

# Computer Controlled Spectrograph

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## **Brief:**

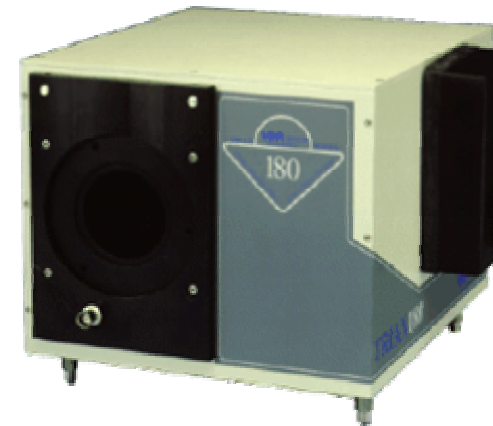
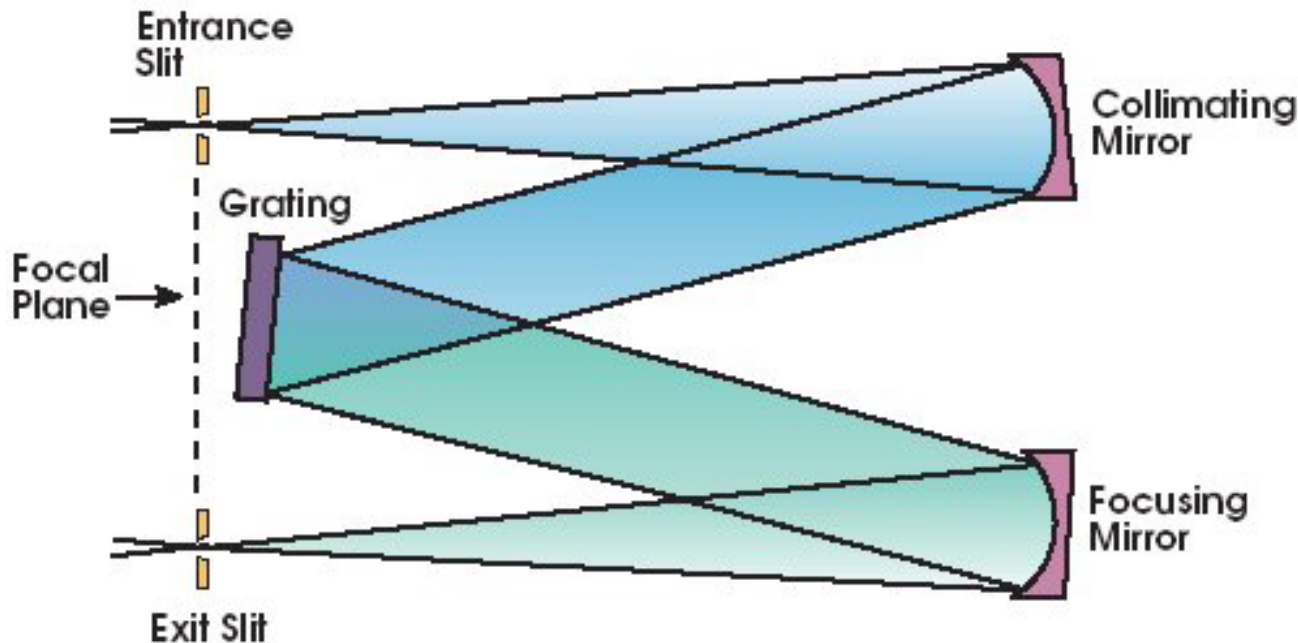
The department has a new Spectrograph (a Triax 180) which has 3 grating and has computer selection of grating and control of grating and slit width.

The spectrograph is provided with a computer interface via the serial port. The project involves writing a user interface to allow the spectrograph to be used for laboratory and observatory measurements.

The performance of the spectrograph will be evaluated by studying the Fraunhofer lines in the solar spectrum.

# What is a spectrograph?

- This is an instrument which presents a range of wavelengths at the exit aperture.
- Allows spectral lines of the source to be viewed.



Triax 180

# The diffraction grating



- It spatially separates the spectrum of the incident light.
- It is lots of edges, which the electromagnetic radiation diffracts off.
- Diffraction is a phenomenon by which wavefronts of propagating waves bend in the neighbourhood of obstacles
- Different wavelengths of light of visible at different angles, so by changing the angle of the diffraction grating are able to determine the wavelength of the light visible. The grating equation specifies the angle that is required to bring each wavelength into view:

$$\sin \alpha + \sin \beta = 10^{-6} kn\lambda$$

# Fraunhofer Diffraction

- Occurs when the Fresnel number is much less than 1.
- Maxima occur at:

$$\sin \beta - \beta \sin \beta \equiv 0$$

- Solving gives the positions of the maxima:

$$\sin \psi = 0, \frac{4.49\lambda}{\pi D}, \frac{7.73\lambda}{\pi D}, \frac{10.9\lambda}{\pi D}, \dots$$

- Minima occur at:

$$\sin \beta = 0, \beta = \pi, 2\pi, 3\pi, \dots$$

- Giving:

$$\sin \psi = \frac{\lambda}{D}, \frac{2\lambda}{D}, \frac{3\lambda}{D}, \dots$$

# Fraunhofer lines in solar spectrum

- These are absorption lines in the solar spectrum
- Occur due to absorption of light by the elements present in the Sun.

