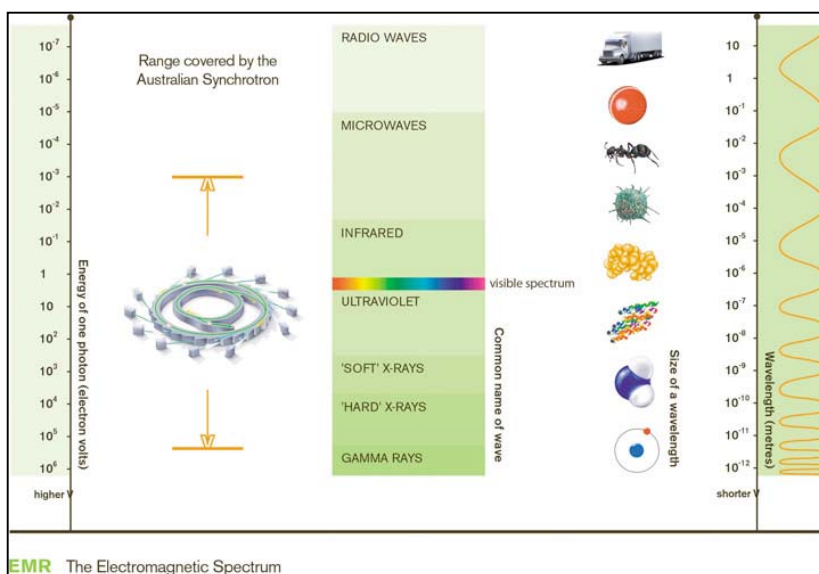


Synchrotron Investigations

4.3 Building a beamline

Background

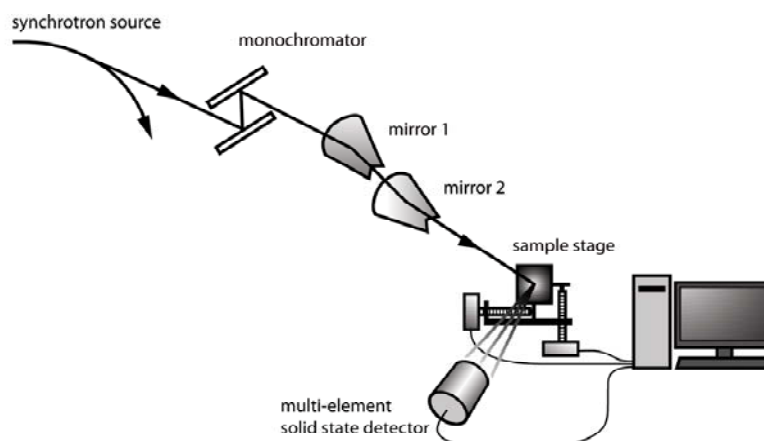
Synchrotron radiation includes wavelengths of electromagnetic radiation from infrared to hard X-ray regions of the spectrum.



Where the Australian Synchrotron fits into the electromagnetic spectrum
Image courtesy: Australian Synchrotron, State of Victoria

To gather useful data, scientists select wavelengths appropriate to the experiment they are conducting and block the rest from interacting with the sample. The process involves directing electromagnetic radiation from the synchrotron down a **beamline**. The electromagnetic radiation selected then passes through a **monochromator** where the desired wavelengths are selected and then focused onto the sample.

Image courtesy: DUIT Multimedia



The interaction of the selected electromagnetic radiation with the sample provides information about the material that the scientist is seeking.

The monochromators used are either gratings or crystals, they diffract and wavelength select the electromagnetic radiation or prisms to refract the light. These are used so a single frequency can be selected. Filters (slits) are then used to select the monochromatic (single frequency) of electromagnetic radiation required.

Notes on the experiment

Building a beamline activity is challenging. Many things need to be positioned to optimise brightness of the monochromatic beam that is focused on the sample of matter being examined. It has been designed to be challenging so give your students sufficient time to succeed.

Working in a darkened room is a big advantage but not absolutely necessary. Hodson Light Boxes are outstanding for the exercise as they contain all the necessary mirrors and lenses that the student might require. If you do not have them, then containing and concentrating light from the light source becomes an additional step to finding a solution to the exercise.

As with all experiments, it is suggested that the teacher trials the experiment before presenting it to the students.

Note to teachers:

Students must have carried out activities 4.1 and 4.2 as an introduction before attempting this activity.