The Life Cycle of a Star!

(Stellar Evolution)

Hi! I'm Sniffle the Star! Today, I'm going to guide you on Stellar Evolution (all hand-drawn by me!), and show you through the journey of stars!

Did you know that smaller stars like our Sun will live for about 10 billion years, but massive stars will live for about 10 million years? You can also use a Hertzprung-Russell (H-R) diagram to see a star's luminosity and temperature!

Births of stars begins in **nebulae**! Here proto-stars (or baby stars) begin collecting gas from their surroundings to grow and become stars. As gas is used up, gaps in a nebula will appear as it has been consumed by forming stars! As these enormous amounts of gas and matter are collected, gravity soon creates a collapse. By doing this, the baby star is heated up and its core is squeezed together which makes enough inward pressure for nuclear fusion to happen!

This is a **massive star**, which is more than 8x the mass of the Sun! Larger stars are born as they consumed more gas and matter from the nebula or dust cloud! Again, stars will spend about 90% of their lives at this stage burning their hydrogen fuel into helium.

This is an **average star**. For most of their lives, stars will stay in this stage – like our Sun now! Here, nuclear fusion is taking place, so stars will be fusing its fuel, hydrogen, into helium, which releases energy as this takes place!

Differing from red giants, this is a **red supergiant**! This is again due to its large mass. The star appears red now as although it is generating more power than before, it is spread over a larger surface area, causing a lower surface temperature and hence the red glow!

Once stars run out of hydrogen & fusion stops, there will be no more gas pressure to stop the star from collapsing., which will create such temperatures where helium fusion will begin. This will cause a massive expansion, turning into a **red giant**!

Fusion like in the average star also occurs here. Once it reaches iron and begins its collapse, but there will be so much energy that even the electron degeneracy pressure cannot prevent this, causing a **supernova**! This is an enormous release of energy which can outshine galaxies!

The star will continue to fuse heavier elements until it reaches iron. Red giants cannot fuse it further due to a lack of energy and fusion stops again, causing a collapse from lack of an outward gas pressure. The cooler outer layers of the star will drift away, forming a **planetary nebula**!

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Remnants of the supernova can result in two paths. One of which being a **neutron star**, which has collapsed so much that atoms have been squeezed so much only nucleons are left. If the star's remnant was above the Oppenheimer–Volkoff limit, it will collapse into a **black hole**, which is so dense even light cannot escape!

After its outer layers drift away, according to the Chandrasekhar limit, if the core is no more than 1.4x the mass of the Sun, the electron degeneracy pressure will prevent further star collapse, and will form a **white dwarf**. White dwarfs are very hot but are quite dim.