THE STRUCTURE AND EVOLUTION OF THE W3 MOLECULAR CLOUD

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A model of the W3 molecular cloud derived from molecular observations is presented and the evolution of the cloud is discussed.

The distributions of the emission from ^{12}CO, ^{13}CO, CS and HCN have been mapped in the W3 molecular cloud (Dickel et al. submitted to Ap.J. 1979). Self-absorption effects are seen in ^{12}CO and probably CS. The abundance of CS is a factor of $\sim$10 lower in the direction of the complex of near-infrared sources designated 5, 6 and 7 than at positions only 0.6 pc away.

From an overall analysis of the data, we conclude that an initial cloud of mass $\sim 5 \times 10^4$ $M_\odot$ started to fragment and collapse after passage through the spiral density-wave shock of the Perseus arm. The open cluster (Ocl 352) which excites the present W4 HII region formed at the head of the cloud a few million years ago (see figure 1). The ionization front with its associated shock is expanding into the remaining W3 molecular cloud where its effects are seen in the velocities of W3(OH) and the infrared source AFGL 333. The bright dense "core" of the W3 molecular cloud which contains 6 compact HII regions, 8 near-infrared sources, and three H_2O masers is collapsing and possibly rotating.

The shock front of the expanding, optical HII region, IC 1795, is moving into the edge of the W3 molecular core at 2 to 3 km s^{-1} as seen by the motion of the CO gas behind the shock front. However, this shocked gas represents only a small fraction of the total material present so the shock can not be responsible for triggering the collapse of the whole W3 core. A full discussion appears in a paper by Dickel (submitted to Ap.J. 1979).

Emission from [OIII] and Hα are seen in a small optical jet which emerges out of the center of the shell radio source W3A close to IRS 2 (see figure 2). This represents the earliest stage of an embedded compact HII region bursting out of its parent cloud to form a "blister" on the edge. Further details will appear in a paper by Dickel and Harten (in preparation).

B. H. Andrew (ed.), Interstellar Molecules, 157–158.

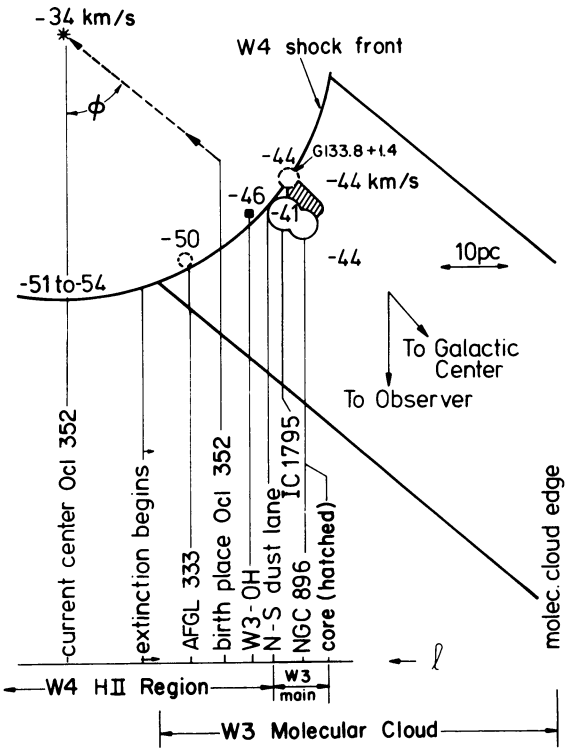

Figure 1. A model of the W3 molecular cloud and adjacent W4 HII region. Observed radial velocities are given at some locations.

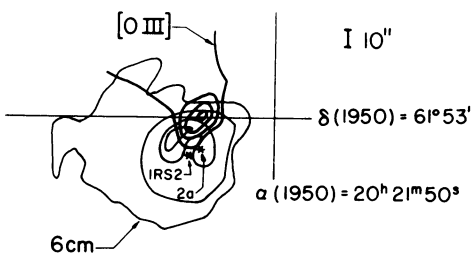

Figure 2. The jet of optical emission emerging from the radio source W3A.

This research was supported in part by the National Science Foundation and by the Sterrewacht, Leiden.