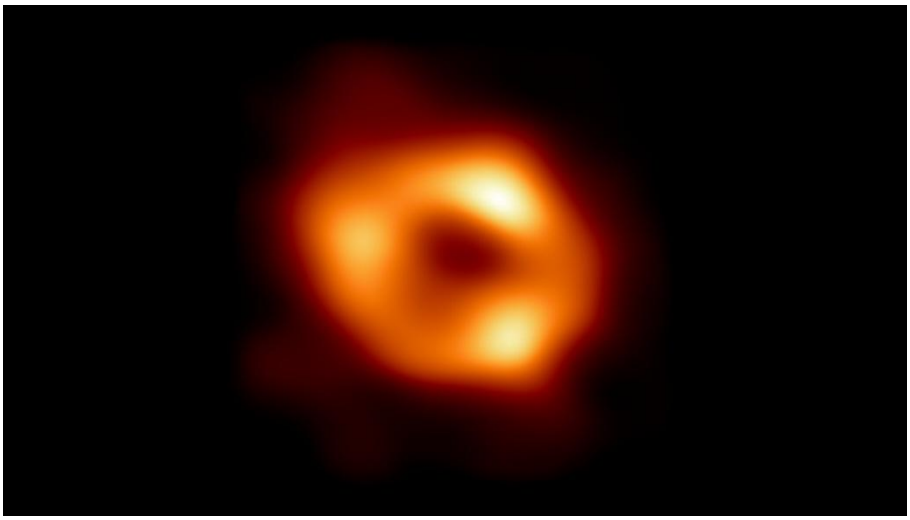
Caldwell 69: Butterfly Nebula by RENEE Y

Credit: NASA, ESA, Joel Kastner (RIT) - https://science.nasa.gov/asset/hubble/ngc-6302-the-butterfly-nebula/

This image of Caldwell 69 includes ultraviolet, visible, and infrared observations taken by Hubble.Caldwell 69 (NGC 6302) also known as the Butterfly Nebula, is a striking bipolar planetary nebula located in the constellation Scorpius. It lies within our Milky Way Galaxy, roughly 3800 light-years away. With a brightness of magnitude of 9.6, it can be seen with large

binoculars or small telescopes, especially in the summer months. The Butterfly nebula was formed around 1,000–2,000 years ago, the nebula was created when a Sun-like star ran out of fuel and expelled its outer layers as a supernova. Its most striking feature is its shape, two vast lobes of gas that look like butterfly wings, stretching nearly 3 light-years across. These clouds expand at speeds of about 100 km/s, carrying both hot gas and cosmic dust. Some dust grains are amorphous, like soot, and others form tiny crystals that could become ingredients for future stars and planets. At the Nebula's center lies one of the a hot, dying star, with a surface temperature near 250,000 °C. Its extreme heat makes the nebula glow in ultraviolet, but it is shrouded by a dense dust cloud, obscured in visible light. Powerful infrared telescopes like the James Webb Space Telescope (JWST) can observe in other wavelengths to detect light that can travel unhindered through the dust to reveal its inner details.

Black holes and glowing accretion discs by OSCAR C Credit: NASA/EHT Collaboration (https://www.nasa.gov/universe/nasa-animation-sizes-up-the-universes-biggest-black-holes/)



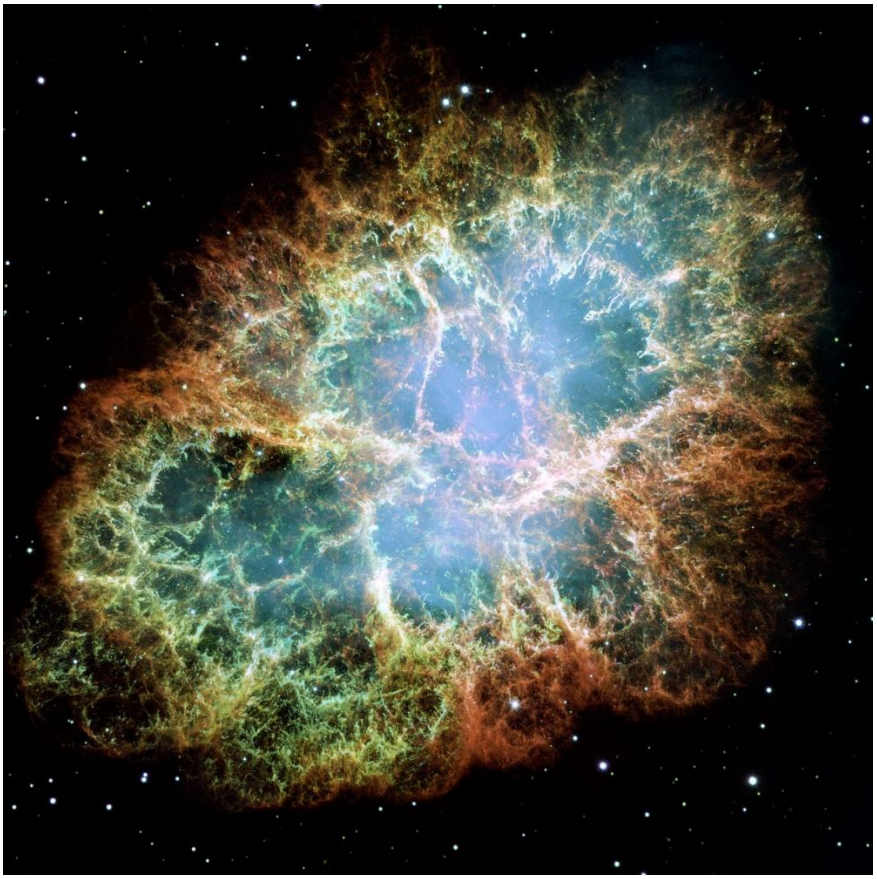
Black holes are some of the most mysterious objects in space. Black holes are made when massive stars come to the end of their life. There is a battle between neutron degeneracy pressure (an outwards force resisting gravity caused by the star burning its fuel) and gravity, which acts inwards. If gravity wins this fight a black hole is formed.

When a black hole is formed, all the star's mass is concentrated at an infinitely small point called a singularity. Gravity increases closer to the black hole,extending to a radius called the event horizon beyond which nothing, not even light, is fast enough to escape the black hole's gravitational pull. The size of this region determines the size of the black hole. The surface's gravity is so strong that if anything goes near it, the object's atoms get pulled into a string just one atom thick in a process called spaghettification.

It is commonly believed that black holes are completely black, but they are not. Gas and dust fall into a black hole once they cross the event horizon, a point of no return beyond which nothing, not even light, can escape a black hole's powerful gravity. Falling in at such high speeds, gas and dust heat up due to friction, emitting light that travels across many light years to get to our telescopes. This photo is of our galaxy's supersized black hole, Sagittarius A*, as seen by the Event Horizon Telescope. It contains the equivalent mass of 4.3 million Suns. The photo shows heated gas falling into the black hole, making a hot, glowing accretion disk, which is the only visible part of a black hole and is what you're seeing in this image.

Crab Nebula by SOPHIA X

Credit: NASA, ESA and Allison Loll/Jeff Hester (Arizona State University).
Acknowledgement: Davide De Martin (ESA/Hubble) -
https://esahubble.org/images/heic0515a/



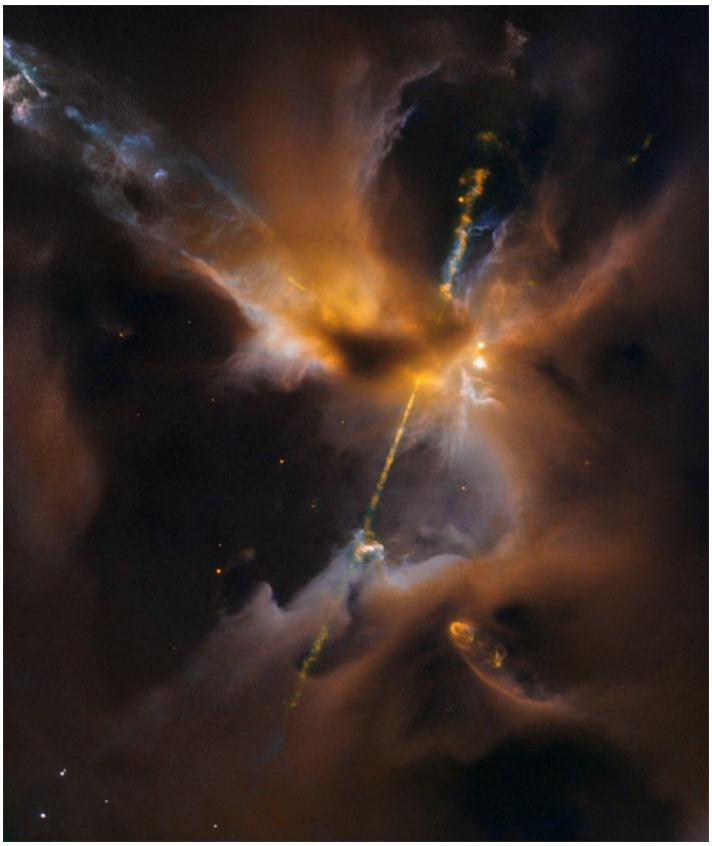
The Crab Nebula is one of the most famous objects in the night sky. It is a huge cloud of gas and dust that was created when a star exploded in a supernova. This explosion was first seen on Earth in the year 1054 by Chinese astronomers, and it was so bright that it could be seen during the day for several weeks. The remains of that explosion are what we now call the Crab Nebula, and it is still expanding today.

The nebula is found in the constellation Taurus and is about 6,500 light years away from Earth. At its centre there is a neutron star, called the Crab Pulsar. This is a very dense object that spins rapidly and gives off pulses of radiation. The Crab Nebula is important as it has helped astronomers learn more about how stars live and die. It also shows us what happens after a supernova, and the central neutron star gives us information about extreme conditions in space, such as crushed up dense stellar cores. The Crab Nebula is also very beautiful, with glowing gases that can be seen through telescopes. The orange parts show the remains of the star, mostly hydrogen, while the blue colours are light

produced by electrons swirling in at nearly the speed of light around the magnetic fields produced by the embedded neutron star at the centre. The rotation of the neutron star produces pulses 30 times per second, which beam out like a lighthouse.

Young star formation in the Milky Way by JUDE C

Credit:NASA/ESA - https://science.nasa.gov/asset/hubble/herbig-haro-jet-hh-24/



This is a photo taken by the Hubble telescope in the 26th year after it was launched into space. The picture shows a young forming star (protostar) in the Orion B molecular cloud complex, which is located 1350 light years away from us, in our Milky Way galaxy.

When a newborn star forms within massive clouds of cool gas (mainly hydrogen molecules), the surrounding material will collapse into dense gas clumps due to gravitational attraction, eventually forming the cores of protostars. A hot, rotating disk of gas and dust forms around the protostar. Material from this disk accretes into the protostar's core, and some very hot material is ejected along the star's axis of rotation in the form of partially ionised gas. Although the formation of the bipolar jets is still a mystery, it is believed that this is a result of interactions between accretion material and the stellar magnetic fields. Another possible explanation for this is through angular

momentum conservation when gases collide and excess angular momentum is carried away.

The emission of electromagnetic radiation from these objects is caused by shockwaves when the jets collide with surrounding gas and dust at very high speeds. The shock fronts heat and ionise the gas, causing it to glow in its characteristic emission lines, showing elements such as hydrogen.

This particular photo shows the protostar Herbig Haro, which resembles a double ended light saber from the science fiction movie 'Star Wars'. Indeed, this Hubble image was actually published during the release of 'Star Wars Episode VII: The force awakens' back in 2015.

Star clusters and observation filters by HIROTO M

Credit: European Southern Observatory - https://www.eso.org/public/images/eso0929b/

This is an image of an open cluster called RCW 38, which is a group of stars located around 5500 light years away in the constellation Vela. This image is taken by using multiple filters (B, V, R and H-alpha). The B filter which is for blue light (wavelength around 440nm) is useful for observing the hottest and biggest stars, which are classified as O, B or A. These stars produce a lot of short wavelength blue light due to their hot temperatures. The V filter is for slightly cooler stars emitting green to yellow light (wavelength around 550 nm) . The image filters used in this image will have brightness similar to human eye perception. The R

filter allows the red light to pass (wavelength around 700nm) and is useful when observing cooler stars, such as red giants. Finally, the H alpha filter is used because it is specialised for filtering out the light produced by the hydrogen which has a distinctive emission wavelength. This allows us to see these nebulae which consist mostly of hydrogen, which in the picture appears as a red cloud. Hydrogen in the clouds can be material for stars to form, and star formation can also be seen taking place in this image. Astronomers combined these pictures taken through these filters to obtain this image. This cluster shows a dramatic environment of intense star formation and explosion, where young stars bombard their surroundings with powerful winds, dazzling light and hot temperatures. This cluster is extremely young with an estimated population of up to 2000 stars and according to some x-ray studies there are more than 500 young stellar objects.