

Exercise walk-through

8.2

Red shift and the Big Bang (P)

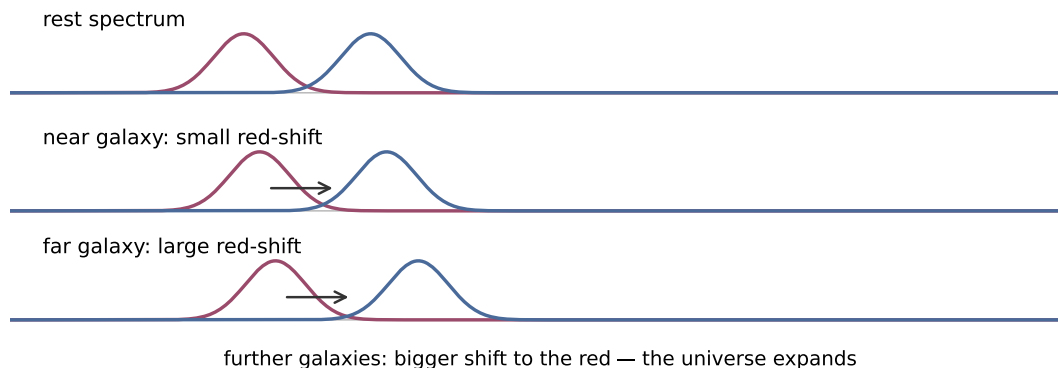
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The method

Method — Shift, distance, beginning

Receding source $\rightarrow$ wavelength increases, frequency decreases. Red-shift grows with distance $\rightarrow$ space expands $\rightarrow$ Big Bang; the CMBR is its afterglow, about 14 thousand million years ago.



Three labelled spectra: further galaxies shift further to the red.

2

Practice

Exercises 2.1·2.3

2.1 (P) What happens to observed wavelength when a source recedes? [1]

2.2 (P) What happens to observed frequency when a source approaches? [1]

2.3 (P) State the link between a galaxy's distance and its red-shift. [1]

Exercises 2.1·2.3

2.1 (P) What happens to observed wavelength when a source recedes? [1]

2.1 (P) It increases – red-shift.

2.2 (P) What happens to observed frequency when a source approaches? [1]

2.2 (P) It increases (wavelength decreases).

2.3 (P) State the link between a galaxy's distance and its red-shift. [1]

2.3 (P) The further the galaxy, the bigger the red-shift (they recede faster).

Exercises 2.4·3.1

2.4 (P) What does red-shift suggest about space? [1]

2.5 (P) How long ago was the Big Bang? [1]

3.1 (P) Explain how increasing red-shift with distance supports the Big Bang model. [3]

Exercises 2.4·3.1

2.4 (P) What does red-shift suggest about space? [1]

2.4 (P) Space itself is expanding.

2.5 (P) How long ago was the Big Bang? [1]

2.5 (P) About 14 thousand million years ago.

3.1 (P) Explain how increasing red-shift with distance supports the Big Bang model. [3]

3.1 (P) Red-shift means the galaxies recede; red-shift growing with distance means the further away, the faster the recession – exactly what expansion of space produces from any vantage point; tracing the expansion backwards gives a very small initial point – the Big Bang.

Exercises 3.2-3.3

3.2 (P) Explain what the cosmic microwave background is and why only the Big Bang theory predicts it. [3]

3.3 (P) A police siren passes you at speed. Describe the pitch change, naming the effect. [2]

Exercises 3.2-3.3

3.2 (P) Explain what the cosmic microwave background is and why only the Big Bang theory predicts it. [3]

3.2 (P) Electromagnetic (microwave) radiation filling the universe, arriving from every direction; it is the stretched, cooled remnant of the radiation present shortly after the beginning; only a hot, dense beginning – the Big Bang – produces such background radiation, so it is the theory's second pillar.

3.3 (P) A police siren passes you at speed. Describe the pitch change, naming the effect. [2]

3.3 (P) As the siren approaches, the pitch is high (bunched wavefronts); as it passes and recedes, the pitch falls (stretched wavefronts); this is the Doppler effect.