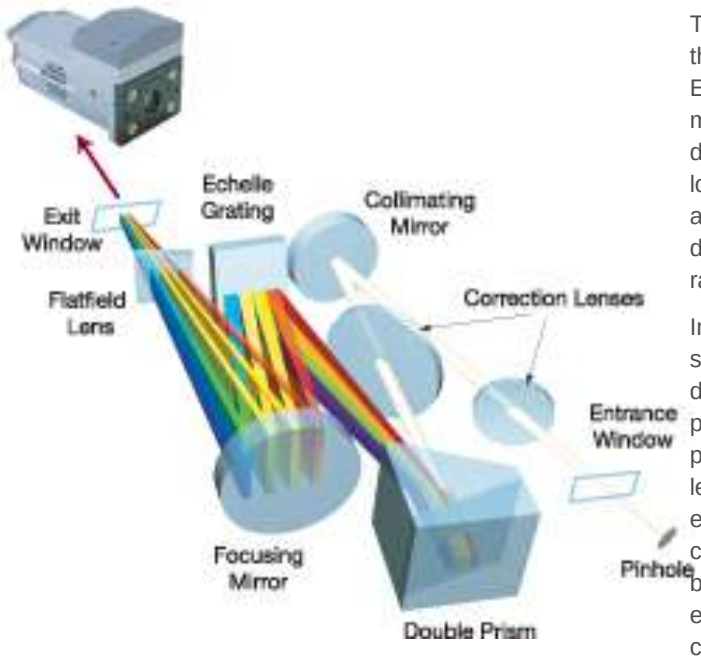
Echelle Spectrographs

The properties of high-resolution Echelle spectrographs

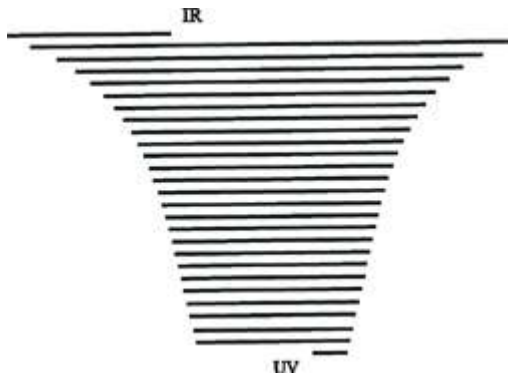
The use of plane gratings for high resolution spectrographs was started with the introduction of the Echelle spectrograph in the 1940's. Prior to this concave grating were used in the 2nd or sometimes the 3rd order to obtain a high dispersion spectrograph. The Echelle spectrograph uses a plane grating at high angles of incidence and diffraction or essentially at very high orders to take advantage of the consequent high resolution and dispersion.

An Echelle spectrograph uses a grating with a large spacing and as the grating is used over a smaller range of angles it can be blazed with a well shaped groove to be more efficient throughout a very wide range of wavelengths.



To individually resolve all the wavelengths the Echelle spectrograph must use a second dispersion element of lower dispersion to be able to resolve the different free spectral ranges.

In the Andor Mechelle spectrograph the second dispersion element is a patented compound prism as shown on the left. The Light from the entrance pinhole is collected and collimated by patented optics to ensure high efficiency collection and low crosstalk among the orders. The light is passes twice through a patented compound prism to provide vertical dispersion of the wavelengths of the free spectral ranges.The light then falls onto an Echelle grating which creates the high dispersion in the horizontal direction of the spectra necessary to achieve the appropriate resolution, The echellegram is then relayed by the focussing mirrors onto the imaging detector.



The patented compound prism allows the orders to be optimized for maximum wavelength coverage with the lowest cross talk.If you compare an echellegram using a simple prism you can see the low dispersion of the prism in the near infrared causes the orders to bunch up and overlap while the high dispersion of the prism in the UV causes the orders to be spread out very far.

Using the Andor patented compound prism the dispersion differences in different materials can be exploited to provide linear dispersion over the entire wavelength range and thereby achieve a much more efficient use of the detector camera.