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CO J=13-12 Observations of Orion KL with CONDOR

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We present the first observations of emission from the CO J=13-12 transition from the Orion KL region in OMC-1. The observations were made possible with the **CO N$^+$ D**euterium **O**bservations **R**eceiver (**CONDOR**) on the APEX telescope. CONDOR is a heterodyne receiver specifically designed to make velocity-resolved observations of spectral lines between 1.25 and 1.5 THz [1]. We obtained spectra from 9 positions in a cross pattern centered on Orion IRc2. Two additional positions, at offsets of +60″ N and -45″ S, were chosen to coincide with previous observations of CO 9-8 emission [2]. Integration times vary with position, but at nearly all positions, a narrow "spike" component ($\Delta V = 5$ km s^{-1}) is combined with moderate- and high-velocity line wings indicating the "hot core" and "plateau" components. We find that the strongest spike components are at positions to the south and east, i.e. closest to the Trapezium stars, which energize the PDR. The gradient in spike velocities from north (9.7 km s^{-1}) to south (10.7 km s^{-1}) is similar in magnitude and orientation to that observed in lower-J CO lines [3]. By comparing spike components in several CO datasets [3,4,5], we also detect a velocity gradient along the line of sight, which suggests that the hotter material traced by high-J CO lines recedes more rapidly than cooler material deeper within the Orion Ridge. Results from matching the CO emission with both an isothermal model and the KOSMA-τ PDR model are presented. The high spatial resolution of CONDOR on APEX ($\theta_{mainbeam} < 5''$) allows us to detect the hot core component at the central position with a width of $\Delta V = 13.5$ km s^{-1}. Measurements of the plateau out to ± 40 km s^{-1} of V_{LSR} agree with the trend in line wing velocities of lower-J CO observations [6,7]. Although more complete spatial sampling is necessary to determine the extent and morphology of the core and plateau in high-J CO emission, these observations demonstrate the utility of CONDOR, as well as the promise of high-resolution THz astronomy from ground-based observatories.

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