Heating Requirements of the Solar Chromosphere

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The chromosphere is arguably the most difficult and least understood domain of solar physics. All at once it represents the transition from optically thick to thin radiation escape, from gas-pressure domination to magnetic-pressure domination, from neutral to ionised state, from MHD to plasma physics, and from near-equilibrium ("LTE") to non-equilibrium conditions.

The heating requirements of the solar chromosphere are not easily determined since the radiative cooling is dominated by optically thick spectral lines that form far from equilibrium. Energy estimates are therefore very model dependent. 1D semi-empirical model atmospheres indicate that to maintain the quiet, average solar chromosphere, the required energy input is in the range 2-12 kW/m^2 but these models neglect many important aspects like the dynamics of the chromosphere, non-equilibrium ionization effects and spatial structuring.

In this talk, we will present 3D "realistic" radiation-MHD simulations spanning the solar atmosphere from the convection zone to the corona, and synthetic observations calculated from the simulations. We will especially focus on what the comparison between the synthetic observations and new observations from the IRIS satellite tell us about the heating requirements of the solar chromosphere.