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ORIGINAL ARTICLE

Exploring morphological correlations among H_2CO, ^{12}CO, MSX and continuum mappings

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Abstract There are relatively few H_2CO mappings of large-area giant molecular cloud (GMCs). H_2CO absorption lines are good tracers for low-temperature molecular clouds towards star formation regions. Thus, the aim of the study was to identify H_2CO distributions in ambient molecular clouds. We investigated morphologic relations among 6-cm continuum brightness temperature (CBT) data and H_2CO ($1_{11}-1_{10}$; Nanshan 25-m radio telescope), ^{12}CO (1–0; 1.2-m CfA telescope) and midcourse space experiment (MSX) data, and considered the impact of background components on foreground clouds. We report simultaneous 6-cm H_2CO absorption lines and H110α radio recombination line observations and give several large-area mappings at 4.8 GHz toward W49 ($50' \times 50'$), W3 ($70' \times 90'$), DR21/W75 ($60' \times 90'$) and NGC2024/NGC2023 ($50' \times 100'$) GMCs. By superimposing H_2CO and ^{12}CO contours onto the MSX color map, we can compare correlations. The resolution for H_2CO, ^{12}CO and MSX data was $\sim 10'$, $\sim 8'$ and $\sim 18.3''$, respectively. Comparison of H_2CO and ^{12}CO contours, 8.28-μm MSX colorscale and CBT data revealed great morphological correlation in the large area, although there are some discrepancies between ^{12}CO and H_2CO peaks in small areas. The NGC2024/NGC2023 GMC is a large area of HII regions with a high CBT, but a H_2CO cloud to the north is possible against the cosmic microwave background. A statistical diagram shows that 85.21% of H_2CO absorption lines are distributed in the intensity range from -1.0 to 0 Jy and the ΔV range from 1.206 to 5 km s^{-1}.

Keywords Formation · Massive · Clouds · HII regions · Imaging · Individual (W49, W3, DR21/W75 & NGC2024/NGC2023)

1 Introduction

Absorption lines for formaldehyde (H_2CO; $J_{KaKc} = 1_{11}-1_{10}$; $\nu_o = 4829.6594$ MHz), discovered in the interstellar medium by Snyder et al. (1969), are commonly detected toward star formation regions. H_2CO is a slightly asymmetric rotor molecule and is inherently sensitive to kinetic temperature. H_2CO is an accurate probe of physical conditions in dense molecular clouds (Mangum and Wootten 1993). Anomalous absorption lines can be seen against the 2.7 K cosmic microwave background (CMB; Palmer et al. 1969) and detected in dark clouds. Absorption is strongest at high density and temperature owing to the collisional pumping mechanism. A survey by Downes et al. (1980) between $l = 0°$ and 60°, $b = \pm 1°$ suggested that HII regions are associated with H_2CO. 12 bright galactic HII regions and two dark clouds (W3, W3(OH), NGC2024, W31, W33, M17, W43, W49A, W51A, W51B, K3-50 and DR21/W75; NGC2264 and Heiles cloud 2) have been mapped at an angular resolution of $2.6'$ using a 100-m telescope (Bieging et al. 1982), but their mapping areas are smaller than

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