OBSERVING A COLUMN-DEPENDENT $\zeta$ IN THE HORSEHEAD PDR

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The molecules CCH, C$_3$H, HCO$^+$, and HC$_3$N have been observed at the edge of the Horsehead Nebula in abundances far higher than those predicted by Photodissociation Region (PDR) models$^a$. Using a column-dependent cosmic ray ionization rate ($\zeta$)$^b$, we model the edge of the Horsehead Nebula as a one-dimensional nearly-"edge-on" heterogeneous PDR with temperature ranging from 15-250 K, number density from $10^3 - 5 \times 10^5$ cm$^{-3}$, and $\zeta = 10^{-16} - 10^{-14}$ s$^{-1}$. The resulting abundances for the molecules listed above are much closer to the observed abundances. In this talk, we will discuss this method, its results, and the usefulness of incorporating a column-dependent $\zeta$ in astrochemical PDR models, especially in the advent of ALMA.

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