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Chromospheric Emission Lines: Rules of Formation. PIERRE-MARIE ROBITAILLE, Ohio State Univ - Columbus — In this work, for the first time, it is reported that strong metallic chromospheric emission lines (306-900 nm) are not random in origin. The following rules apply: 1) Strong lines have at least a single unpaired electron in the lower energy state reached (H, He II, Ca II H K, CaII triplet at 849-866 nm, all excited He I singlets and triplets, Mg I triplets at 516-518 nm, O I triplet at 777 nm are examples); 2) Line intensity does not result from random absorption-emission and temperature arguments as currently accepted; 3) Condensation reactions are involved as H is delivered through a metal hydride (e.g. H_2, CaH, OH, FeH) to a condensed hydrogen structure (CHS), like spicules (e.g. CHS + MH $\rightarrow$ CHS-HM* $\rightarrow$ CHS-H + M* $\rightarrow$ CHS-H + M + hv); 4) Such processes distort the intensities of the lines relative to actual chromospheric abundances and laboratory values; 5) The transition electron is the one making the bond in the metal hydride; 6) Transitions which involve an electron in a closed shell ground state do not occur. The first exception appears to be recorded $4s^2$ transitions. Several of these may be improperly assigned, although many are real; 7) He lines (50.8-59.14 nm) arise by capture of H^+ from H_2^+ and delivery to a CHS. H^+ release from HeH^+, leads to a $1s^2$ ground state on He. This is the second exception; 8) Two electron transitions from a d-shell ground state imply delivery of molecular hydrogen, whereby two paired electrons in the d-shell act to create a transient π-back donation molecular shell and the two hydrogen molecule electrons contribute a σ-donation (consider: 415.964 nm in ApJSS, 1968, 150(17), 1-364, which if Ti I as recorded, originates from $3d^3(^2D)4s \rightarrow 3d4s^24p$).

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