Opposite page:
The Trifid nebula (top) *and the Lagoon* (bottom) *photographed by 1·2 m UK Schmidt telescope.*

The difference in brightness between the two regions of the Milky Way is far less marked than might be imagined, as the glow of the Sagittarian star-clouds is considerably dimmed by intervening obscuring matter. The effects of this material are strikingly obvious in the 'Great Rift' in the constellation of Cygnus – where the Milky Way appears to divide into two – and in the aptly-named Coalsack in Crux. These are some of Herschel's so-called voids in space. They lead us into considering two further important constituents of our Galaxy: the gas and dust of the interstellar medium.

Mixed in with the stars of the disc is a considerable quantity of cold gas. It is mainly very rarefied hydrogen, and makes up only 10 per cent of the mass of the Galaxy, but its consequences are far-reaching, for it is the future material of new stars. In some regions – near glowing gas clouds like the great Orion nebula – we see the gas under compression and collapse, as the star-formation process sets to work. Hot, glowing gas clouds are strung out along the arms of other galaxies, pointing up the spiral structure, just as they undoubtedly do in our own.

Only 0·1 per cent of the mass of our Galaxy is in the form of interstellar dust, but it is this component which produces the most severe observational consequences. Choking the plane of the Galaxy, the tiny dust grains – comparable in size with particles of cigarette smoke – act just like city smog. At best, they scatter and redden the light of distant stars; at worst, they absorb it completely. A leading American astronomer, Bart J. Bok, has likened the exploration of our Galaxy to 'trying to map a large city from a suburb on a misty day'!

All the contents of the disc rotate about the centre of the Galaxy, the inner regions more rapidly than those towards the edge. This **differential rotation** has an important application in measuring the way in which the Galaxy's mass is distributed, as we shall see later. At the Sun's distance from the galactic centre, the rotational velocity is 250 km per s (about 900 000 km per hour!), and yet it still takes us some 250 million years to do one circuit of the Galaxy. The Sun and its family of planets have travelled round the Galaxy only twenty times since their formation.

In addition to their rotation about the galactic centre, the objects in the disc share another important property: they are all relatively young. Gas, dust, open clusters of stars and bright blue supergiants are all indicators of youth, and are found only in the galactic disc. Historically, they are referred to as 'Population I objects', following on from a decisive

Star clouds in one of the densest regions of the Milky Way, crossed by starless voids where clumps of interstellar dust obscure our view.