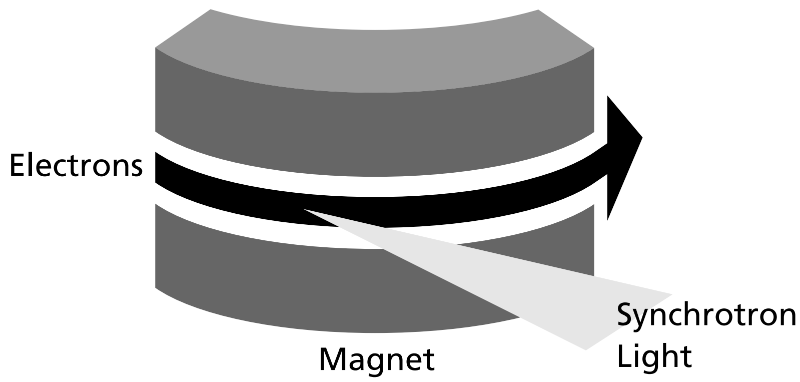
THE D FILES 2

Title	Can you be a Special Agent?
D File Number	WA44AD002
Background	The research facility at Daresbury is centred around a huge circular machine –the Synchrotron Radiation Source or SRS. Synchrotron radiation is basically a very bright form of light which, as well as visible light, includes infrared, ultraviolet and X-rays. Inside the SRS, a beam of electrons is accelerated to almost the speed of light. Sixteen huge magnets provide a field which bends the electrons into a circular path. As the electron beam accelerates through each of the magnets, each electron gives off synchrotron light, like a searchlight in front of itself. The light – a mix of the many wavelengths – is collected from eleven of the sixteen magnets and channelled along 'beam lines' to experimental areas, where teams of scientists can use it for their research.



Emitting synchrotron light takes a great deal of energy so, to replace the energy that the electron beam uses creating light, radio waves are fed into the SRS. The waves push the electron beam along, rather like you would need to push a roundabout to keep it turning.

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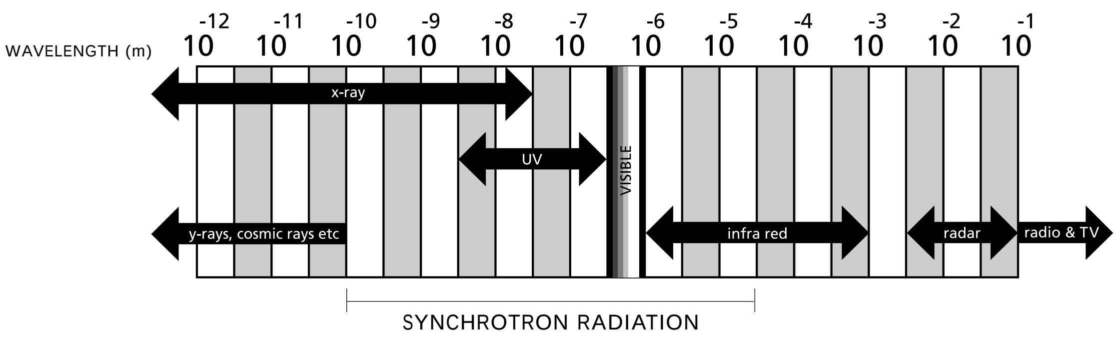
In this way, the same electron beam can give off synchrotron light for many hours.

Synchrotron light is very bright – like the light from a million 100 watt light bulbs shining onto the area of a full stop. Its unparalleled intensity allows scientists to perform experiments that would not be possible using a less bright X-ray or ultraviolet light. Experiments that happen very quickly or samples that are changing very rapidly can be investigated easily because the X-ray source is bright enough to take a very brief ‘snapshot’ of the experiment. Synchrotron light is also different from ordinary light because it comes in pulses rather than being continuous. This means that data can be collected that reveal changes in the samples, rather like a movie camera records many images of someone moving across the screen.

Synchrotron light contains many wavelenghts-the greater the acceleration of the electron beam the shorter the wavelength of the light it produces. In two places in the SRS there are magnets with particularly high magnetic fields. These bend the electron beam much more than the sixteen dipoles. The sharp corner that the beam is forced to take gives it a huge acceleration and, as a consequence, the beam emits much shorter wavelength light from these magnets. This increases the range of wavelengths available to the scientists, providing even shorter wavelength X-rays.

ELECTROMAGNETIC SPECTRUM



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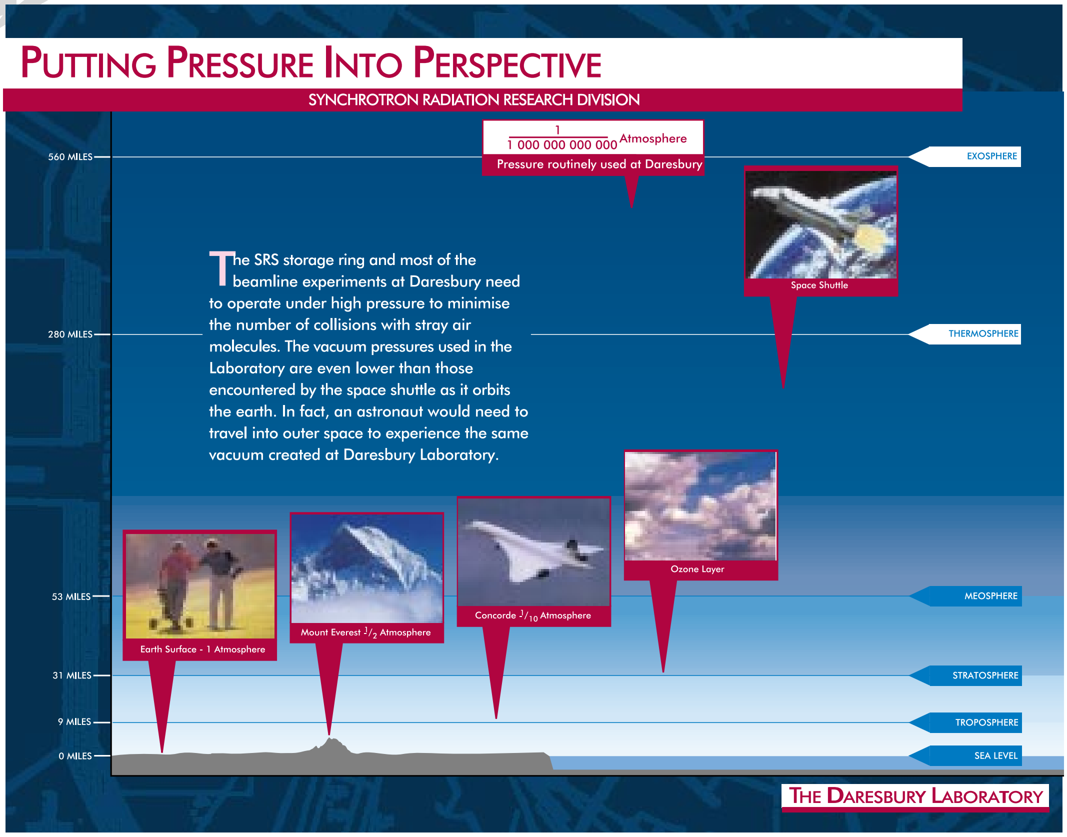
In the SRS,the circulating electron beam is housed in a vacuum chamber where the pressure can be as small as the air pressure found 1,000 miles into space. Were it any higher, the electrons would collide with air mollecules and scatter out of the beam. The beam lines and some of the experiments are also under vacuum so that the very bright synchrotron light is not diffused by gas and delicate samples are not contaminated by being exposed to the atmosphere.

Putting Pressure into Perspective



The SRS runs 24 hours a day providing the intense beams of light needed by research teams who come from all over the world. The range of experiments they do helps us to increase our understanding of biology, chemistry, materials science, physics and medicine.

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Mission	TO FIND OUT IF YOU CAN BE A SPECIAL AGENT COMPLETE THE TWO TASKS
Task One	Special Agents are required to find the secret location where the answers to many scientific questions may be found.

Solve the clues then insert the answers into the grid to reveal it.

1. This is produced as electrons whiz around in the SRS
2. Scientists do this to help us understand things
3. The visible spectrum is only a small part of this
4. The home of the SRS
5. A substance which glows in ultraviolet light is said to do this
6. A wavelength of light that we feel as heat
7. X-rays and light travel along these to reach the experiments
8. The greater the acceleration, the shorter the ....
9. The shortest wavelength from the SRS

Special Agent's Task: Find the secret place where the answer to many questions may be found:

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1.  _ _ _ _ _ _ _[_]_ _ _
2.  _ _ _ _ _ _ _[_]
3.               [_]_ _ _ _ _ _ _ _ _ _ _ _ _ _ _  _ _ _ _ _ _ _ _
4.               [_]_ _ _ _ _ _ _ _
5.               [_]_ _ _ _ _ _ _ _
6.               [_]_ _ _ _  _ _ _
7.      _ _ _ _  [_]_ _ _ _
8.         _ _ _ [_]_ _ _ _ _ _
9.      _  _ _ _ [_]
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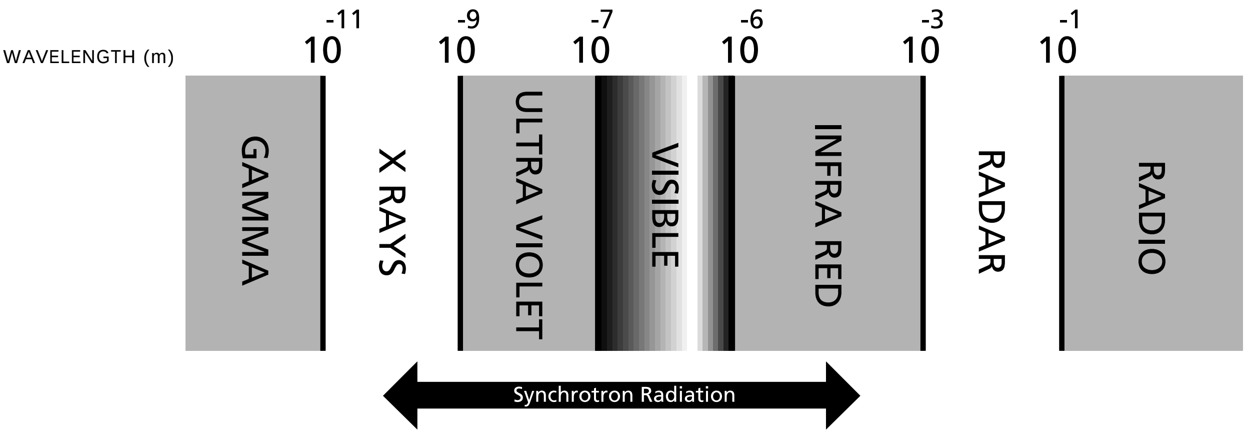
Task Two

Electromagnetic Spectrum



What are the wavelengths which cover Synchrotron?

What is the difference in the extremes of the wavelengths for Ultra Violet Radiation?

TOP SECRET FILE

ANSWER FILE

1. SYNCHROTRON
2. RESEARCH
3. ELECTROMAGNETIC SPECTRUM
4. DARESBURY
5. FLUORESCE
6. INFRA RED
7. BEAM LINES
8. WAVELENGTH
9. X RAYS