DETECTION OF OH^+ AND H_2O^+ TOWARD ORION KL

HARSHAL GUPTA[a], JOHN C. PEARSON, SHANSHAN YU, *Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109*; PAUL RIMMER, ERIC HERBST, *Departments of Physics, Chemistry, and Astronomy, The Ohio State University, Columbus, OH 43210*; EDWIN A. BERGIN, *Department of Astronomy, University of Michigan, Ann Arbor, MI 48109*; and the HEXOS TEAM, *HTTP://WWW.HEXOS.ORG/TEAM.PHP*.

The reactive molecular ions, OH^+, H_2O^+, and H_3O^+, key probes of the oxygen chemistry of the interstellar gas, have been observed toward Orion KL with the Heterodyne Instrument for Far Infrared on board the *Herschel Space Observatory*. All three $N = 1 - 0$ fine-structure transitions of OH^+ at 909, 971, and 1033 GHz and both fine-structure components of the doublet *ortho*-H_2O^+ $1_{11} - 0_{00}$ transition at 1115 and 1139 GHz were detected, and an upper limit was obtained for H_3O^+. OH^+ and H_2O^+ are observed purely in absorption, showing a narrow component at the source velocity of 9 km s^{-1}, and a broad blue shifted absorption similar to that reported recently for HF and *para*-$H_2^{18}O$, and attributed to the low velocity outflow of Orion KL. We estimate column densities of OH^+ and H_2O^+ for the 9 km s^{-1} component of $9 \pm 3 \times 10^{12}$ cm^{-2} and $7 \pm 2 \times 10^{12}$ cm^{-2}, and those in the outflow of $1.9 \pm 0.7 \times 10^{13}$ cm^{-2} and $1.0 \pm 0.3 \times 10^{13}$ cm^{-2}. Upper limits of 2.4×10^{12} cm^{-2} and 8.7×10^{12} cm^{-2} were derived for the column densities of *ortho* and *para*-H_3O^+ from transitions near 985 and 1657 GHz. The column densities of the three ions are up to an order of magnitude lower than those obtained from recent observations of W31C and W49N. A higher gas density, despite the assumption of a large ionization rate, may explain the comparatively low column densities of OH^+ and H_2O^+.

[a] A part of this work was performed at the Jet Propulsion Laboratory, California Institute of Technology under contract with the National Aeronautics and Space Administration.