A stepwise model for heating the solar corona

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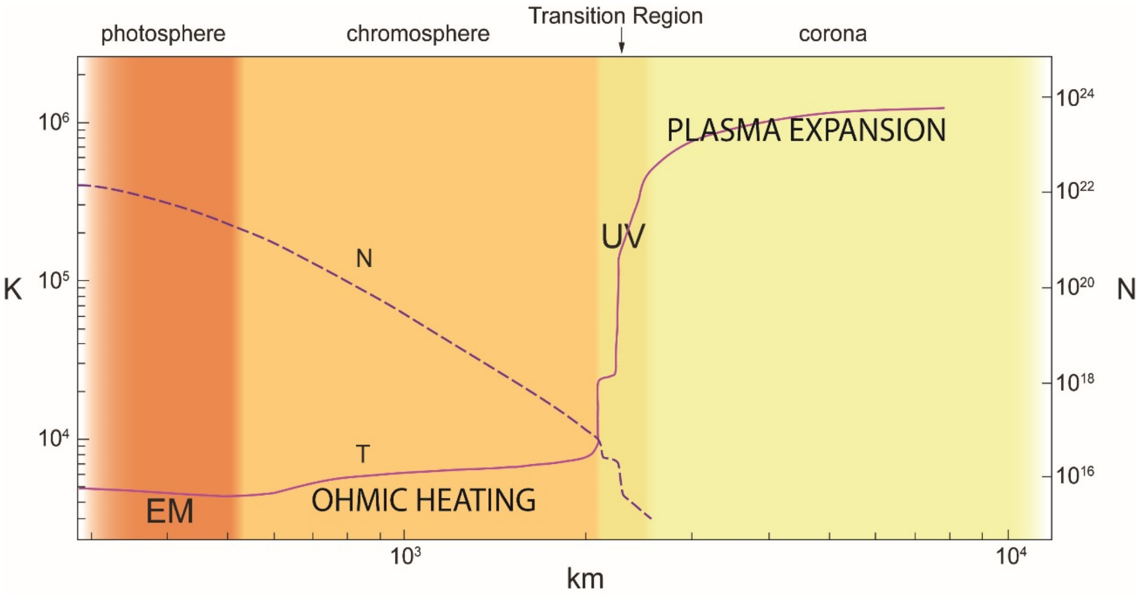
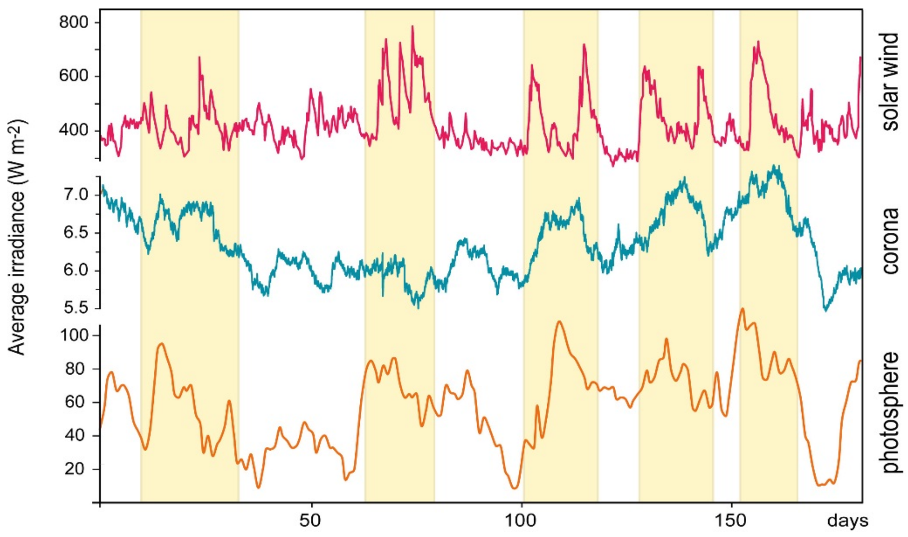
Distinct processes define and characterise the Sun's chromosphere, transition region and corona (Fig A). The solar interior is the energy source for the convection zone, with induction by way of electromagnetic energy derived from spinning convective pseudo-Taylor columns in the Rayleigh-Bénard setting. Spitzer resistivity renders ohmic heating in the chromosphere self-limiting and thus serves to define the lower margin of the transition region; its upper margin is at ~6.10^3 K, where radiative cooling of He/H plasma decelerates sharply. The third stage in the proposed scheme, the corona, sees expansion into the tenuous plasma of space, which leads to the acceleration of ions to high energies[1] long recorded by spacecraft instruments as He^{++}.



A T (temperature) and N (plasma particle density)[2]



B Irradiance variation for 1 Jan-1July 2012

Despite the threefold structure there is dynamic continuity all the way from the photosphere to the coronal exhalation of the solar wind (Fig B), a finding which should benefit the analysis of space weather, witness the association between helium in the solar wind and the incidence of coronal mass ejections[3].

References

[1] Gurevich AV et al (1966) *J Eksp Teor Fiz* 22: 49

[2] Peter H (2004) *Rev Mod Astron* 17: 87

[3] Vita-Finzi C (2021) *ArXiv*:2101.08251[astr-ph.SR]