Contributed Talk

Splinter Computation

Non-equilibrium energy balance in the solar chromosphere

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The enormous increase in computing resources in recent years has made it feasible to approximate the solar photosphere in great detail using numerical magneto-hydrodynamic (MHD) simulations. Extending these simulations to the solar chromosphere, that lies above, has been challenging, due to the dominant role played by radiative losses there. These losses are driven by a small number of strongly scattering spectral lines, so that the approximation of local thermodynamic equilibrium cannot be used. In addition, the dynamic time scale of the atmosphere is similar or below that of the dominant collisional processes, so that even statistical equilibrium cannot be assumed. We present a time-implicit numerical method that simultaneously solves the atomic population evolution and radiative transfer equations, together with the MHD quantities. The method is implemented as a module for the MHD code MURaM, which was used to simulate some preliminary results for a one-dimensional, pure hydrogen atmosphere.