FLUID DESCRIPTION OF MULTI-COMPONENT SOLAR PARTIALLY IONIZED PLASMA

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The particular temperature and density conditions in the magnetized photosphere and chromosphere of the Sun usually lead to a very small degree of atomic ionization. In addition, at particular heights, the magnetic field may be strong enough to give rise to a cyclotron frequency larger than the collisional frequency for some species, while for others the opposite may happen. These circumstances can influence the collective behaviour of the particles and some of the hypotheses of MHD may be relaxed, giving rise to non-ideal MHD effects. Additional complications come from coupling between the plasma and the radiation field. The latter can not be treated in the local thermodynamic equilibrium (LTE) approach. Both non-MHD and NLTE and effects are potentially important for the dynamics and energy exchange in the solar photosphere and, especially, chromosphere. In particular, there are evidences that such phenomena as wave propagation and damping, magnetic reconnection, formation of stable magnetic field concentrations, magnetic flux emergence, etc. can be affected. In this contribution, I will discuss the different ways of treating the multi-component multi-species solar plasma and its coupling to radiation. I will revise the assumptions and derivation of the single-fluid (quasi-MHD) and two-fluid equations, as well as the generalized Ohm's law. I will discuss the importance the different terms of the generalized Ohm's law may have for different solar situations.