

The Rydberg-Rydberg emission spectra of neutral H₃ and D₃

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The Rydberg-Rydberg emission spectra of neutral H₃ and D₃ were discovered in 1979 by G. Herzberg in a fairly conventional electrical discharge through molecular hydrogen, although the observation was sensitive to the design of the discharge tube. They were originally identified as broad lines to predissociated lower levels, and the fact that the H₃ or D₃ lines were observable in the cathode glow but not the anode glow gave an empirical method of distinguishing sharp H₃ or D₃ lines from the many emission lines of H₂ or D₂. The mixed isotopes H₂D and D₂H have also been observed, but are more difficult to separate from other species. Spectra have also been observed in emission using high-pressure hydrogen discharges, and in absorption from metastable levels. More recently, cleaner emission spectra were obtained using a Droege-Engelking type of corona discharge source.

An extensive amount of data on various components of the $n = 3-2$ (visible) and $n = 3-3$ (infrared) Rydberg-Rydberg transitions has been analysed, and will be described briefly. The mechanism of production of this spectrum by



will be discussed, and on energy grounds seems consistent with the weakness or absence of emission from the $n = 4$ states. As yet, this spectrum has not been identified from astronomical sources.