

A nursery for stars

The Orion Nebula is the nearest region of massive star formation to Earth: just 1,300 light-years away

Jonathan Freundlich

The Orion Constellation is one of the easiest constellations to identify in the winter night sky, because of three aligned stars that constitute Orion's belt. It represents a giant hunter with broad chest and strong feet from Ancient Greek mythology, whom the gods placed amongst the stars at his death.

A colourful cloud

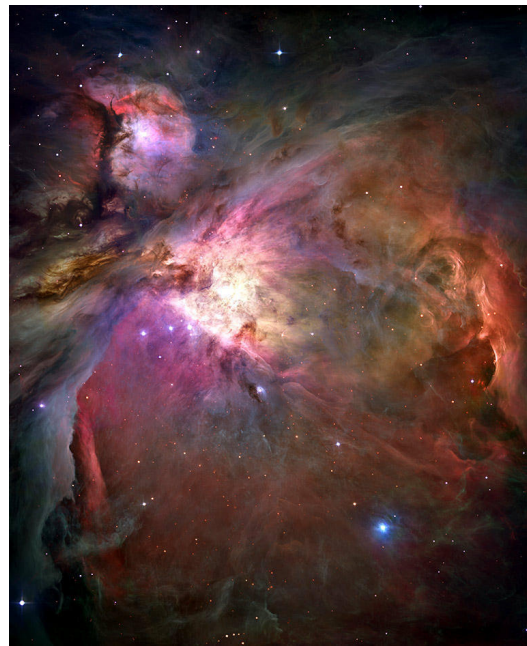
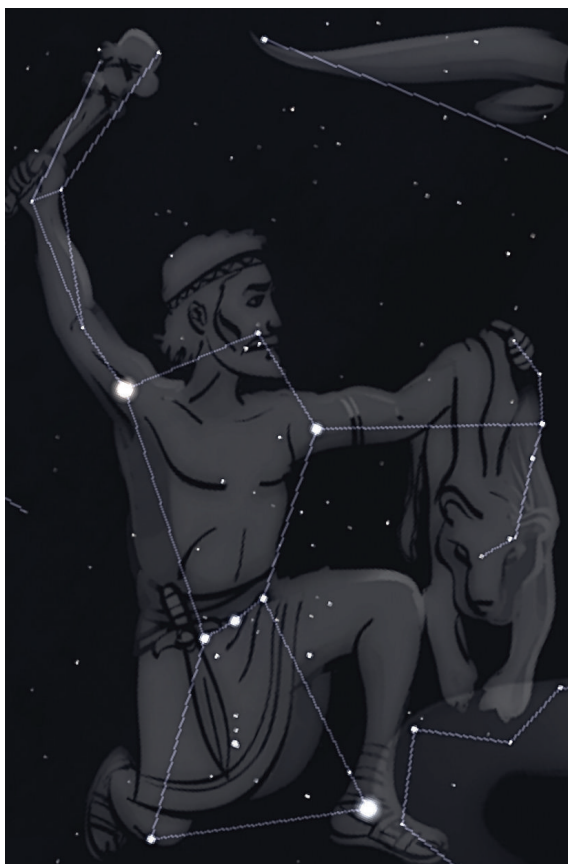
Below Orion's belt is an alignment of stars that could represent his sword sheath. This is where one of the most magnificent astronomical objects lies: the Orion Nebula. It can be visible to the naked eye or with binoculars as a faint red glow, but one needs a powerful telescope such as the Hubble Space Telescope to uncover its inner structure and beauty.

Yet beware that astrophysical images usually use false colours and do not necessarily show what our eyes would see! Such images are indeed obtained from combinations of black and white pictures taken with different filters. For example, ultraviolet light is often displayed in blue, so we can visualize its distribution in space, which is something we wouldn't be able to see directly with our limited sight.

Each filter and each colour tells us something about the contents of the objects we observe, in the same way that you can guess the composition of a fruit juice from its colour. In the Orion Nebula, young stars emit ultraviolet light, while the surrounding gas glows red. The combination of both colours can result in purple strokes in the images, while denser regions occasionally obscure this background and appear as dark foreground clouds. Green shades indicate the presence of oxygen atoms.

Born in turmoil

The Orion Nebula is the nearest region of massive star formation to Earth: it is only about 1,300 light-years away from us, which is a very small distance



The Orion Nebula as seen by the Hubble Space Telescope. PHOTO: NASA, ESA, M. ROBERTO (SPACE TELESCOPE SCIENCE INSTITUTE/ESA) AND THE HUBBLE SPACE TELESCOPE ORION TREASURY PROJECT TEAM. (Left) *The Orion Constellation.* CREDIT: JOHAN MEURIS/STELLARIUM

when compared to the total size of the Milky Way. Thousands of stars of various sizes and ages are visible in the sharpest images of this nebula. These stars are embedded in a giant cloud of gas and dust, from which even more stars are being born.

New stars form in the densest regions, where gravity pulls gas particles together. There, density and temperature can be so high that atoms start to merge through powerful and incredibly luminous nuclear fusion reactions. These reactions are the ones that make stars shine, and young stars are particularly vigorous. They emit highly energetic ultraviolet light and generate strong winds that blow away their surroundings. At the

center of the Orion Nebula lies a group of four very bright young stars, named the Trapezium. Each of these stars is thousands of times brighter than our Sun and the winds they generate carve a huge oval cavity in the nebula and thus disturb the growth of hundreds of smaller stars!

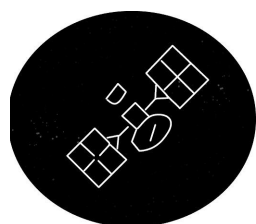
The Orion Nebula is a very active and turbulent region, with flows of gas in different directions, sometimes colliding, areas denser than others, and streams of particles and light unleashed by the numerous

stars. It hosts all stages of star formation, from the dense gas clouds where new stars are forming to the massive young stars at its center.

Try spotting

Would you be able to spot Orion in the sky during the next winter months and to see the faint red glow of the Orion Nebula?

(Jonathan Freundlich is a PhD student at the Paris Observatory, in France, working on star formation and galaxy evolution)



ASTROPHYSICAL SERIES

- The names of many Western constellations are inspired by Ancient Greek mythology.
- In Hindu Vedic astronomy, the Orion Constellation is seen as a deer (Mriga).
- The word nebula comes from Latin, so its plural is nebulae. It originally means a small cloud, because this is how it looks like at first sight.
- Our Solar System and the Orion Nebula are located on the same spiral arm of the Milky Way, which was appropriately named the Orion Arm.