DIRECT MEASUREMENTS OF THE FUNDAMENTAL ROTATIONAL TRANSITIONS OF CD AND ^{13}CH ($X^2\Pi_r$)

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The $N = 1 \rightarrow 1$ and $N = 1 \rightarrow 2$ rotational transitions of CD, and the $N = 1 \rightarrow 1$ lines of ^{13}CH have been measured in their $^2\Pi_r$ ground electronic states using sub-mm direct absorption spectroscopy. The measurements below 600 GHz (CD: $N = 1 \rightarrow 1$ and ^{13}CH: $N = 1 \rightarrow 1$) were carried out at Arizona, while those in the 900 GHz range were conducted at JPL (CD: $N = 1 \rightarrow 1$). The two radical species were created in an electrical discharge of either $^{13}CH_4$ or CD_4. Both lambda-doubling and hyperfine splitttings were resolved in the spectra. The data were analyzed with a case(b) effective Hamiltonian, resulting in an improvement in the lambda-doubling and deuterium, proton, and ^{13}C hyperfine constants. Highly accurate rest frequencies are now available for astronomical searches for these species. CH is an abundant and widespread interstellar molecule, and thus CD and ^{13}CH should be of astrophysical interest.