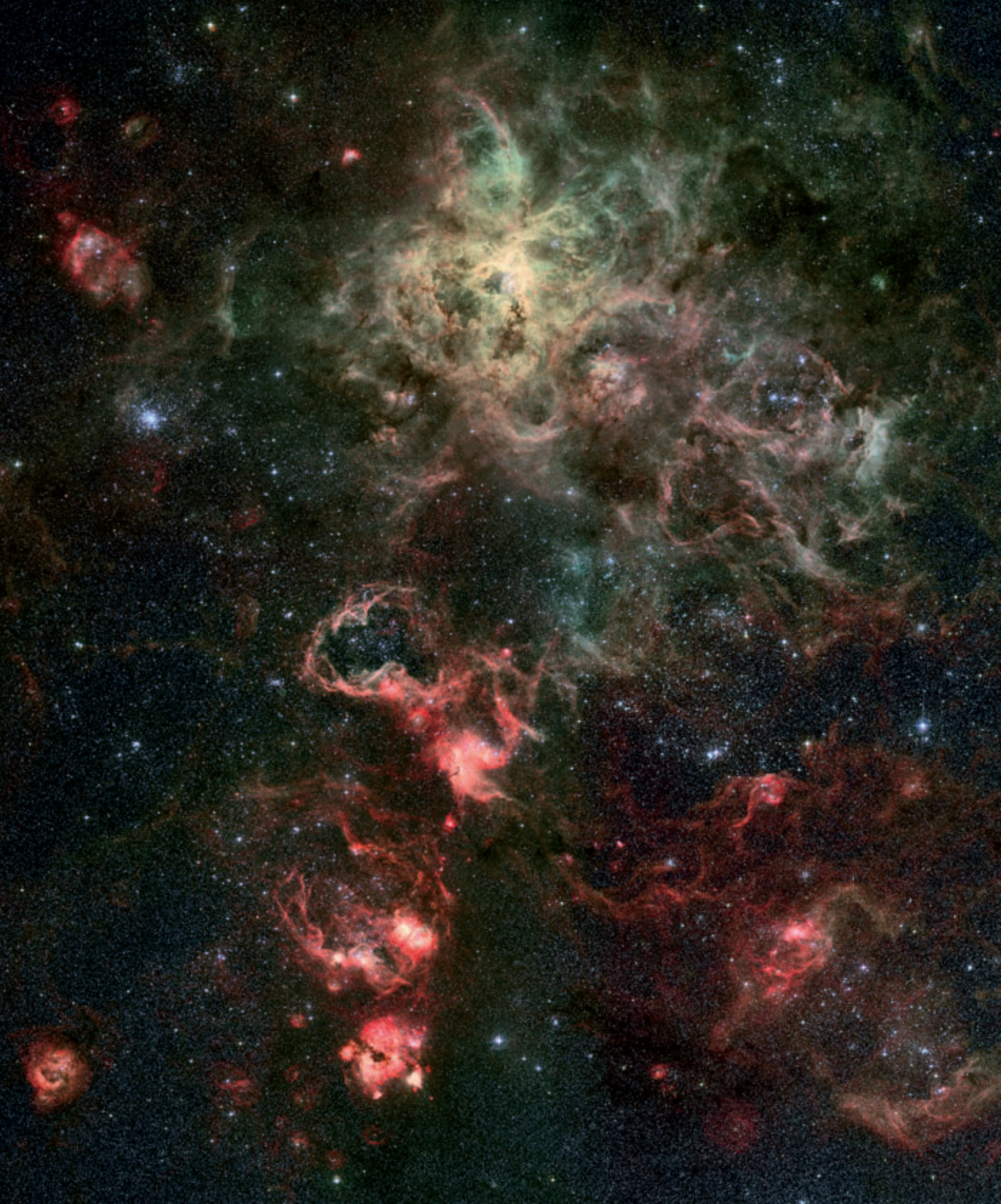

4 THE VISIBLE UNIVERSE

FIGURE 21: TARANTULA NEBULA

This beautiful one degree square mosaic of the Tarantula nebula region of the Large Magellanic Cloud was taken through four different colour filters (blue, green/yellow, ionised oxygen in green and ionised hydrogen in red) with the ESO/MPG 2.2-metre telescope on La Silla in Chile. The Tarantula nebula is the youngest, most active star-forming region in our local group of galaxies and is hot enough to excite oxygen atoms to glow green. The red parts of the nebula emit light from excited hydrogen atoms, glowing with the light of somewhat older, cooler stars. The blue star clusters sprinkled over the field are even older and no longer have a surrounding nebula. The scattered remnants of the huge, dusty molecular cloud that mothered all of this activity can still be seen obscuring the background stars.

The visible part of the electromagnetic spectrum is the astronomical base camp. This is where people first started to look at the sky with the naked eye many thousands of years ago and it remains the reference point for research taking place in all other wavelength bands. The visible band is home to the majority of the starlight and, although many scientists and engineers are finding ingenious ways to exploit the non-visible bands, there are still many secrets left to explore in the visible...

Before the first radio observations were made in the 1930s (see Chapter 7), all that was known about the Universe came from observations in the visible part of the **spectrum**. Scientists were not even aware of the "hidden Universe" beyond the boundaries of the visible. For many years a kind of narrow-sightedness existed amongst astronomers that could perhaps be called "visible-light chauvinism" — an exaggerated focus on the processes that are visible to our eyes. For all that the visible part of the spectrum is very important and information-rich, it is just a tiny part of the full story. Although this book is about the cosmic radiation that we cannot see for ourselves, a chapter on the visible Universe is necessary to set the scene.

The visible wavelengths are called "visible" because they are the wavelengths that we can see naturally. Natural selection has forged a connection between our eyes and the Sun's light, most of which emerges in the visible range. Our eyes are biologically tuned to be sensitive where the Sun is brightest. Coincidentally, like the Sun — which is a perfectly ordinary G dwarf star — many other stars emit a large part, or even the majority, of their light in the visible range.

Visible light regimes

Although the visible **band** is the smallest of the spectral bands, we are very familiar with all the different parts of the visible range. We know them by the names of the colours that we can see with our eyes: violet, blue, green, yellow, orange and red. The band stretches from 380 to 740 **nanometres** (the range of wavelengths humans can perceive):

- Violet: 380 – 450 nm
- Blue: 450 – 490 nm
- Green: 490 – 560 nm
- Yellow: 560 – 590 nm
- Orange: 590 – 630 nm
- Red: 630 – 740 nm

FIGURE 22: THE STAR-FORMING REGION NGC 3603

The star-forming region NGC 3603 — seen here imaged with the Hubble Space Telescope — contains one of the most impressive massive young star clusters in the Milky Way. Bathed in gas and dust, the cluster generated in a huge surge 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 seen to the right of the star cluster, in NGC 3603's centre. The red colour in the upper left may either be a colder star or a star partly obscured by dust.