

Topic 8: Space physics

AQA GCSE Physics 8463 · spec 4.8 · sheets 8.1–8.3

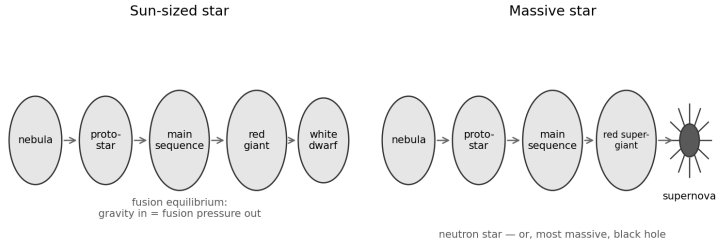
Space physics: the biggest picture

- Stars are born, burn and die; galaxies race apart.
- The whole topic is physics only; orbits are HT.
- Facts must be exact: life cycles, elements, red-shift chain.

The Sun: gravity lights a fire

- One star, eight planets, dwarf planets, moons; part of the Milky Way.
- A nebula pulled together by gravity; fusion begins.
- Equilibrium: gravity in, fusion pressure out.

Two lives, by mass

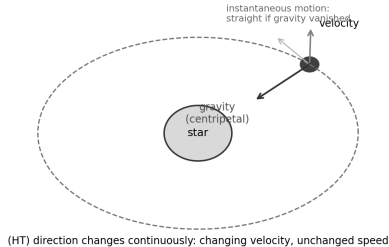


- The life cycle of a star is set by its mass at birth.
- Sun-sized: main sequence, red giant, white dwarf.
- Massive: red supergiant, supernova, neutron star or black hole.

We are made of supernovae

- Fusion builds elements up to iron.
- Heavier than iron: made in a supernova.
- The explosion scatters them through the universe.

Gravity bends the path into a circle



- Orbital motion and satellites: gravity is the centripetal force.
- Planets orbit the Sun; moons orbit planets; ours are artificial.
- (HT) Changing velocity at constant speed; radius change for stability.

Your turn: stable orbit

- A satellite fires its engines and speeds up.
- What must happen to its orbital radius?

Stable orbit worked

- 1 **Faster** more distance per second at the same pull.
- 2 **Result** the old radius stops closing the circle.
- 3 **Fix** a smaller (lower) radius — where gravity is stronger — is stable.

Red-shift: the stretch of space

absorption lines shift to the red end



further galaxy = faster receding
= bigger red-shift

expanding universe → Big Bang

- Light from most distant galaxies: wavelength increased.
- Further away = faster receding = bigger red-shift.
- Expansion run backwards: the Big Bang.

The theory and its edges

- 1998: supernovae show galaxies receding ever faster.
- Observations build the theory; peer review checks it.
- Dark matter and dark energy: still unknown.

Check yourself

- Checklist before you call this topic done.
- Both life cycles in order; where each element forms.
- Orbits by gravity; the red-shift chain to the Big Bang.