THE STRUCTURE OF DIFFUSE MOLECULAR GAS IN STAR-FORMING REGIONS[a]

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Absorption seen in spectra of background stars is used to probe diffuse molecular gas. We present results of a comprehensive study for 29 lines of sight that sample the star-forming regions, ρ Ophiuchus, Cepheus OB2, and Cepheus OB3. Measurements at visible wavelengths from McDonald Observatory and Kitt Peak National Observatory and at ultraviolet wavelengths with the *Far Ultraviolet Spectroscopic Explorer* formed the basis of our study. In particular, absorption from the molecules, CH, CH^+, CN, and H_2, and from neutral potassium, neutral calcium, and singly-ionized calcium was analyzed. We were able to infer the distribution of species along the line of sight. For instance, CH absorption arises from two distinct chemical environments that differ mainly in gas density. Small-scale structure in terms of density variations was studied for the binary and multiple star systems in our sample. Density contrasts of factors of 5 over sub-parsec scales were seen. The CH/H_2 ratios for material associated with Cep OB2 and OB3 are not the same as is usually assumed; again differences in density are the cause.

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