Laserspectroscopy of the $C^2\Pi (41242 \text{ cm}^{-1})$ and $^2\Delta (42192 \text{ cm}^{-1})$ States of Magnesium Hydride

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Two laser-induced fluorescence techniques were used to access the high-lying $C^2\Pi$ state (41242 cm$^{-1}$) in the metal-bearing molecule MgH. First, we directly excited the $C^2\Pi$ state from the $X^2\Sigma^+$ ground state with UV light produced by frequency-doubling pulsed visible laser light. Second, a resonant two-photon experiment was performed with different laser beams tuned to the $A^2\Pi - X^2\Sigma^+$ and $C^2\Pi - A^2\Pi$ transitions. Term energies for levels up to $J = 11.5$ were fit to a $^2\Pi$ Hamiltonian to yield rotational parameters $B = 6.1045(10) \text{ cm}^{-1}$, $D = 3.176(86) \times 10^{-4} \text{ cm}^{-1}$, $A = 3.843(60) \text{ cm}^{-1}$, and $p = -2.653(88) \times 10^{-2} \text{ cm}^{-1}$. We also observed levels of a $^2\Delta$ state (42192 cm$^{-1}$) up to $J = 4.5$ with the two-photon technique. Guntch previously observed the $^2\Delta - A^2\Pi$ spectrum in 1937, but assigned the upper state as $^2\Sigma^-$. The molecular parameters determined for the $^2\Delta$ state are $B = 6.2861(23) \text{ cm}^{-1}$ and $A = -0.168(17) \text{ cm}^{-1}$.