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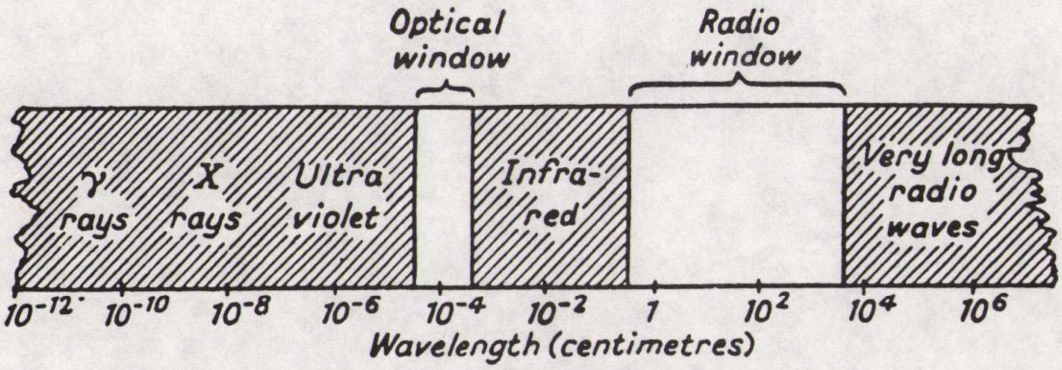
Why do Astronomy from Space

Although the Earth's atmosphere appears transparent to us as we look at the stars on a clear night we must remember that our eyes only respond to a narrow range of optical frequencies or wavelengths (colours). Radiation that is of a shorter wavelength (eg ultraviolet) or a longer wavelength (eg infrared) simply is not detected by our eyes. Our view of the Universe is rather a limited one because of this effect. We do not "see" stars which are very cool and just at the beginning of their life as they emit mostly in the infrared. When we look into the sky, we do not see anything special about stars which are extremely hot, over a million degrees, as these emit most of their radiation at ultraviolet or even at X-ray wavelengths. We basically see only stars that are more or less like our Sun and this is natural because humans have evolved on Earth with eyes that respond best to sunlight.

Astronomers now know, however, that there is much more going on in the Universe than appears in the optical bands visible to us. A major problem in studying these unusual very cool or very hot objects is that unlike in the visible, our atmosphere absorbs infrared, ultraviolet and X-rays, blocking our view. This is the main reason that the study of the Universe has to be carried out to some extent from space, above the Earth's opaque atmosphere.



The complete electromagnetic spectrum showing the regions of transparency of the earth's atmosphere and ionosphere.

Our atmosphere also moves optical images (it makes stars twinkle) and this can even be a problem to astronomers working in the visible part of the spectrum, if they want to study objects with very good positional accuracy. Two satellites working in the optical waveband have been launched recently, one called HIPPARCOS, designed to measure star positions with great accuracy and the other, the Hubble Space Telescope, will amongst other things look at very small star images for evidence of other planets. Scientists have had to use telescopes in space for both these purposes.

One advantage of observing from space is that the weather is always good (it is never cloudy or raining!). This means that space observatories can make measurements for 24 hours of every day compared to a much shorter period for ground-based telescopes.

Astronomers may go to the trouble of launching telescopes into space for making very accurate radio pictures of the Universe even though the Earth's atmosphere is transparent to radio waves. This is because they need radio telescopes separated by very long distances in order to produce such high resolution pictures, and the Earth is not big enough! Radio telescopes in the US, Europe, the USSR and Australia have already been coupled together but the studies of Radio Galaxies need the much better resolution that will come from a pair of telescopes, one on the Earth and the other in orbit.

The final reason for doing astronomy in space is because the space instrument needs to visit a particular location in the Solar System to measure the particles, fields or dust close to a planet or to take close-up pictures of its surface or atmosphere.

Working from space is expensive and difficult but our knowledge of the Universe has been increased dramatically by the ability to use telescopes and sensors which are not fixed to the ground.