The Southern Fall

10.00 to 16.00 Hours Right Ascension

The Southern Fall

The southern fall is the season of Centaurus, bordered to its south by the iconic Southern Cross the dark hole of the Coalsack and the nearest stars. Its north border forms part of vast constellation of Hydra, which in turn joins the southern part of Virgo and Antlia, rich in galaxies. As fall deepens into winter, Antares begins to dominate the late evening sky, and our own Milky Way makes its presence known.

A small telescope captured this panoramic view of the southern autumn sky. The Carina–Sagittarius arm of the Milky Way is home to many legendary objects such as the Carina Nebula, but also an assortment of other bright star-forming regions and young star clusters.

Panoramic View of the Central Part of the Carina Nebula

This spectacular panoramic view shows the central part of the Carina Nebula, which includes the exotic star Eta Carinae, the well-known Keyhole Nebula, and a multitude of dust globules and young star clusters. The composite picture was created from image data recorded by professional and amateur telescopes located in Australia and Chile.

Carina Nebula

The Carina Nebula (NGC 3372) is one of the largest and brightest nebulae in the sky, and we see it from a distance of 7500 light-years. It extends for some 260 light-years across the southern Milky Way and is clearly visible to the unaided eye, but is less famous than the much smaller and closer Orion Nebula. In part this is because NGC 3372 is in the far southern sky, while the Orion Nebula is on the celestial equator, framed by a memorable collection of stars and visible from all parts of the globe.

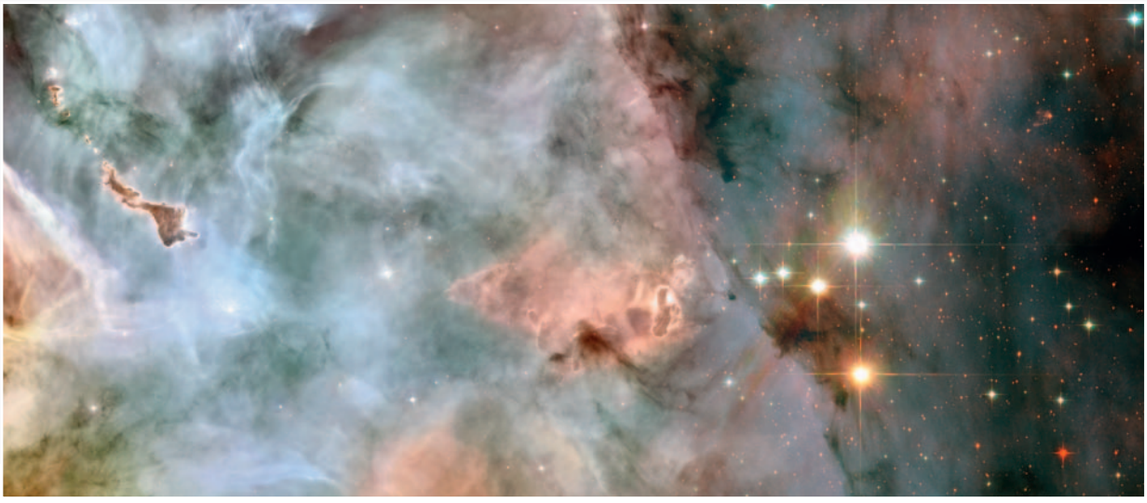
The nebula in the constellation of Carina (The Keel) was discovered by the Abbé Nicolas de Lacaille in 1751 from the Cape of Good Hope. With more powerful telescopes it is seen to be quite unlike the Orion Nebula and rich in an astonishing variety of smaller structures such as the Keyhole Nebula, the Homunculus Nebula, and numerous bright rimmed and dark globules, dust pillars, and open star clusters.

The Keyhole Nebula is a smaller, darker cloud with an outer rim of brightly glowing filaments some seven light-years in diameter. The shape of the Keyhole is sculpted by an outburst from the enigmatic, erratically variable, hypergiant star, Eta Carinae. Its unusual form is silhouetted against the brighter parent nebula, creating its namesake configuration. The Keyhole was named by the English astronomer Sir John Herschel in the 19th century, when Eta was one of the brightest stars in the sky and the keyhole shape was fully illuminated. Now Eta Carinae hovers on the verge of naked-eye visibility, and the Keyhole is much less well delineated.

The Carina Nebula in a Different Light
This image provides a different way of looking at the Carina Nebula. Like the larger picture on this page, it was made in visible light, using a ground-based telescope, but in this case the light was captured through narrowband filters. These emphasize discrete wavelengths that carry the spectral signatures of the glowing gases and mostly reject the white light of the stars, which seem almost absent here. Three different filters trace the blue-green emission from oxygen (shown in blue), the red emission from hydrogen (shown in green), and the red emission from sulfur (shown in red). This color scheme reveals the complex chemistry and physics of the nebula and is also representative of the temperature in the ionized gas: blue is relatively hot and red is cooler.

The vast Carina Nebula contains over a dozen stars with masses between 50 to 100 times that of the Sun, and these are the main source of illumination of the nebula itself. However, by far the most exotic star here is Eta Carinae. It is shrouded in a tiny nebula — the expanding, dumbbell-shaped Homunculus — that was blasted off the star in the 1830s and 40s, which is why it appeared so bright to Herschel. The nebula has cooled into dust and become almost opaque to visible light, but it is one of the strongest Galactic infrared sources in the sky, despite its distance. Without this dusty envelope we would see Eta Carinae shining with the light of five million Suns and emitting as much energy in six seconds as does the Sun in a year!

Such an output implies a very massive young star, perhaps 150 times the mass of the Sun and a few million years old, but recent observations of its variable brightness suggest that it is a binary system, with a period of about 5.5 years. Eta Carinae is still an oddity and of abiding interest to astronomers, partly because it is expected to end as a great supernova in the near future. This may even have already happened, and if it has, we will know within the next 7500 years, when the light reaches us. Although a supernova event in Carina would produce a daytime star, it would not affect our planet. The story would be different if Eta Carinae had been born in the Orion Nebula.



Region of WR 25 and Trumpler 16

Trumpler 16 is one of several similar star clusters associated with the Carina Nebula. All of these star clusters are extremely young and contain some very hot stars, a few of which appear on the right side of this image. The bright yellow star is in the foreground and has no part to play in the action here, but the others emit powerful stellar winds that erode nearby dusty globules. One of these, seen at the left of the picture, seems to raise a defiant finger in the face of this energetic onslaught, but resistance is futile.

Star Birth in the Extreme

The region abounds in dense clouds of dust — molecular clouds — that survive relatively briefly, exposed to the intense bombardment of ultraviolet radiation from the bright stars around them. It is within such clouds that new stars form, and there is the subtle evidence of it here, in the delicate jets of material shot out of the dark clouds. These are the signatures of stars settling down to a steady state, in the final stages of accreting material from the molecular cloud. Soon, the dust will be dispersed by the steady erosion of the surrounding stars, revealing the youngest of them, in all their glory.

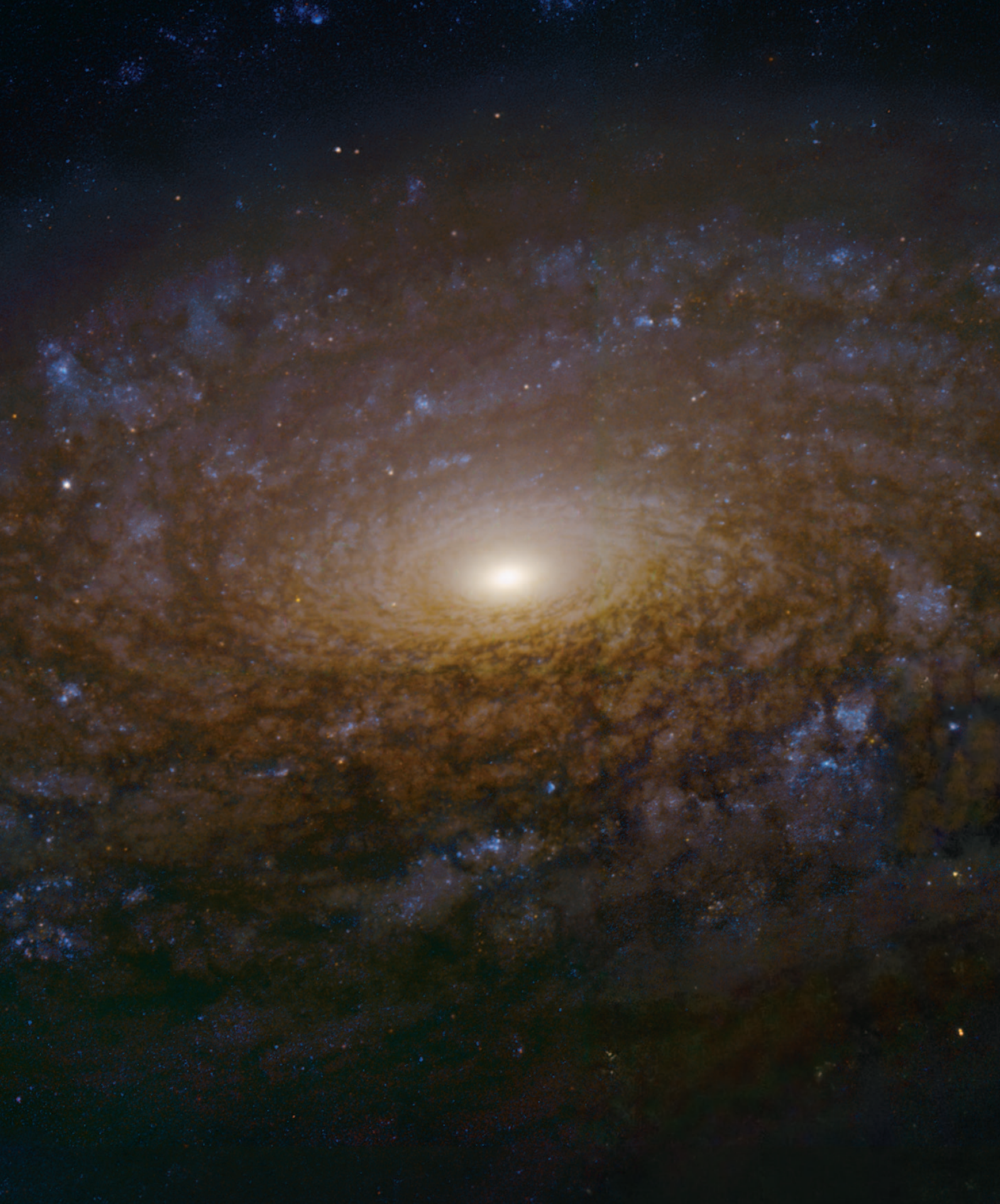
NGC 3293

This beautiful open cluster is in the constellation of Carina, a little northwest of the great Carina Nebula (see p. 84), and has many characteristics in common with the Jewel Box Cluster (NGC 4755, see p. 104), including a single red giant star, which is in striking contrast to the multitude of brilliant blue stars. The cluster was discovered by the Abbé de Lacaille during his visit to South Africa in 1751–2. It is 8500 light-years away, and the component stars are all very young. The cluster is rather more compact than the Jewel Box Cluster, and there are traces of blue reflection nebulosity associated with the brighter stars and the red emission nebula surrounding part of the cluster, which are both indications of youth.

Open clusters such as NGC 3293 are excellent laboratories for studying the late stages of star formation and their early evolution. The young stars have not moved far from their birthplace, so it is certain that they are all at the same distance. This allows a detailed comparison to be made of the individual stars, which reveals that they are not all the same age, but seem have been born in the last four to ten million years. A total of about one hundred stars have been identified as belonging to the cluster, most of them much fainter than the sky-blue (i.e., very hot) B stars. There are no O-type stars in this cluster (or in NGC 4755). These stars are even hotter than B stars and more massive, and are only found in the youngest clusters, such as that in Messier 16 (p. 148).

NGC 3293

NGC 3293 is an open cluster that seems connected with NGC 3324 in the Carina Nebula (see p. 84). Remnants of nebulous material are visible in the image.



NGC 3521

NGC 3521 is a galaxy highly inclined to the line of sight and is about 25 million light-years distant, on the celestial equator in Leo. This orientation on the sky shows it to be extremely dusty, with few obvious star-forming regions, and it emphasizes the very bright nucleus. NGC 3521 is superficially similar to Messier 63 and belongs to the class of compact bright galaxies recognized as lacking a well-defined spiral arm structure. Such galaxies have an appearance that is as remote from the "grand design" paradigm as it is possible to be and still be a spiral galaxy. They are known as flocculent galaxies because they have patchy spiral arms that are fragmented and loosely organized. "Fluffy" would be the obvious word to describe their appearance on photographs, but that is not normally part of the scientific lexicon.

Many spiral galaxies have flocculent spiral arms to some extent, and other well-known flocculent spirals in the southern hemisphere are NGC 6744 (p. 160) and NGC 7793, (p. 172) with Messier 33 in the northern sky. The Milky Way is also in this category. NGC 3521 also has at least one other anomaly, a rotation curve that falls with increasing distance from the nucleus, suggesting that any dark matter is concentrated towards the center of the luminous disk. Deep photographs show it to have an extensive, faint, and asymmetrical halo, strongly suggestive of a recent merger.

NGC 3521 Close-up

This close-up view of NGC 3521 highlights this galaxy's characteristic, patchy, irregular spiral arms laced with dust and clusters of young, blue stars. NGC 3521 is easily visible in small telescopes, but often overlooked by amateur imagers in favor of the better-known Leo spiral galaxies Messier 65 and Messier 66.

NGC 3576 and NGC 3603

NGC 3603 (left) and NGC 3576 (right) are two of the most luminous star-forming regions in our galaxy, but their juxtaposition is really an illusion. The objects are physically unrelated; NGC 3603 is 20,000 light-years away, about twice as distant as NGC 3576. Although they appear side by side, NGC 3603 is in the Carina arm of our galaxy while NGC 3576 resides in the much closer Sagittarius arm. In true-color images, NGC 3603 (below) has a distinctly redder hue than the closer NGC 3576, due to the selective absorption of blue light by the intervening dust.

Despite their different appearances there are some similarities, as both are undergoing a high rate of star formation. NGC 3603, a giant star-forming region, is an extraordinary object. It is likely the most massive visible emission region in our galaxy, extending at least 1000 light-years across and containing the overall mass of 10,000 suns. NGC 3576 contains several embedded clusters and scattered small dark nebulae known as Bok Globules, seen in silhouette against the emission nebula. The bright emission component extends some 100 light-years across.

Close-up on NGC 3603

The compact open cluster NGC 3603 is seen here with the Hubble Space Telescope in close to its natural colors. It is one of the most impressive massive young star clusters in the Milky Way. Bathed in gas and dust, the cluster formed in a huge rush of star formation thought to have occurred around a million years ago. The hot blue stars at the core are responsible for carving out a huge cavity in the gas around it.

NGC 3576 and NGC 3603 Overview

This image shows a large field that contains both of the star-forming regions NGC 3603 (left) and NGC 3576 (right). It was taken through narrowband filters that let through only the monochromatic light from particular atomic transitions. This reduces the amount of light from the stars and gives a crisp view of the nebulosity.

NGC 3621

NGC 3621 is a member of the Leo spur of galaxies and is an isolated spiral, relatively neglected compared to other famous denizens of Hydra (The Water Snake) such as Messier 83.

This galaxy has a flat pancake shape, indicating that it hasn't recently come face to face with another galaxy, as such a galactic collision would have disturbed the thin disk of stars, creating a small bulge in its center. Most astronomers think that galaxies grow by merging with other galaxies, in a process called hierarchical galaxy formation. Over time, this should create large bulges in the centers of spirals. Recent research, however, has suggested that bulgeless, or purely disk-like spiral galaxies such as NGC 3621 are fairly common.

The galaxy has loose spiral arms almost 100,000 light-years across. This is seen to be even bigger on deep images. The galaxy also has an unusually small, bright nucleus that does not seem to have any significant bulge of older stars that are common in spiral galaxies. The nucleus was recently shown by the Chandra X-ray Observatory to contain X-ray sources consistent with the presence of a black hole. This galaxy provides one of the best examples of a spiral galaxy that has both an active central black hole and nuclear star clusters, and it shows that central black holes can occur in disk galaxies even in the absence of a significant bulge.

In the late 1990s, NGC 3621 was studied extensively using the Hubble Space Telescope as part of an enormous project to determine the extragalactic distance scale. NGC 3621 contributed 69 Cepheid variable stars to the project, establishing its distance as 20 million light-years.

NGC 3621

The bright galaxy NGC 3621, as seen here, appears to be a fine example of a classical spiral. But it is in fact rather unusual: it does not have a central bulge and is therefore described as a pure disk galaxy.