

Metastable H_3^+ and the Discovery of Warm and Diffuse Gas in the Galactic Center

T. R. Geballe¹, T. Oka², M. Goto³, B. J. McCall⁴, T. Usuda⁵

¹Gemini Observatory, 670 N. A'ohoku Place, Hilo, HI 96720 USA

²Dept. of Astronomy and Astrophysics and Dept. of Chemistry, University of Chicago, Chicago, IL 60637 USA

³Max Planck Institute for Astronomy, Heidelberg, Germany

⁴Dept. of Chemistry and Dept. of Astronomy, University of Illinois, Urbana, IL 61801 USA

⁵Subaru Telescope, National Astronomical Observatory of Japan, Hilo, HI 96720 USA

Abstract.

Using the recently detected absorption line from the metastable (3,3) rotational level of H_3^+ combined with high resolution spectroscopy of other lines of H_3^+ and of CO, we have discovered a substantial component of the inner few hundred parsecs of the Galaxy, a large quantity of warm ($T \sim 250$ K) and diffuse ($n \sim 100 \text{ cm}^{-3}$) gas. Much but not all of this gas is associated with known denser cloud components in the center. The high abundance of H_3^+ in the central few hundred parsecs suggests an ionization rate that is several times larger than suspected for diffuse clouds outside the Galactic center in which H_3^+ has been detected, and thus two orders of magnitude greater than originally predicted for diffuse clouds. The high ionization rate has interesting implications for gas phase chemistry in the Galactic center and elsewhere. The absorption line from the (3,3) level has not been detected outside of the Galactic center in either diffuse or dense clouds, attesting to the unique and energetic environment in the nucleus.
