MILLIMETER-WAVE TIME-RESOLVED STUDIES OF HCO^+ - H_2 INELASTIC COLLISIONS

LEE C. OESTERLING, ERIC HERBST, and FRANK C. DE LUCIA, *Department of Physics, The Ohio State University, 174 W. 18^{th} Ave., Columbus, OH 43210.*

Rotationally inelastic cross sections for HCO^+ - H_2 collisions at 77 K and 41 K were measured using time-resolved double resonance spectroscopy. The $J = 2$ level of HCO^+ was pumped with a gated KVARZ millimeter-wave synthesizer and the $J = 3 \leftarrow 2$ transition was probed with a klystron based synthesizer. From an analysis of the time dependent millimeter-wave absorption of the probe, rotationally inelastic cross sections were calculated.

Since the reactions which form HCO^+ are highly exothermic, HCO^+ is not formed in thermal equilibrium. With the ionizing electron beam on, the average rotational and translational temperatures are greater than the temperature of the background gas. These average temperatures are a function of the initial temperature at which the ions are formed, the rate at which the ions are thermalized, and the rate at which the ions are destroyed. We will discuss how we are able to determine the average translational and rotational temperatures of the molecular ions using millimeter-wave time-resolved spectroscopy.