## Telescope Mirror

Telescopes work by focusing light using either lenses or mirrors, or sometimes a combination of the two. Mirrors tend to be much lighter and easier to manufacture, and so almost all space telescopes – and large ground-based telescopes - use them instead of lenses

The mirror of a telescope is one of the most important parts. It collects the light and focuses it onto the scientific instruments. Bigger mirrors are able to collect more light, and therefore see fainter objects more easily. They also have a higher resolution, and so can see finer detail.

The maximum possible resolution of a telescope is given by:

where ** is the wavelength of the light, *D* is the diameter of the telescope. The value of R is in radians. You can convert to other units using the following relations:

1 radian = degrees 1 degree = 60 arcminutes 1 arcminute = 60 arcseconds

This gives the maximum possible resolution that a telescope mirror can provide, and is called the “**diffraction limit**”. Note that it is different for different wavelengths. On some satellites, not all instruments have taken advantage of this maximum resolution.

Example calculation using the Hubble Space Telescope

The Hubble Space Telescope has a main mirror that is 2.4m across, so . It observes visible light, which has a wavelength of around 600 nm, so . The resolution of the Hubble Space Telescope is:

### Questions

1. Calculate the resolution of the Lovell Telescope at Jodrell Bank. The main dish is 76 m across, and it typically works at a wavelength of around 21 cm.
2. How does that compare to the Hubble Space Telescope?
3. If a telescope were to have the same resolution as the Hubble Space Telescope, but observe wavelengths of 100 microns, what diameter mirror would it need? [1 micron = 1 millionth of a metre]