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Measuring the CO/CO_2 Mixing Ratio in Comets

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Abstract

CO and CO_2 are abundant molecules in comets that may play important roles in driving distant activity, and their relative abundances may provide important observational constraints to models of solar system formation and evolution. Recent discussions often assume that $Q_{CO2} >> Q_{CO}$ for most comets within 5 au, but we show that the documented record is not well-enough established to support this. This is highly relevant for studies that rely on NEOWISE and Spitzer photometric data obtained at ~4.5um which contains combined emission from $CO+CO_2$ and emission is typically attributed to only one of the volatiles. We compiled a comprehensive list of individually determined CO and CO_2 production rates from the literature which shows that there is a non-negligible percentage of comets in each group of CO-rich, CO_2-rich, and those with equal amounts of both. We present a preferred way to establish the relative abundances of CO and CO_2 using NEOWISE or Spitzer 4.5 um data when simultaneous CO spectra are available. We also discuss plans to incorporate the heliocentric distance of comets to include differential thermal effects, and to use modeling of spatial profiles of CO and CO_2 in photometric images to establish the mixing ratio when CO spectra is not available.