

OBSERVING A COLUMN-DEPENDENT ζ IN THE HORSEHEAD PDR

P.B. RIMMER, *Department of Physics, Ohio State University, Columbus, OH 43210*; O. MORATA, *Institute of Astronomy and Astrophysics, Academia Sinica, Taipei 11677, Taiwan*; E. ROUEFF, *Observatoire de Paris, LUTH and Université Denis Diderot, Place J. Janssen 92190 Meudon, France*; E. HERBST, *Departments of Astronomy, Physics, and Chemistry, Ohio State University, Columbus, OH 43210*.

The molecules CCH, C₄H, HCO⁺, and HC₃N 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 (ζ)^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 $10^3 - 5 \times 10^5 \text{ cm}^{-3}$, and $\zeta = 10^{-16} - 10^{-14} \text{ s}^{-1}$. 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 ζ in astrochemical PDR models, especially in the advent of ALMA.

^aJ. Pety et al., A&A 435, 885 (2005)

^bM. Padovani, D. Galli, A.E. Glassgold, A&A 501, 619 (2009)