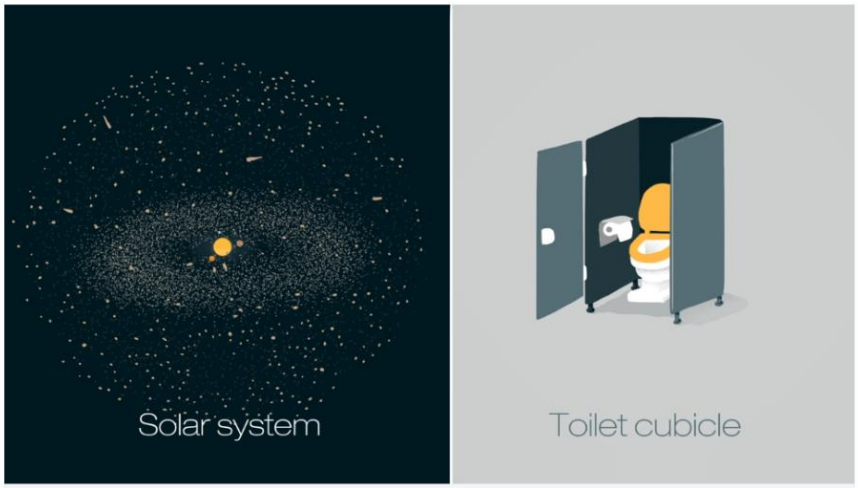
ROYAL OBSERVATORY GREENWICH

Scales of the Universe

Key Stage 4

Topics covered: Velocity, distance, light-years, standard form

Watch the video "How big is the Universe?" https://vimeo.com/88899162



Imagine the Solar System was the size of a toilet cubicle 1 metre across. The total diameter of the Solar System (including the giant Oort Cloud – a vast bubble of cometary rocks surrounding us) is around 2 light-years. A light-year is the distance that light travels in a year e.g. if a star is 0.2 light-years away the light has travelled for 0.2 years.

1. The black hole in the centre of the Milky Way is 1.25×10^{-6} light-years across. Calculate this in units of toilet cubicle.

2. The size of the Milky Way is 100 000 light-years. If the Solar System was the size of a toilet cubicle, our galaxy would stretch from Greenwich to Maidstone (a distance of 50 km). Prove this.

3. The distance to Andromeda is 2.4×10^{19} km. The speed of light is 3×10^{5} km/s. Work out how long a text message would take to reach Andromeda travelling at the speed of light.

4. Calculate how long it would take us to reach Andromeda if we travelled at the same speed as the Voyager spacecraft which is currently at the edge of the Solar System moving at a speed of 17 km/s. Write your answer in years.

5. If the lifetime of the Universe was a 10 hour movie, what fraction of that movie would feature humans? The current age of the Universe is 13.8 billion years.

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Scales of the Universe: ANSWERS

Key Stage 4

1. 6.25×10^{-7} toilet cubicles (0.6 millionth of a cubicle)
2. 100 000 ÷ 2 = 50 000 cubicles ≡ 50 km
3. 2.5 million years
4. 44 billion years
5. 1 second