HIGH RESOLUTION OBSERVATIONS OF METHYL CYANIDE (CH_3CN) TOWARD THE HOT CORE REGIONS W51 e1/e2.

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We have detected strong methyl cyanide (CH_3CN) emission lines from the hot core regions W51 e1 and W51 e2 using the BIMA Array. This is the first survey of CH_3CN toward W51 to utilize both 3 mm (J=5−4 & 6−5) and 1 mm (J=12−11, 13−12 & 14−13) transitions as probes of the physical and chemical conditions present in these regions. To determine the true kinetic temperatures, densities and column densities of the emitting regions W51 e1 and e2, statistical equilibrium models were used to calculate the relative populations of each energy level. The best fit to the observed spectra toward W51 e1 is given by a temperature of 123(11) K, a hydrogen density of $5(1)\times10^5$ cm^{-3} and a total methyl cyanide column density of $1.4(1)\times10^{16}$ cm^{-2}. The best fit to the observed spectra toward W51 e2 is given by a temperature of 153(21) K, a hydrogen density of $5(2)\times10^5$ cm^{-3} and a total methyl cyanide column density of $3.8(7)\times10^{16}$ cm^{-2}. Our observations indicate that CH_3CN can be used as a good probe of the physical conditions present in hot molecular cores and as a tracer of hard to detect large molecular species. Despite the differences in molecular structure and chemical formation mechanisms, methyl cyanide (CH_3CN), ethyl cyanide (CH_3CH_2CN), and acetic acid (CH_3COOH) are found to have similar abundances toward the W51 e1 and e2 regions. In contrast, for a column density of CH_3CN more than 15 times smaller than the column density of $HCOOCH_3$, the integrated line flux is more than 7 times larger. Thus, because CH_3CN lines are easy to detect, it appears to be a much better tracer of CH_3CH_2CN and CH_3COOH rather than $HCOOCH_3$.

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