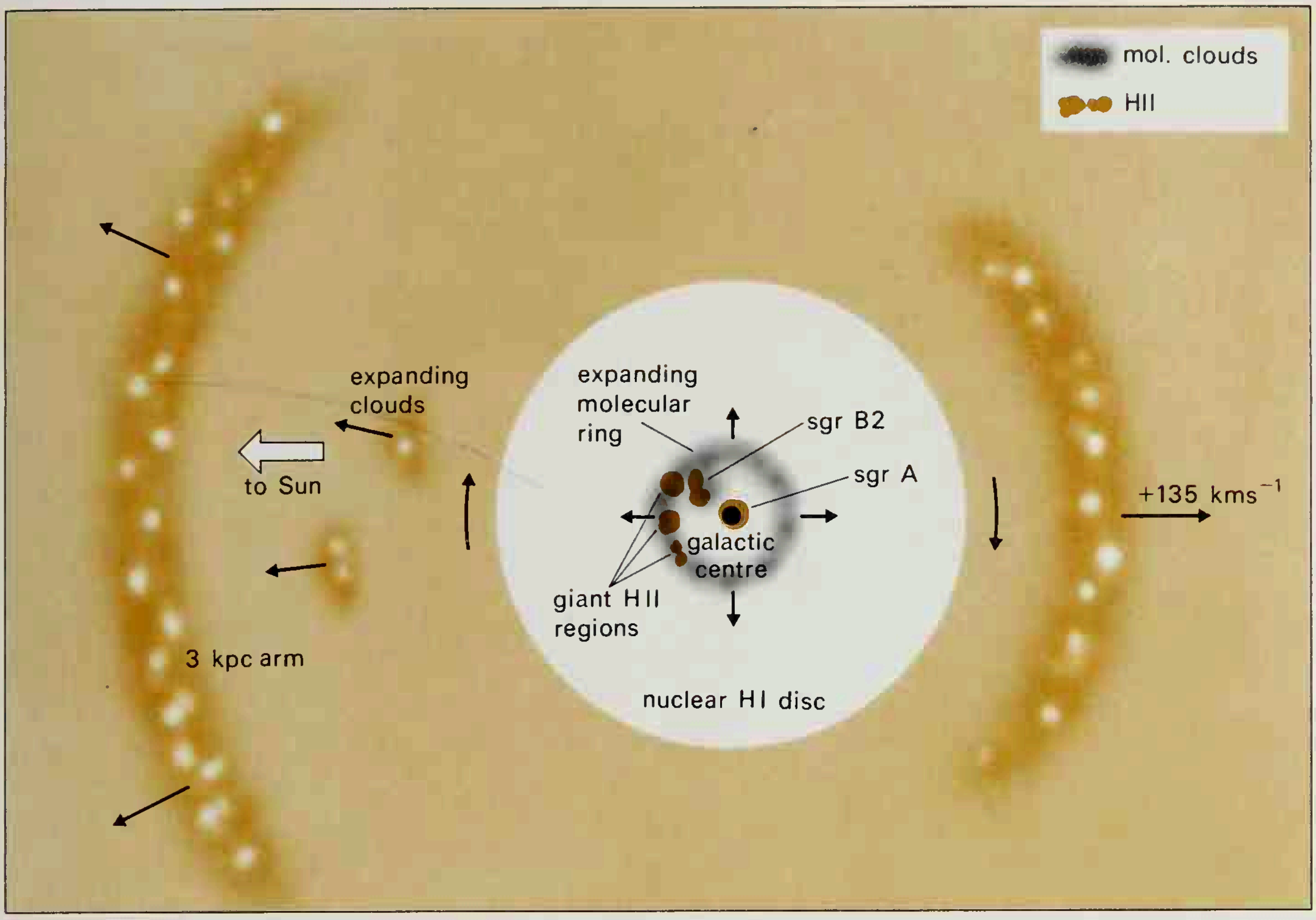

Fig. 6·8
Features surrounding the centre of our Galaxy, showing the expanding ring of molecular clouds embedded in the rotating disc of neutral hydrogen. Outside are several expanding features, including the 3 kpc arm (left).

to be thin jets of material moving at steep angles to the galactic plane. The evidence strongly suggested that some disturbance or explosion had occurred at the galactic centre. However, astronomers in the early 1960s were unused to such concepts and preferred to explain the observations in more conventional terms. It is just possible, for example, that some of the 'expanding' features arise from the ever-changing orientation of a bar-like distribution of mass at the galactic centre, such as we see in the so-called barred spiral galaxies. Other astronomers believed that Oort's features could be RESONANCE effects in the Galaxy's gravitational field. But later work has turned up many more anomalous features, and these have generally lent further support to the explosive hypothesis.

Because of the 28–30 magnitudes of visual absorption between ourselves and the galactic centre, our picture of its structure has been built up almost entirely from observations at radio and infrared wavelengths and, more recently, from X- and γ-ray observations (Fig. 6·8). Such observations show that, after an initial drop inside the 3 kpc arm, the H I density rises as we approach the centre, and the gas forms a uniformly rotating disc, some 1 500 pc across. Embedded in this disc, with a diameter of 380 pc, is an expanding ring of cool, dense molecular clouds jostling with supergiant H II regions. There is an extraordinarily high concentration of molecules in this region, including the most enormous complex of molecules in the entire Galaxy: the 10^6 -$M_\odot$ cloud Sagittarius B2. Some 30 pc across, and containing at least seven H II regions each as bright as the Orion Nebula, Sgr B2 sits just inside the expanding ring. Every type of molecule so far discovered in the Galaxy has also been found in the Sgr B2 complex.

Moving inwards from the molecular ring, we reach the radio source Sagittarius A. This, in fact, comprises two regions: Sgr A East, a bright supernova remnant, and Sgr A West, which surrounds the galactic centre.

Between them is a giant molecular cloud, rushing away from the centre at a velocity of 40 km per s. Sgr A West is another unique feature in the Galaxy, a very evenly lit H II region whose gas begins to form a thin uniformly rotating disc towards the centre. This ionized disc is only a couple of parsecs across, 1 000 times smaller than the H I disc we discussed earlier. Infrared observations show it to be in turbulent motion, studded with hot clouds of gas, possibly stripped off stars lying within a few parsecs of the galactic centre (Fig. 6·9).

However, their infrared emission gives an estimate of their space density, which reaches the alarming figure of 10^8 times the solar neighbourhood value as we approach the central star cluster of our Galaxy. Even at these densities, the stars are not touching, although near-neighbours would be separated by a mere 4 light-days. Astronomers have estimated that the central star cluster – made up largely of cool, Population II stars – would have a mass of around $3 \times 10^6 M_\odot$. There is, however, a puzzling discrepancy, for the rotation speed of the 1·2 pc ionized gas disc indicates a central mass twice as great as this. Where is this hidden mass? Current thinking indicates that the innermost regions of our Galaxy may contain several million solar masses which are not in the form of stars.

Right at the centre of the ionized gas disc lies a tiny, possibly variable, radio source. Using very long baseline interferometry (see page 242), radioastronomers have tracked down the emission to a region 150