The Non-Astronomer's Discerning Guide to Tom's Defence

A quick cheatsheet for a variety of astro jargon

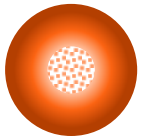
Stellar evolution

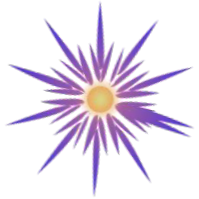
Massive stars for *my* purposes are those that end their lives in a supernova, so at least ~7x more massive than the sun

More massive stars evolve *more quickly* because of higher pressures/temperatures in their cores, accelerating nuclear fusion

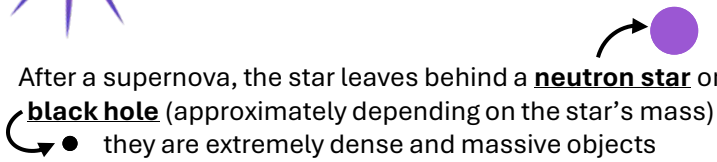
The **metallicity** of a star is the fraction that is "metals", meaning not hydrogen or helium. The *earlier* in the Universe a star is born, generally the *lower* its metallicity

Massive stars have **convective cores** (which mix up all of the elements), and **radiative envelopes** (which don't)





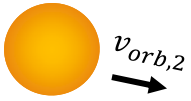
A **supernova** is a huge explosion when the core of a massive star collapses – they can obliterate entire solar systems and outshine galaxies!



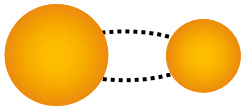
After a supernova, the star leaves behind a **neutron star** or a **black hole** (approximately depending on the star's mass) – they are extremely dense and massive objects

Supernovae aren't *completely* symmetrical; more material goes in one direction. So, by Newton's third law, the resulting objects get a **natal kick**, which can cause them to fly off at 100s of km/s!

These kicks can **unbind** a binary, causing the star to also be ejected at high velocities, potentially producing **runaway stars** (which move faster than ~30 km/s)

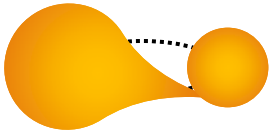


Binary stellar interactions



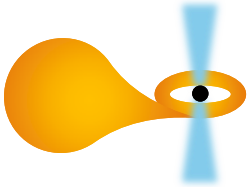
Most massive stars have ≥ 1 companion that they orbit in a **binary**

Stars in binaries can interact through **mass transfer**, where the **donor** star pours material onto the **accretor** star



If this becomes unstable, the two stellar cores can orbit in a single **common envelope**, which can shrink the orbit, or lead to a **stellar merger**

You can make all sorts of exotic binaries, like **X-ray binaries** where a star is pouring material onto a compact object, forming a disc of material, with huge polar jets – all emitting lots of X-rays!



If you get really lucky, you can form a binary with two compact objects (e.g. two black holes). We can't see these with telescopes, but when they collide and merge, they shake the fabric of spacetime so violently that we can detect the **gravitational waves** they emit!

Miscellaneous terms

Parsec: ~3 light-years, ~20,000 billion miles

Asteroseismology: The study of stellar pulsations

High-redshift galaxies: Galaxies from the early universe

LISA: Future space-based gravitational-wave detector

Hydrodynamical simulations: Encapsulate gas physics, heating, gravity & more

Compact object: A white dwarf, neutron star, or black hole

Double compact object: As above, but two bound together in a binary

O B A F G K M

Stellar classifications, most massive are O, least are M