Multi-fluid solar chromosphere

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The solar chromosphere is the boundary layer between the interior and exterior of the Sun, routing the origins of the coronal heating. Future large-aperture solar telescopes, such as the 4-meter European Solar Telescope (in which the Spanish group at the IAC has a leading role), will have among their primary focus observations of chromospheric magnetic fields. The correct interpretation of solar data requires sophisticated theories. The solar chromosphere is made of strongly stratified, weakly ionised and not completely collisionally coupled plasma. On the top of the complexity is the fact that solar photosphere and chromosphere are only partially ionised. The importance of the presence of neutral gas in chromospheric plasma has not been considered to its full extent in the past in the solar physics community. Only now, with the powerful computing techniques that are accessible, we start to be in the position to simulate complex partial ionisation effects and understand their profound consequences. In the recent few years it has been repeatedly demonstrated that processes related to the non-ideal plasma behaviour due to neutrals may be the key ones to solve the problem of chromospheric heating, dynamics and fine structure. In this talk I will describe our recent advances and future ambition in multi-fluid modeling of the solar chromosphere.