

CONSTRAINING COSMIC-RAY IONIZATION RATES AND CHEMICAL TIMESCALES IN MASSIVE HOT CORES

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Several studies have demonstrated that the cosmic ray ionization rate is highly variable in the interstellar medium. However, constraints of this rate for several regions including those that contain hot cores are lacking. Hot cores are appealing sources to study given their rich chemical complexity. The chemistry of these cores can be influenced by both their cosmic ray ionization rates and their warm-up timescales, however, understanding the chemical response to these parameters requires further investigation. We study these effects using the astrochemical hot-core modeling code **MAGICKAL**, in which we construct a grid of 81 models using nine ionization rates and nine warm-up timescales. We also simulate LTE radiative transfer for these models to obtain results that can be directly compared with observations. We compare molecular emission of these models with observations toward NGC 6334 IRS 1, NGC 7538 IRS 1, W3(H₂O), and W33A in an effort to constrain their cosmic ray ionization rates and warm-up timescales. Our best fits to the observations suggest that these sources possess elevated cosmic ray ionization rates compared to the canonical value used in previous modeling studies, and rapid warm-up timescales. We also demonstrate that there exists a strong correlation among the cosmic ray ionization rate and the total hydrogen column density of a source, and a strong correlation among the warm-up timescale and total source mass. Furthermore, these relationships are in good agreement with other theoretical studies.