Numerical Simulations of Ion-Neutral Interaction Effects in the Solar Chromosphere

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IRIS was launched in 2013 to study the chromosphere and transition region which is crucial for understanding how these regions modulate the flow of mass and energy into the upper atmosphere. The complexity of the chromosphere and transition region results from the various regime changes that take place across them these layers. Some of these regime changes are as follows: Hydrogen goes from predominantly neutral to predominantly ionized; the plasma behavior changes from collisional to collision-less; it goes from gas-pressure dominated to magnetically driven, the radiation goes from optically think to optically thin, etc. Consequently, the interpretation of chromospheric observations in general and those from IRIS, in particular, is a challenging task. It is thus crucial to combine IRIS observations with advanced radiative-MHD numerical modeling. Because the photosphere, chromosphere and transition region are partially ionized, the interaction between ionized and neutral particles has important consequences on the magneto-thermodynamics of these regions. We implemented the effects of partial ionization in terms of a generalized Ohm's law in the Bifrost code (Gudiksen et al. 2011) which solves the full MHD equations with non-grey and non-LTE radiative transfer and thermal conduction along magnetic field lines. I will describe the relevance of partial ionization effects in the modeled radiative-MHD atmosphere.