TERAHERTZ SPECTROSCOPY OF CaH ($X^2\Sigma^+$), MgH ($X^2\Sigma^+$), AND ZnH ($X^2\Sigma^+$) : EXTREME HYDRIDE SYNTHESIS

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Sub-millimeter spectra of CaH ($X^2\Sigma^+$), MgH ($X^2\Sigma^+$), and ZnH ($X^2\Sigma^+$) have been measured in the sub-mm/THz regime (500−805 GHz) using direct-absorption methods. All species were produced by the reaction of metal vapor with H_2 under DC discharge in a Broida-type oven. Because of efficient molecule production, spectra of ^{26}MgH, ^{66}ZnH, ^{68}ZnH and ^{70}ZnH could be recorded in their natural abundance as well, with high signal-to-noise. Additionally, the N = 0 → 1 and N = 1 → 2 transitions of ^{25}MgH and ^{67}ZnH were measured. Fermi contact, dipolar, and quadrupole constants for the ^{25}Mg and ^{67}Zn nuclei have been accurately determined for the first time in the gas phase, and are in good agreement with previous ESR studies. The hyperfine constants suggest a substantial amount of covalent character is present in metal hydrides.