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The plasma properties of the solar corona, a detailed interpretation

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The solar corona is the plasma volume surrounding the 1.5x10^6 km diameter Sun. It consists of numerous structures of various sizes of which some last for days and reach lengths of several solar radii. Having a low electron density (usually $n_e \leq 1x10^9$ cm^{-3}) the corona is essentially optically thin allowing emission from all structure along a line of sight to reach an observer. When assuming that each coronal structures has its own unique temperature, a value slightly different from that of the rest, it is tempting to assume that the function describing the coronal emission measure vs. temperature ($\int n_e^2 dV$ where n_e is the electron density and dV a volume element along the line of sight) is a monotonically changing function in the 7x10^5-5x10^6 K range. Essentially for the last half century this was the accepted depiction of the coronal condition. Recently, aided by spectra recorded by a high resolution stigmatic spectrometer, we studied in great details the electron temperature and emission measure properties of plasmas between 1.03$R_/$ and 1.5$R_/$ (30,000-450,000 km) and found that the commonly accepted description is lacking. In reality coronal plasmas at such heights are isothermal and could attain but one of only three temperatures, 9x10^5, 1.4x10^6 and 3x10^6 K. Furthermore, we found that in at least the two higher temperature plasma volumes to within the observational uncertainties the electron distribution is Maxwellian. The fraction of super thermal electrons, if present, in the 1.4x10^6 and the 3x10^6 K volumes are less than few percent.