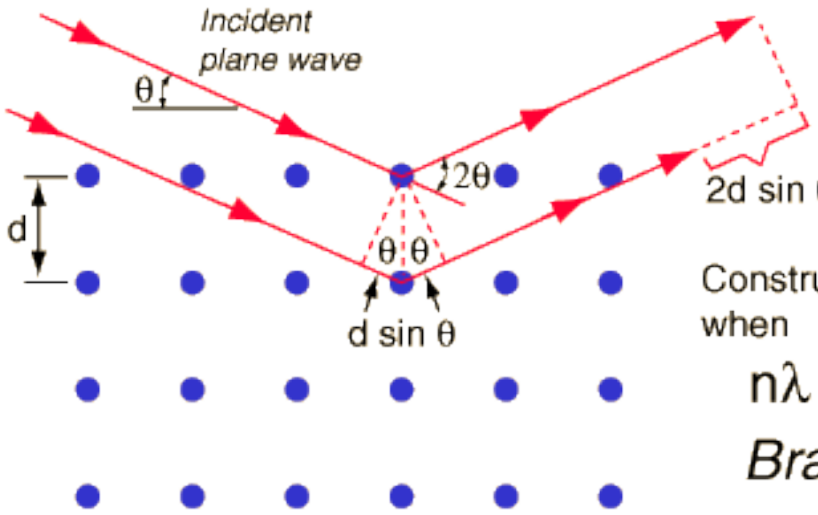


An optical device used to disperse light into a spectrum. It is ruled with closely-spaced, fine, parallel grooves, typically several thousand per cm, that produce interference patterns in a way that separates all the components of the incoming light. A diffraction grating can be used as the main dispersing element in a spectrograph.

http://en.wikipedia.org/wiki/Huygens%27_principle

http://www.daviddarling.info/images/diffraction_grating.jpg&imgrefurl=http://www.daviddarling.info/encyclopedia/

Bragg's Law

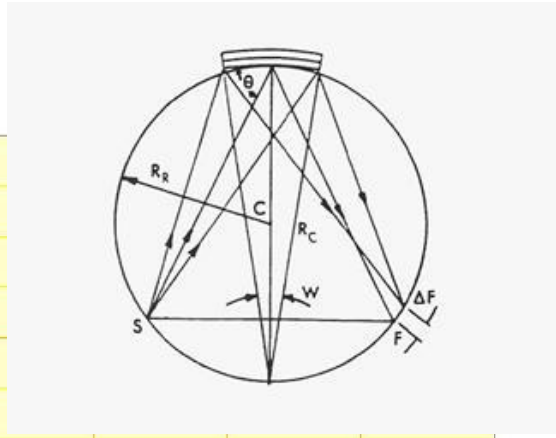


Constructive interference when

$n\lambda = 2d \sin\theta$

Bragg's Law

Crystal monochromator for X-ray monochromatisation



$$n\lambda = 2d \sin\theta$$ *Bragg's Law*

http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/bragg.html

Use of monochromators in various spectroscopies

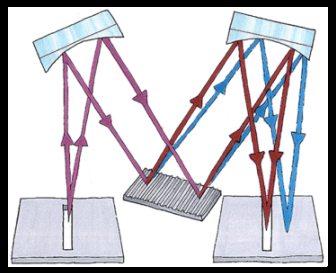
3 reference points –

Light source Analyte The detector

Monochromator grating

Raman

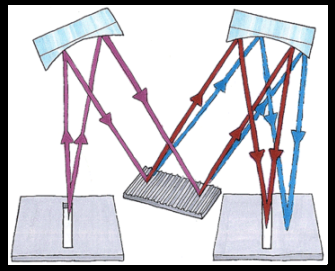
Light source Analyte



The detector

UV Visible

Light source

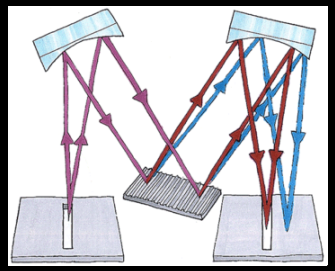


Analyte

The detector

I R absorption

Light source (IR)

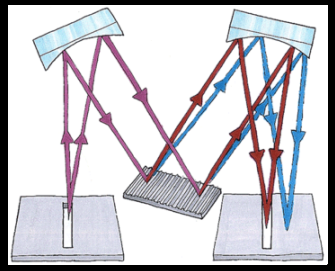


Analyte

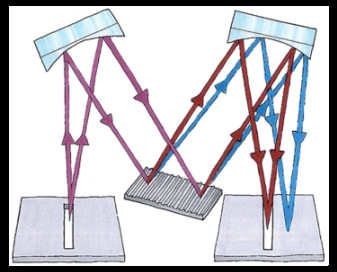
The detector

Fluorescence

Light source (IR)



Analyte

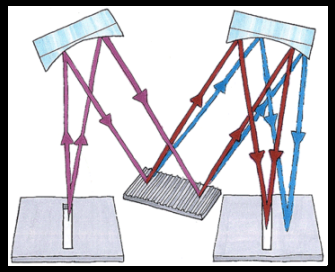


The detector

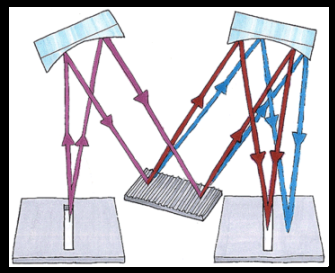
Emission

Fluorescence

Light source (IR)



Analyte

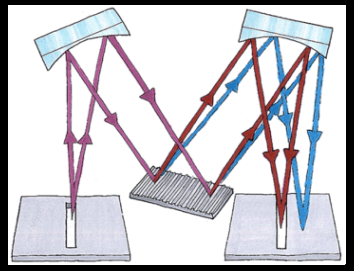


The detector

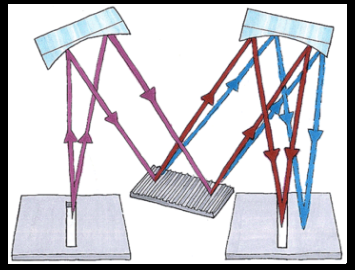
Excitation

Fluorescence

Light source (IR)



Analyte



The detector

Thank you all

Robin John
Ph08d023
05/08/11