

The death of stars – What happens when stars run out of fuel?

The universe is filled with billions and billions of stars with very different sizes, but with the same working mechanism. Some people might already know that stars - and therefore our sun – shine, because it fuses hydrogen via nuclear fusion to helium, but fewer know what happens once this “fuel” is used up. The phenomena that result from this shortage lead to some of the most gigantic physical reactions known to man, such as the birth of “neutron stars” and “black holes”. These phenomena base on some very basic laws of physics, which makes it easy to understand the main aspects of this topic. Which particular “death scenario” will happen to a star, solely depends on its size. But to a certain point, all stars go to through the same stations, which I will explain now.

Stars are in equilibrium of gravitation and radiation pressure, caused by the nuclear fusion inside. Once the hydrogen is used up, the radiation pressure decreases, whereby the gravitation causes the star to densify. Thus, the temperature increases to a point, so that the produced helium in the core can be fused to carbon. A new nuclear fusion has been started! This new radiation/heat source, causes the outer layers of the star to expand dramatically, increasing the volume. The star became a so called “red giant”. What happens after this point depends on the size of the star. Small stars cool down eventually and shrink, leaving a glowing corpse with a still unknown fate. Bigger stars go through several cycles of densifying and starting fusion reactions, ultimately exploding in super novae. What stays behind after this gigantic explosion, is either a neutron star or a black hole. Both are objects with incredible characteristics, which are target of current scientific research.

